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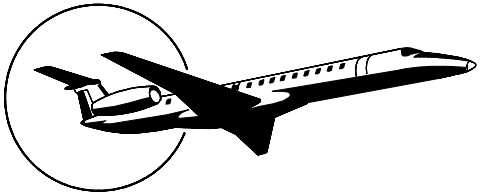

AIRPLANE OPERATIONS MANUAL
VOLUME 1

EMBRAER S.A.

This manual is applicable to the EMB-145 airplanes equipped with AE3007A1P engines operating under FAA certification.

THIS PUBLICATION IS INCOMPLETE WITHOUT AIRPLANE OPERATIONS MANUAL AOM–145/1114 VOLUME 2

AOM–145/1114-106
OCTOBER 31, 1996
REVISION 46 – OCTOBER 28, 2024

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CUSTOMER COMMENT FORM

Airplane Operations Manual
AOM–145/1114

Please use this Customer Comment Form to notify us of any discrepancies or problems you find in the Airplane Operations Manual. We would also welcome constructive suggestions on how we can further improve our documentation or service.

Your feedback will be acknowledged, and we will advise you of the action we intend to take.

Sincerely,
Flight Operations Engineering & Support

Please return this form to:

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Airplane Operations Manual
AOM–145/1114

Section/Page/Code:_____ Date of Page:_____ Revision:____

Name:_____
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HIGHLIGHTS OF CHANGE

REVISION 46 – OCTOBER 28, 2024

- 1-01-30 code 03 — Added information related to the EGPWS. Changed information related to the EGPWS functions and actions regarding the system.
- 1-01-56 code 02 — Added information related to the Autopilot limitations applicable to ERJ-140 and EMB-145 models except EMB-145 XR.
- 1-01-56 code 07 — Added information related to the Autopilot limitations applicable to ERJ-140 EMB-145 models.
- 1-02-37 code 01 — Deleted information related to the Gust Lock and added information related to the Elevator operation.
- 1-02-79 code 01 — Changed temperature reference for Engine Start during cold weather operations.
- 1-03-05 code 03 — Added step in the BAGGAGE COMPARTMENT SMOKE procedure, according to AFM.
- 1-03-36 code 03 — Added information prohibiting CAT III approaches if GPWS INOP or AURAL WARN FAIL message is displayed.
- 1-03-37 code 03 — Added information related to the altitude in the ELECTRICAL EMERGENCY ABNORMAL TRANSFER procedure, according to AFM.
- 1-03-48 code 03 — Added condition in the HYDRAULIC SYSTEM LOW QUANTITY and HYDRAULIC ENGINE PUMP FAILURE procedures.
- 1-03-50 code 03 — Changed ABNORMAL LANDING GEAR EXTENSION and LANDING GEAR

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	AIR/GROUND SYSTEM FAILURE procedures, according to AFM.
• 1-04-05 code 01	Changed the introduction of GEOMETRIC HEIGHT TO PRESSURE HEIGHT to specify the table applicability.
• 1-05-30 code 03	Changed the Pressure Altitude to Geometric Altitude in the DRIFTDOWN TABLES introduction.
• 1-07-70 code 01	Added information related to the Maximum Floor Distributed Load for all models. Changed drawing for editorial purpose.
• 1-07-70 code 02	Added information related to the Maximum Floor Distributed Load for all models.
• 2-04-40 code 01	Added information related to the TCAS software version.
• 2-18-35 code 01	Added information related to the CDU-380 regarding to its functions, display, controls, and indicators.

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LIST OF EFFECTIVE PAGES

(VOLUME 1)

ORIGINAL	0	OCT 31, 1996
REVISION	1	FEB 14, 1997
REVISION	2	MAR 10, 1997
REVISION	3	APR 15, 1997
REVISION	4	MAY 08, 1997
REVISION	5	JUL 10, 1997
REVISION	6	SEP 19, 1997
REVISION	7	NOV 28, 1997
REVISION	8	FEB 02, 1998
REVISION	9	APR 03, 1998
REVISION	10	AUG 31, 1998
REVISION	11	JAN 12, 1999
REVISION	12	JUN 01, 1999
REVISION	13	SEP 20, 1999
REVISION	14	DEC 15, 1999
REVISION	15	APR 28, 2000
REVISION	16	SEP 29, 2000
REVISION	17	MAR 30, 2001
REVISION	18	JUN 29, 2001
REVISION	19	AUG 24, 2001
REVISION	20	OCT 02, 2001
REVISION	21	JAN 21, 2002
REVISION	22	MAR 28, 2002
REVISION	23	JUN 28, 2002
REVISION	24	DEC 20, 2002
REVISION	25	JUN 30, 2003
REVISION	26	DEC 30, 2003
REVISION	27	JUN 30, 2004
REVISION	28	NOV 30, 2004
REVISION	29	JUN 30, 2005
REVISION	30	NOV 30, 2005
REVISION	31	JUN 30, 2006
REVISION	32	NOV 30, 2006
REVISION	33	JUN 29, 2007
REVISION	34	NOV 30, 2007
REVISION	35	JUN 30, 2008
REVISION	36	DEC 19, 2008
REVISION	37	OCT 30, 2009
REVISION	38	AUG 15, 2011
REVISION	39	OCT 22, 2012

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REVISION.....40 ..... NOV 14, 2013
REVISION.....41 ..... MAR 06, 2015
REVISION.....42 .....APR 05, 2017
REVISION.....43 .....APR 26, 2019
REVISION.....44 ..... AUG 14, 2020
REVISION.....45 ..... NOV 30, 2022
REVISION.....46 ..... OCT 28, 2024

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-LEP	**title**	106	*	REVISION 46	AOM-145/1114-106
1-LEP	1	106	*	REVISION 46	
1-LEP	2	106	*	REVISION 46	
1-LEP	3	106	*	REVISION 46	
1-LEP	4	106	*	REVISION 46	
1-LEP	5	106	*	REVISION 46	
1-LEP	6	106	*	REVISION 46	
1-LEP	7	106	*	REVISION 46	
1-LEP	8	106	*	REVISION 46	
1-LEP	9	106	*	REVISION 46	
1-LEP	10	106	*	REVISION 46	
1-LEP	11	106	*	REVISION 46	
1-LEP	12	106	*	REVISION 46	
1-LEP	13	106	*	REVISION 46	
1-LEP	14	106	*	REVISION 46	
1-LEP	15	106	*	REVISION 46	
1-LEP	16	106	*	REVISION 46	
1-LEP	17	106	*	REVISION 46	
1-LEP	18	106	*	REVISION 46	
1-LEP	19	106	*	REVISION 46	
1-LEP	20	106	*	REVISION 46	
1-LEP	21	106	*	REVISION 46	
1-LEP	22	106	*	REVISION 46	
1-LEP	23	106	*	REVISION 46	
1-LEP	24	106	*	REVISION 46	
1-LEP	25	106	*	REVISION 46	
1-LEP	26	106	*	REVISION 46	
1-LEP	27	106	*	REVISION 46	
1-LEP	28	106	*	REVISION 46	

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-LEP	29	106	*	REVISION 46	
1-LEP	30	106	*	REVISION 46	
1-LEP	31	106	*	REVISION 46	
1-LEP	32	106	*	REVISION 46	
1-LEP	33	106	*	REVISION 46	
1-LEP	34	106	*	REVISION 46	
1-LEP	35	106	*	REVISION 46	
1-LEP	36	106	*	REVISION 46	
1-LEP	37	106	*	REVISION 46	
1-LEP	38	106	*	REVISION 46	
1-LEP	39	106	*	REVISION 46	
1-LEP	40	106	*	REVISION 46	
1-LEP	41	106	*	REVISION 46	
1-LEP	42	106	*	REVISION 46	
1-LEP	43	106	*	REVISION 46	
1-LEP	44	106	*	REVISION 46	
1-LEP	45	106	*	REVISION 46	
1-LEP	46	106	*	REVISION 46	
1-LEP	47	106	*	REVISION 46	
1-LEP	48	106	*	REVISION 46	
1-LEP	49	106	*	REVISION 46	
1-LEP	50	106	*	REVISION 46	
1-TOC	1	01		REVISION 25	ALL
1-TOC	2	01		REVISION 23	
1-00-00	1	01		REVISION 43	ALL
1-00-00	2	01		REVISION 43	
1-00-00	3	01		REVISION 43	
1-00-00	4	01		REVISION 43	
1-00-00	5	01		REVISION 43	
1-00-00	6	01		REVISION 43	

* Asterisk indicates pages revised, added or deleted by the current revision.

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-00-00	7	01	REVISION 43	
1-00-00	8	01	REVISION 43	
1-00-10	1	01	REVISION 41	ALL
1-00-10	2	01	REVISION 41	
1-00-10	3	01	REVISION 41	
1-00-10	4	01	REVISION 41	
1-00-10	5	01	REVISION 41	
1-00-10	6	01	REVISION 41	
1-00-10	7	01	REVISION 41	
1-00-10	8	01	REVISION 41	
1-00-10	9	01	REVISION 41	
1-00-10	10	01	REVISION 41	
1-00-10	11	01	REVISION 41	
1-00-10	12	01	REVISION 41	
1-00-10	13	01	REVISION 41	
1-00-10	14	01	REVISION 42	
1-00-10	15	01	REVISION 41	
1-00-10	16	01	REVISION 41	
1-00-20	1	01	REVISION 25	ALL
1-00-20	2	01	REVISION 13	
1-00-30	1	01	REVISION 41	ALL
1-00-30	2	01	REVISION 41	
1-00-30	3	01	REVISION 41	
1-00-30	4	01	REVISION 41	
1-00-30	5	01	REVISION 41	
1-00-30	6	01	REVISION 41	
1-00-30	7	01	REVISION 41	
1-00-30	8	01	REVISION 41	
1-00-30	9	01	REVISION 41	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-00-30	10	01	REVISION 43	
1-00-30	11	01	REVISION 45	
1-00-30	12	01	REVISION 45	
1-00-35	1	01	REVISION 45	ALL
1-00-35	2	01	REVISION 45	
1-00-35	3	01	REVISION 45	
1-00-35	4	01	REVISION 45	
1-00-35	5	01	REVISION 45	
1-00-35	6	01	REVISION 45	
1-01-00	1	02	REVISION 31	FAA
1-01-00	2	02	REVISION 13	
1-01-01	1	01	REVISION 39	ALL
1-01-01	2	01	REVISION 39	
1-01-05	1	07	REVISION 31	145 FAA ER
1-01-05	2	07	REVISION 31	
1-01-05	3	07	REVISION 31	
1-01-05	4	07	REVISION 31	
1-01-05	5	07	REVISION 31	
1-01-05	6	07	REVISION 31	
1-01-05	1	08	REVISION 45	145 FAA LR
1-01-05	2	08	REVISION 45	
1-01-05	3	08	REVISION 45	
1-01-05	4	08	REVISION 45	
1-01-05	5	08	REVISION 45	
1-01-05	6	08	REVISION 45	
1-01-05	1	20	REVISION 26	145 FAA MP
1-01-05	2	20	REVISION 26	
1-01-05	3	20	REVISION 26	
1-01-05	4	20	REVISION 26	

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-01-05	1	21		REVISION 45	145 FAA EP
1-01-05	2	21		REVISION 45	
1-01-05	3	21		REVISION 45	
1-01-05	4	21		REVISION 45	
1-01-05	5	21		REVISION 45	
1-01-05	6	21		REVISION 45	
1-01-10	1	01		REVISION 41	FAA
1-01-10	2	01		REVISION 41	
1-01-10	3	01		REVISION 41	
1-01-10	4	01		REVISION 41	
1-01-10	5	01		REVISION 41	
1-01-10	6	01		REVISION 41	
1-01-10	7	01		REVISION 41	
1-01-10	8	01		REVISION 41	
1-01-12	1	03		REVISION 36	ANAC/FAA - High Alt 8500ft
1-01-12	2	03		REVISION 36	
1-01-12	1	05		REVISION 41	FAA - High Alt 10000ft
1-01-12	2	05		REVISION 41	
1-01-30	1	03	*	REVISION 46	FAA
1-01-30	2	03	*	REVISION 46	
1-01-32	1	01		SEP 20, 1999	ALL
1-01-32	2	01		SEP 20, 1999	
1-01-36	1	03		REVISION 41	FAA ER EP MP
1-01-36	2	03		REVISION 41	
1-01-36	1	04		REVISION 41	LR FAA lb
1-01-36	2	04		REVISION 41	
1-01-38	1	02		REVISION 39	FAA
1-01-38	2	02		REVISION 39	
1-01-40	1	10		REVISION 38	145 A1P FAA

* Asterisk indicates pages revised, added or deleted by the current revision.

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-01-40	2	10		REVISION 38	
1-01-40	3	10		REVISION 38	
1-01-40	4	10		REVISION 40	
1-01-48	1	01		SEP 20, 1999	ALL
1-01-48	2	01		SEP 20, 1999	
1-01-50	1	02		REVISION 45	FAA
1-01-50	2	02		REVISION 45	
1-01-52	1	01		JAN 21, 2002	FAA
1-01-52	2	01		SEP 20, 1999	
1-01-52	3	01		SEP 20, 1999	
1-01-52	4	01		SEP 20, 1999	
1-01-56	1	02		REVISION 43	FAA AHRS
1-01-56	2	02		REVISION 43	
1-01-56	3	02	*	REVISION 46	
1-01-56	4	02	*	REVISION 46	
1-01-56	5	02	*	REVISION 46	
1-01-56	6	02	*	REVISION 46	
1-01-56	1	07		REVISION 43	FAA AHRS/IRS
1-01-56	2	07		REVISION 43	
1-01-56	3	07		REVISION 43	
1-01-56	4	07	*	REVISION 46	
1-01-56	5	07	*	REVISION 46	
1-01-56	6	07	*	REVISION 46	
1-01-60	1	02		REVISION 43	FAA FMZ 2000 FMS
1-01-60	2	02		REVISION 43	
1-01-60	3	02		REVISION 43	
1-01-60	4	02		REVISION 43	
1-01-60	5	02		REVISION 43	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-01-60	6	02	REVISION 43	
1-01-60	1	04	REVISION 38	FAA UNS 1K FMS
1-01-60	2	04	REVISION 38	
1-01-60	3	04	REVISION 38	
1-01-60	4	04	REVISION 38	
1-01-60	1	09	REVISION 45	FMZ 2010 FMS (FMS 6.1.1) ANAC FAA
1-01-60	2	09	REVISION 45	
1-01-60	3	09	REVISION 45	
1-01-60	4	09	REVISION 45	
1-01-60	5	09	REVISION 45	
1-01-60	6	09	REVISION 45	
1-01-60	7	09	REVISION 45	
1-01-60	8	09	REVISION 45	
1-01-60	9	09	REVISION 45	
1-01-60	10	09	REVISION 45	
1-01-60	1	10	REVISION 45	FMZ 2010 FMS (FMS 6.1.1) / LPV / Baro-VNAV
1-01-60	2	10	REVISION 45	
1-01-60	3	10	REVISION 45	
1-01-60	4	10	REVISION 45	
1-01-60	5	10	REVISION 45	
1-01-60	6	10	REVISION 45	
1-01-60	7	10	REVISION 45	
1-01-60	8	10	REVISION 45	
1-01-60	9	10	REVISION 45	
1-01-60	10	10	REVISION 45	
1-01-60	11	10	REVISION 45	
1-01-60	12	10	REVISION 45	
1-01-70	1	01	REVISION 25	FAA ANAC cockpit security door
1-01-70	2	01	REVISION 25	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-01-80	1	01	REVISION 38	FAA PRIMUS 1000 AFCS
1-01-80	2	01	REVISION 38	
1-01-82	1	02	REVISION 41	HGS
1-01-82	2	02	REVISION 41	
1-01-82	3	02	REVISION 41	
1-01-82	4	02	REVISION 41	
1-02-00	1	01	REVISION 44	ALL
1-02-00	2	01	REVISION 44	
1-02-00	3	01	REVISION 44	
1-02-00	4	01	REVISION 44	
1-02-01	1	01	REVISION 41	ALL
1-02-01	2	01	REVISION 43	
1-02-05	1	01	REVISION 41	ALL
1-02-05	2	01	REVISION 43	
1-02-05	3	01	REVISION 43	
1-02-05	4	01	REVISION 43	
1-02-09	1	01	REVISION 41	ALL
1-02-09	2	01	REVISION 41	
1-02-09	3	01	REVISION 41	
1-02-09	4	01	REVISION 41	
1-02-13	1	01	REVISION 37	ALL
1-02-13	2	01	REVISION 37	
1-02-13	3	01	REVISION 37	
1-02-13	4	01	REVISION 37	
1-02-13	5	01	REVISION 37	
1-02-13	6	01	REVISION 37	
1-02-13	7	01	REVISION 37	
1-02-13	8	01	REVISION 37	
1-02-17	1	01	REVISION 37	Panel I

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-02-17	2	01	REVISION 37	
1-02-17	3	01	REVISION 37	
1-02-17	4	01	REVISION 37	
1-02-17	5	01	REVISION 37	
1-02-17	6	01	REVISION 37	
1-02-17	7	01	REVISION 38	
1-02-17	8	01	REVISION 37	
1-02-17	9	01	REVISION 37	
1-02-17	10	01	REVISION 40	
1-02-17	11	01	REVISION 40	
1-02-17	12	01	REVISION 37	
1-02-17	1	02	REVISION 37	Panel II
1-02-17	2	02	REVISION 37	
1-02-17	3	02	REVISION 37	
1-02-17	4	02	REVISION 37	
1-02-17	5	02	REVISION 37	
1-02-17	6	02	REVISION 37	
1-02-17	7	02	REVISION 37	
1-02-17	8	02	REVISION 37	
1-02-17	9	02	REVISION 37	
1-02-17	10	02	REVISION 37	
1-02-17	11	02	REVISION 40	
1-02-17	12	02	REVISION 40	
1-02-17	13	02	REVISION 37	
1-02-17	14	02	REVISION 37	
1-02-21	1	02	REVISION 37	FAA
1-02-21	2	02	REVISION 37	
1-02-21	3	02	REVISION 37	
1-02-21	4	02	REVISION 40	

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-02-21	5	02		REVISION 37	
1-02-21	6	02		REVISION 37	
1-02-23	1	01		REVISION 42	ALL
1-02-23	2	01		REVISION 44	
1-02-23	3	01		REVISION 44	
1-02-23	4	01		REVISION 44	
1-02-29	1	01		REVISION 43	ALL
1-02-29	2	01		REVISION 44	
1-02-29	3	01		REVISION 44	
1-02-29	4	01		REVISION 44	
1-02-33	1	01		REVISION 41	ALL
1-02-33	2	01		REVISION 41	
1-02-33	3	01		REVISION 42	
1-02-33	4	01		REVISION 41	
1-02-37	1	01	*	REVISION 46	ALL
1-02-37	2	01		REVISION 42	
1-02-40	1	01		REVISION 34	ALL EXCEPT XR A1E
1-02-40	2	01		REVISION 30	
1-02-40	1	03		REVISION 34	A1P
1-02-40	2	03		REVISION 34	
1-02-45	1	02		REVISION 37	All Except XR FAA ANAC
1-02-45	2	02		REVISION 38	
1-02-49	1	01		REVISION 37	ALL
1-02-49	2	01		REVISION 37	
1-02-57	1	02		REVISION 37	FAA
1-02-57	2	02		REVISION 37	
1-02-57	3	02		REVISION 36	
1-02-57	4	02		REVISION 36	
1-02-61	1	01		REVISION 37	ALL

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-02-61	2	01		REVISION 37	
1-02-69	1	01		REVISION 43	ALL
1-02-69	2	01		REVISION 43	
1-02-73	1	01		REVISION 42	ALL
1-02-73	2	01		REVISION 42	
1-02-73	3	01		REVISION 42	
1-02-73	4	01		REVISION 42	
1-02-77	1	01		REVISION 43	Panel I
1-02-77	2	01		REVISION 43	
1-02-77	1	02		REVISION 43	Panel II
1-02-77	2	02		REVISION 43	
1-02-78	1	01		REVISION 33	ALL
1-02-78	2	01		REVISION 33	
1-02-79	1	01		REVISION 41	ALL
1-02-79	2	01		REVISION 41	
1-02-79	3	01		REVISION 43	
1-02-79	4	01		REVISION 43	
1-02-79	5	01	*	REVISION 46	
1-02-79	6	01		REVISION 41	
1-02-79	7	01		REVISION 41	
1-02-79	8	01		REVISION 41	
1-02-79	9	01		REVISION 41	
1-02-79	10	01		REVISION 41	
1-02-79	11	01		REVISION 41	
1-02-79	12	01		REVISION 42	
1-02-79	13	01		REVISION 41	
1-02-79	14	01		REVISION 41	
1-02-79	15	01		REVISION 41	
1-02-79	16	01		REVISION 41	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-02-79	17	01	REVISION 41	
1-02-79	18	01	REVISION 41	
1-02-79	19	01	REVISION 42	
1-02-79	20	01	REVISION 42	
1-02-79	21	01	REVISION 41	
1-02-79	22	01	REVISION 41	
1-02-79	23	01	REVISION 41	
1-02-79	24	01	REVISION 41	
1-02-79	25	01	REVISION 41	
1-02-79	26	01	REVISION 41	
1-02-79	27	01	REVISION 41	
1-02-79	28	01	REVISION 41	
1-02-79	29	01	REVISION 41	
1-02-79	30	01	REVISION 41	
1-02-79	31	01	REVISION 41	
1-02-79	32	01	REVISION 41	
1-02-79	33	01	REVISION 44	
1-02-79	34	01	REVISION 44	
1-02-79	35	01	REVISION 44	
1-02-79	36	01	REVISION 44	
1-02-80	1	01	REVISION 45	ANAC/FAA FMZ 2000 / FMZ 2010 FMS (NZ 6.1.1)
1-02-80	2	01	REVISION 45	
1-02-80	3	01	REVISION 45	
1-02-80	4	01	REVISION 45	
1-02-80	5	01	REVISION 45	
1-02-80	6	01	REVISION 45	
1-02-80	7	01	REVISION 45	
1-02-80	8	01	REVISION 45	
1-02-80	9	01	REVISION 45	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-02-80	10	01	REVISION 45	
1-02-80	11	01	REVISION 45	
1-02-80	12	01	REVISION 45	
1-02-80	13	01	REVISION 45	
1-02-80	14	01	REVISION 45	
1-02-80	15	01	REVISION 45	
1-02-80	16	01	REVISION 45	
1-02-80	17	01	REVISION 45	
1-02-80	18	01	REVISION 45	
1-02-80	19	01	REVISION 45	
1-02-80	20	01	REVISION 45	
1-02-80	21	01	REVISION 45	
1-02-80	22	01	REVISION 45	
1-02-80	23	01	REVISION 45	
1-02-80	24	01	REVISION 45	
1-02-80	25	01	REVISION 45	
1-02-80	26	01	REVISION 45	
1-02-80	27	01	REVISION 45	
1-02-80	28	01	REVISION 45	
1-02-80	29	01	REVISION 45	
1-02-80	30	01	REVISION 45	
1-02-80	1	02	REVISION 44	ANAC/FAA UNS-1K FMS
1-02-80	2	02	REVISION 44	
1-02-80	3	02	REVISION 44	
1-02-80	4	02	REVISION 44	
1-02-80	5	02	REVISION 44	
1-02-80	6	02	REVISION 44	
1-02-80	7	02	REVISION 44	
1-02-80	8	02	REVISION 44	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-02-80	9	02	REVISION 44	
1-02-80	10	02	REVISION 44	
1-02-80	11	02	REVISION 44	
1-02-80	12	02	REVISION 44	
1-02-80	13	02	REVISION 44	
1-02-80	14	02	REVISION 44	
1-02-80	15	02	REVISION 44	
1-02-80	16	02	REVISION 44	
1-02-80	17	02	REVISION 44	
1-02-80	18	02	REVISION 44	
1-02-80	19	02	REVISION 44	
1-02-80	20	02	REVISION 44	
1-02-80	21	02	REVISION 44	
1-02-80	22	02	REVISION 44	
1-02-80	23	02	REVISION 44	
1-02-80	24	02	REVISION 44	
1-02-80	25	02	REVISION 44	
1-02-80	26	02	REVISION 44	
1-02-81	1	01	REVISION 44	ALL
1-02-81	2	01	REVISION 42	
1-02-81	3	01	REVISION 42	
1-02-81	4	01	REVISION 42	
1-02-81	5	01	REVISION 44	
1-02-81	6	01	REVISION 42	
1-02-82	1	01	REVISION 28	ALL
1-02-82	2	01	REVISION 28	
1-02-83	1	02	REVISION 42	ANAC/FAA
1-02-83	2	02	REVISION 42	
1-02-83	3	02	REVISION 42	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-02-83	4	02	REVISION 42	
1-02-85	1	01	REVISION 39	HGS
1-02-85	2	01	REVISION 39	
1-02-85	3	01	REVISION 39	
1-02-85	4	01	REVISION 39	
1-02-85	5	01	REVISION 39	
1-02-85	6	01	REVISION 39	
1-02-85	7	01	REVISION 39	
1-02-85	8	01	REVISION 39	
1-02-87	1	01	REVISION 41	High Alt
1-02-87	2	01	REVISION 41	
1-02-92	1	01	REVISION 31	8500 ft operation
1-02-92	2	01	REVISION 31	
1-02-94	1	01	REVISION 39	ALL
1-02-94	2	01	REVISION 39	
1-02-95	1	05	REVISION 42	ALL
1-02-95	2	05	REVISION 42	
1-02-95	3	05	REVISION 42	
1-02-95	4	05	REVISION 42	
1-02-95	5	05	REVISION 42	
1-02-95	6	05	REVISION 42	
1-02-95	7	05	REVISION 42	
1-02-95	8	05	REVISION 42	
1-02-95	9	05	REVISION 42	
1-02-95	10	05	REVISION 42	
1-02-95	11	05	REVISION 42	
1-02-95	12	05	REVISION 42	
1-02-95	13	05	REVISION 42	
1-02-95	14	05	REVISION 42	

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-02-95	15	05		REVISION 42	
1-02-95	16	05		REVISION 42	
1-02-95	17	05		REVISION 42	
1-02-95	18	05		REVISION 42	
1-02-95	19	05		REVISION 42	
1-02-95	20	05		REVISION 42	
1-03-00	1	01		REVISION 39	ANAC/FAA
1-03-00	2	01		REVISION 39	
1-03-00	3	01		REVISION 39	
1-03-00	4	01		REVISION 39	
1-03-01	1	03		REVISION 40	FAA
1-03-01	2	03		REVISION 40	
1-03-02	1	03		REVISION 43	FAA
1-03-02	2	03		REVISION 43	
1-03-02	3	03		REVISION 44	
1-03-02	4	03		REVISION 43	
1-03-03	1	03		REVISION 40	FAA
1-03-03	2	03		REVISION 40	
1-03-03	3	03		REVISION 40	
1-03-03	4	03		REVISION 40	
1-03-05	1	03		REVISION 43	FAA
1-03-05	2	03		REVISION 43	
1-03-05	3	03		REVISION 43	
1-03-05	4	03		REVISION 43	
1-03-05	5	03	*	REVISION 46	
1-03-05	6	03		REVISION 43	
1-03-07	1	03		REVISION 40	145 except XR FAA
1-03-07	2	03		REVISION 36	
1-03-09	1	03		REVISION 40	FAA

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-03-09	2	03	REVISION 40	
1-03-11	1	03	REVISION 42	FAA
1-03-11	2	03	REVISION 42	
1-03-11	3	03	REVISION 42	
1-03-11	4	03	REVISION 42	
1-03-11	5	03	REVISION 42	
1-03-11	6	03	REVISION 42	
1-03-11	7	03	REVISION 42	
1-03-11	8	03	REVISION 42	
1-03-14	1	03	REVISION 45	FAA
1-03-14	2	03	REVISION 45	
1-03-20	1	03	REVISION 40	FAA
1-03-20	2	03	REVISION 40	
1-03-20	3	03	REVISION 40	
1-03-20	4	03	REVISION 40	
1-03-20	5	03	REVISION 40	
1-03-20	6	03	REVISION 40	
1-03-20	7	03	REVISION 40	
1-03-20	8	03	REVISION 40	
1-03-20	9	03	REVISION 40	
1-03-20	10	03	REVISION 40	
1-03-24	1	03	REVISION 40	FAA
1-03-24	2	03	REVISION 40	
1-03-24	3	03	REVISION 40	
1-03-24	4	03	REVISION 40	
1-03-26	1	03	MAR 30, 2001	FAA
1-03-26	2	03	MAR 30, 2001	
1-03-30	1	03	REVISION 43	FAA
1-03-30	2	03	REVISION 43	

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-03-30	3	03		REVISION 43	
1-03-30	4	03		REVISION 43	
1-03-35	1	03		REVISION 29	FAA
1-03-35	2	03		REVISION 17	
1-03-36	1	03	*	REVISION 46	FAA
1-03-36	2	03	*	REVISION 46	
1-03-37	1	03	*	REVISION 46	FAA
1-03-37	2	03	*	REVISION 46	
1-03-37	3	03	*	REVISION 46	
1-03-37	4	03	*	REVISION 46	
1-03-37	5	03	*	REVISION 46	
1-03-37	6	03	*	REVISION 46	
1-03-38	1	03		OCT 02, 2001	FAA
1-03-38	2	03		MAR 30, 2001	
1-03-39	1	03		REVISION 40	FAA
1-03-39	2	03		REVISION 40	
1-03-40	1	03		REVISION 40	145 FAA except XR
1-03-40	2	03		REVISION 40	
1-03-40	3	03		REVISION 40	
1-03-40	4	03		REVISION 40	
1-03-41	1	03		REVISION 40	FAA
1-03-41	2	03		REVISION 40	
1-03-45	1	03		REVISION 43	FAA
1-03-45	2	03		REVISION 43	
1-03-45	3	03		REVISION 43	
1-03-45	4	03		REVISION 43	
1-03-45	5	03		REVISION 43	
1-03-45	6	03		REVISION 43	
1-03-45	7	03		REVISION 43	

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-03-45	8	03		REVISION 43	
1-03-45	9	03		REVISION 43	
1-03-45	10	03		REVISION 43	
1-03-45	11	03		REVISION 43	
1-03-45	12	03		REVISION 43	
1-03-45	13	03		REVISION 43	
1-03-45	14	03		REVISION 43	
1-03-45	15	03		REVISION 43	
1-03-45	16	03		REVISION 43	
1-03-48	1	03		REVISION 42	FAA
1-03-48	2	03		REVISION 43	
1-03-48	3	03		REVISION 42	
1-03-48	4	03		REVISION 42	
1-03-48	5	03	*	REVISION 46	
1-03-48	6	03		REVISION 42	
1-03-50	1	03	*	REVISION 46	FAA
1-03-50	2	03	*	REVISION 46	
1-03-50	3	03	*	REVISION 46	
1-03-50	4	03	*	REVISION 46	
1-03-50	5	03	*	REVISION 46	
1-03-50	6	03	*	REVISION 46	
1-03-50	7	03	*	REVISION 46	
1-03-50	8	03	*	REVISION 46	
1-03-53	1	03		REVISION 40	FAA
1-03-53	2	03		REVISION 40	
1-03-53	3	03		REVISION 40	
1-03-53	4	03		REVISION 40	
1-03-53	5	03		REVISION 40	
1-03-53	6	03		REVISION 40	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-03-53	7	03	REVISION 40	
1-03-53	8	03	REVISION 40	
1-03-56	1	03	REVISION 41	FAA
1-03-56	2	03	REVISION 41	
1-03-56	3	03	REVISION 41	
1-03-56	4	03	REVISION 41	
1-03-56	5	03	REVISION 44	
1-03-56	6	03	REVISION 41	
1-03-56	7	03	REVISION 41	
1-03-56	8	03	REVISION 41	
1-03-56	9	03	REVISION 41	
1-03-56	10	03	REVISION 41	
1-03-56	11	03	REVISION 41	
1-03-56	12	03	REVISION 41	
1-03-57	1	03	REVISION 40	FAA
1-03-57	2	03	REVISION 40	
1-03-57	3	03	REVISION 40	
1-03-57	4	03	REVISION 40	
1-03-57	5	03	REVISION 40	
1-03-57	6	03	REVISION 40	
1-03-57	7	03	REVISION 40	
1-03-57	8	03	REVISION 40	
1-03-58	1	03	DEC 20, 2002	FAA
1-03-58	2	03	MAR 30, 2001	
1-03-59	1	03	REVISION 45	FAA
1-03-59	2	03	REVISION 45	
1-03-59	3	03	REVISION 45	
1-03-59	4	03	REVISION 45	
1-03-59	5	03	REVISION 45	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-03-59	6	03	REVISION 45	
1-03-59	7	03	REVISION 45	
1-03-59	8	03	REVISION 45	
1-03-59	9	03	REVISION 45	
1-03-59	10	03	REVISION 45	
1-03-59	11	03	REVISION 45	
1-03-59	12	03	REVISION 45	
1-03-59	13	03	REVISION 45	
1-03-59	14	03	REVISION 45	
1-03-59	15	03	REVISION 45	
1-03-59	16	03	REVISION 45	
1-03-59	17	03	REVISION 45	
1-03-59	18	03	REVISION 45	
1-03-60	1	03	DEC 20, 2002	FAA
1-03-60	2	03	MAR 30, 2001	
1-03-65	1	03	REVISION 25	FAA
1-03-65	2	03	REVISION 25	
1-03-65	3	03	REVISION 31	
1-03-65	4	03	REVISION 25	
1-03-66	1	01	REVISION 40	HGS
1-03-66	2	01	REVISION 40	
1-03-70	1	03	REVISION 43	FAA
1-03-70	2	03	REVISION 43	
1-03-70	3	03	REVISION 43	
1-03-70	4	03	REVISION 43	
1-03-70	5	03	REVISION 43	
1-03-70	6	03	REVISION 43	
1-03-70	7	03	REVISION 43	
1-03-70	8	03	REVISION 43	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-03-70	9	03	REVISION 43	
1-03-70	10	03	REVISION 43	
1-03-70	11	03	REVISION 43	
1-03-70	12	03	REVISION 43	
1-03-70	13	03	REVISION 43	
1-03-70	14	03	REVISION 43	
1-03-70	15	03	REVISION 43	
1-03-70	16	03	REVISION 43	
1-03-70	17	03	REVISION 43	
1-03-70	18	03	REVISION 43	
1-03-70	19	03	REVISION 43	
1-03-70	20	03	REVISION 43	
1-03-70	21	03	REVISION 43	
1-03-70	22	03	REVISION 43	
1-03-70	23	03	REVISION 43	
1-03-70	24	03	REVISION 43	
1-03-70	25	03	REVISION 43	
1-03-70	26	03	REVISION 43	
1-03-70	27	03	REVISION 43	
1-03-70	28	03	REVISION 43	
1-03-70	29	03	REVISION 43	
1-03-70	30	03	REVISION 43	
1-03-70	31	03	REVISION 43	
1-03-70	32	03	REVISION 43	
1-03-70	33	03	REVISION 43	
1-03-70	34	03	REVISION 43	
1-03-70	35	03	REVISION 43	
1-03-70	36	03	REVISION 43	
1-03-70	37	03	REVISION 43	
1-03-70	38	03	REVISION 43	

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-03-70	39	03		REVISION 43	
1-03-70	40	03		REVISION 43	
1-03-70	41	03		REVISION 43	
1-03-70	42	03		REVISION 43	
1-03-70	43	03		REVISION 43	
1-03-70	44	03		REVISION 43	
1-03-70	45	03		REVISION 43	
1-03-70	46	03		REVISION 43	
1-03-70	47	03		REVISION 43	
1-03-70	48	03		REVISION 43	
1-03-95	1	03		SEP 29, 2000	FAA
1-03-95	2	03		SEP 29, 2000	
1-03-95	3	03		SEP 29, 2000	
1-03-95	4	03		APR 28, 2000	
1-03-97	1	01		REVISION 42	ALL
1-03-97	2	01		REVISION 42	
1-03-97	3	01		REVISION 42	
1-03-97	4	01		REVISION 42	
1-04-00	1	01		REVISION 26	ALL
1-04-00	2	01		REVISION 13	
1-04-03	1	01		REVISION 43	Noise Levels
1-04-03	2	01		REVISION 43	
1-04-03	3	01		REVISION 43	
1-04-03	4	01		REVISION 43	
1-04-05	1	01	*	REVISION 46	ALL
1-04-05	2	01	*	REVISION 46	
1-04-05	3	01	*	REVISION 46	
1-04-05	4	01	*	REVISION 46	
1-04-05	5	01	*	REVISION 46	

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-04-05	6	01	*	REVISION 46	
1-04-10	1	05		REVISION 27	145 A1/P
1-04-10	2	05		REVISION 27	
1-04-10	3	05		REVISION 27	
1-04-10	4	05		REVISION 27	
1-04-10	5	05		REVISION 27	
1-04-10	6	05		REVISION 27	
1-04-10	7	05		REVISION 27	
1-04-10	8	05		REVISION 27	
1-04-10	9	05		REVISION 27	
1-04-10	10	05		REVISION 27	
1-04-10	11	05		REVISION 27	
1-04-10	12	05		REVISION 27	
1-04-10	13	05		REVISION 27	
1-04-10	14	05		REVISION 27	
1-04-10	15	05		REVISION 27	
1-04-10	16	05		REVISION 27	
1-04-10	17	05		REVISION 27	
1-04-10	18	05		REVISION 27	
1-04-10	19	05		REVISION 27	
1-04-10	20	05		REVISION 27	
1-04-10	21	05		REVISION 27	
1-04-10	22	05		REVISION 27	
1-04-10	23	05		REVISION 27	
1-04-10	24	05		REVISION 27	
1-04-10	25	05		REVISION 27	
1-04-10	26	05		REVISION 27	
1-04-15	1	05		MAR 30, 2001	145 A1/P FAA Ib
1-04-15	2	05		JUN 28, 2002	
1-04-15	3	05		JUN 28, 2002	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-04-15	4	05	JUN 28, 2002	
1-04-15	5	05	JUN 28, 2002	
1-04-15	6	05	JUN 28, 2002	
1-04-15	7	05	REVISION 32	
1-04-15	8	05	REVISION 26	
1-04-15	9	05	REVISION 28	
1-04-15	10	05	REVISION 32	
1-04-15	11	05	REVISION 32	
1-04-15	12	05	REVISION 32	
1-04-15	13	05	REVISION 32	
1-04-15	14	05	REVISION 32	
1-04-15	15	05	REVISION 32	
1-04-15	16	05	REVISION 28	
1-04-15	17	05	REVISION 28	
1-04-15	18	05	REVISION 28	
1-04-15	19	05	REVISION 28	
1-04-15	20	05	REVISION 28	
1-04-20	1	02	REVISION 42	145 lb
1-04-20	2	02	REVISION 42	
1-04-20	3	02	REVISION 42	
1-04-20	4	02	REVISION 42	
1-04-20	5	02	REVISION 42	
1-04-20	6	02	REVISION 42	
1-04-20	7	02	REVISION 42	
1-04-20	8	02	REVISION 42	
1-04-20	9	02	REVISION 42	
1-04-20	10	02	REVISION 42	
1-04-20	11	02	REVISION 42	
1-04-20	12	02	REVISION 42	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-04-20	13	02	REVISION 42	
1-04-20	14	02	REVISION 42	
1-04-20	15	02	REVISION 42	
1-04-20	16	02	REVISION 42	
1-04-20	17	02	REVISION 42	
1-04-20	18	02	REVISION 42	
1-04-20	19	02	REVISION 42	
1-04-20	20	02	REVISION 42	
1-04-20	21	02	REVISION 42	
1-04-20	22	02	REVISION 42	
1-04-20	23	02	REVISION 42	
1-04-20	24	02	REVISION 42	
1-04-25	1	05	REVISION 36	145 A1/P FAA lb
1-04-25	2	05	REVISION 36	
1-04-25	3	05	REVISION 39	
1-04-25	4	05	REVISION 36	
1-04-30	1	02	REVISION 41	135/145 FAA lb
1-04-30	2	02	REVISION 41	
1-04-30	3	02	REVISION 41	
1-04-30	4	02	REVISION 41	
1-04-30	5	02	REVISION 41	
1-04-30	6	02	REVISION 41	
1-04-30	7	02	REVISION 41	
1-04-30	8	02	REVISION 41	
1-04-30	9	02	REVISION 41	
1-04-30	10	02	REVISION 41	
1-04-30	11	02	REVISION 41	
1-04-30	12	02	REVISION 41	
1-04-30	13	02	REVISION 41	
1-04-30	14	02	REVISION 41	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-04-30	15	02	REVISION 41	
1-04-30	16	02	REVISION 41	
1-04-30	17	02	REVISION 41	
1-04-30	18	02	REVISION 43	
1-04-30	19	02	REVISION 43	
1-04-30	20	02	REVISION 41	
1-04-30	21	02	REVISION 41	
1-04-30	22	02	REVISION 41	
1-04-30	23	02	REVISION 41	
1-04-30	24	02	REVISION 41	
1-04-30	25	02	REVISION 41	
1-04-30	26	02	REVISION 41	
1-04-30	27	02	REVISION 41	
1-04-30	28	02	REVISION 41	
1-04-30	29	02	REVISION 41	
1-04-30	30	02	REVISION 41	
1-04-30	31	02	REVISION 41	
1-04-30	32	02	REVISION 41	
1-04-30	33	02	REVISION 41	
1-04-30	34	02	REVISION 41	
1-04-30	35	02	REVISION 41	
1-04-30	36	02	REVISION 41	
1-04-30	37	02	REVISION 41	
1-04-30	38	02	REVISION 41	
1-04-30	39	02	REVISION 41	
1-04-30	40	02	REVISION 41	
1-04-30	41	02	REVISION 41	
1-04-30	42	02	REVISION 41	
1-04-30	43	02	REVISION 41	
1-04-30	44	02	REVISION 41	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-04-30	45	02	REVISION 41	
1-04-30	46	02	REVISION 41	
1-04-30	47	02	REVISION 41	
1-04-30	48	02	REVISION 41	
1-04-30	49	02	REVISION 41	
1-04-30	50	02	REVISION 41	
1-04-30	51	02	REVISION 41	
1-04-30	52	02	REVISION 41	
1-04-30	53	02	REVISION 41	
1-04-30	54	02	REVISION 41	
1-04-30	55	02	REVISION 41	
1-04-30	56	02	REVISION 41	
1-04-30	57	02	REVISION 41	
1-04-30	58	02	REVISION 41	
1-04-30	59	02	REVISION 41	
1-04-30	60	02	REVISION 41	
1-04-30	61	02	REVISION 41	
1-04-30	62	02	REVISION 41	
1-04-30	63	02	REVISION 41	
1-04-30	64	02	REVISION 41	
1-05-00	1	01	REVISION 36	ALL
1-05-00	2	01	REVISION 36	
1-05-05	1	02	REVISION 42	145 A1 and A1P lb
1-05-05	2	02	REVISION 42	
1-05-05	3	02	REVISION 42	
1-05-05	4	02	REVISION 42	
1-05-05	5	02	REVISION 42	
1-05-05	6	02	REVISION 42	
1-05-05	7	02	REVISION 42	
1-05-05	8	02	REVISION 42	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-05-05	9	02	REVISION 42	
1-05-05	10	02	REVISION 42	
1-05-05	11	02	REVISION 42	
1-05-05	12	02	REVISION 42	
1-05-05	13	02	REVISION 42	
1-05-05	14	02	REVISION 42	
1-05-05	15	02	REVISION 42	
1-05-05	16	02	REVISION 42	
1-05-07	1	02	DEC 20, 2002	lb
1-05-07	2	02	DEC 20, 2002	
1-05-10	1	02	REVISION 40	145 A1 and A1P lb
1-05-10	2	02	REVISION 40	
1-05-10	3	02	REVISION 40	
1-05-10	4	02	REVISION 40	
1-05-10	5	02	REVISION 40	
1-05-10	6	02	REVISION 40	
1-05-10	7	02	REVISION 40	
1-05-10	8	02	REVISION 40	
1-05-10	9	02	REVISION 40	
1-05-10	10	02	REVISION 40	
1-05-10	11	02	REVISION 40	
1-05-10	12	02	REVISION 40	
1-05-10	13	02	REVISION 40	
1-05-10	14	02	REVISION 40	
1-05-10	15	02	REVISION 40	
1-05-10	16	02	REVISION 40	
1-05-10	17	02	REVISION 40	
1-05-10	18	02	REVISION 40	
1-05-10	19	02	REVISION 40	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-05-10	20	02	REVISION 40	
1-05-10	21	02	REVISION 40	
1-05-10	22	02	REVISION 40	
1-05-15	1	02	REVISION 40	145 A1 and A1P lb
1-05-15	2	02	REVISION 40	
1-05-15	3	02	REVISION 40	
1-05-15	4	02	REVISION 40	
1-05-15	5	02	REVISION 40	
1-05-15	6	02	REVISION 40	
1-05-15	7	02	REVISION 40	
1-05-15	8	02	REVISION 40	
1-05-15	9	02	REVISION 40	
1-05-15	10	02	REVISION 40	
1-05-15	11	02	REVISION 40	
1-05-15	12	02	REVISION 40	
1-05-15	13	02	REVISION 40	
1-05-15	14	02	REVISION 40	
1-05-15	15	02	REVISION 40	
1-05-15	16	02	REVISION 40	
1-05-15	17	02	REVISION 40	
1-05-15	18	02	REVISION 40	
1-05-15	19	02	REVISION 40	
1-05-15	20	02	REVISION 40	
1-05-15	21	02	REVISION 40	
1-05-15	22	02	REVISION 40	
1-05-20	1	02	REVISION 40	145 A1 and A1P lb
1-05-20	2	02	REVISION 40	
1-05-20	3	02	REVISION 40	
1-05-20	4	02	REVISION 40	

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
1-05-25	1	02		REVISION 40	145 A1 and A1P lb
1-05-25	2	02		REVISION 40	
1-05-25	3	02		REVISION 40	
1-05-25	4	02		REVISION 40	
1-05-25	5	02		REVISION 40	
1-05-25	6	02		REVISION 40	
1-05-25	7	02		REVISION 40	
1-05-25	8	02		REVISION 40	
1-05-30	1	03	*	REVISION 46	145 A1 and A1P FAA
1-05-30	2	03	*	REVISION 46	
1-05-30	3	03	*	REVISION 46	
1-05-30	4	03	*	REVISION 46	
1-05-30	5	03	*	REVISION 46	
1-05-30	6	03	*	REVISION 46	
1-05-30	7	03	*	REVISION 46	
1-05-30	8	03	*	REVISION 46	
1-05-30	9	03	*	REVISION 46	
1-05-30	10	03	*	REVISION 46	
1-05-30	11	03	*	REVISION 46	
1-05-30	12	03	*	REVISION 46	
1-05-30	13	03	*	REVISION 46	
1-05-30	14	03	*	REVISION 46	
1-05-30	15	03	*	REVISION 46	
1-05-30	16	03	*	REVISION 46	
1-05-35	1	02		REVISION 39	145 A1, A1P lb
1-05-35	2	02		REVISION 39	
1-05-35	3	02		REVISION 39	
1-05-35	4	02		REVISION 39	
1-05-35	5	02		REVISION 39	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-05-35	6	02	REVISION 39	
1-05-35	7	02	REVISION 39	
1-05-35	8	02	REVISION 39	
1-05-35	9	02	REVISION 39	
1-05-35	10	02	REVISION 39	
1-05-35	11	02	REVISION 39	
1-05-35	12	02	REVISION 39	
1-05-35	13	02	REVISION 39	
1-05-35	14	02	REVISION 39	
1-05-35	15	02	REVISION 39	
1-05-35	16	02	REVISION 39	
1-05-35	17	02	REVISION 39	
1-05-35	18	02	REVISION 39	
1-05-35	19	02	REVISION 39	
1-05-35	20	02	REVISION 39	
1-05-35	21	02	REVISION 39	
1-05-35	22	02	REVISION 39	
1-05-35	23	02	REVISION 39	
1-05-35	24	02	REVISION 39	
1-05-35	25	02	REVISION 39	
1-05-35	26	02	REVISION 39	
1-05-40	1	02	MAR 28, 2002	145 A1, A1P lb
1-05-40	2	02	MAR 28, 2002	
1-05-40	3	02	MAR 28, 2002	
1-05-40	4	02	MAR 28, 2002	
1-05-40	5	02	MAR 28, 2002	
1-05-40	6	02	MAR 28, 2002	
1-05-40	7	02	MAR 28, 2002	
1-05-40	8	02	MAR 28, 2002	
1-05-40	9	02	MAR 28, 2002	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-05-40	10	02	MAR 28, 2002	
1-05-40	11	02	MAR 28, 2002	
1-05-40	12	02	MAR 28, 2002	
1-05-40	13	02	MAR 28, 2002	
1-05-40	14	02	MAR 28, 2002	
1-05-40	15	02	MAR 28, 2002	
1-05-40	16	02	MAR 28, 2002	
1-05-40	17	02	MAR 28, 2002	
1-05-40	18	02	MAR 28, 2002	
1-05-40	19	02	MAR 28, 2002	
1-05-40	20	02	MAR 28, 2002	
1-05-50	1	02	REVISION 38	145 A1 and A1P FAA lb
1-05-50	2	02	REVISION 38	
1-05-50	3	02	REVISION 38	
1-05-50	4	02	REVISION 38	
1-05-50	5	02	REVISION 38	
1-05-50	6	02	REVISION 38	
1-05-50	7	02	REVISION 38	
1-05-50	8	02	REVISION 38	
1-05-50	9	02	REVISION 38	
1-05-50	10	02	REVISION 38	
1-05-50	11	02	REVISION 38	
1-05-50	12	02	REVISION 38	
1-05-50	13	02	REVISION 38	
1-05-50	14	02	REVISION 38	
1-05-50	15	02	REVISION 38	
1-05-50	16	02	REVISION 38	
1-05-50	17	02	REVISION 38	
1-05-50	18	02	REVISION 38	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-05-50	19	02	REVISION 38	
1-05-50	20	02	REVISION 38	
1-05-50	21	02	REVISION 38	
1-05-50	22	02	REVISION 38	
1-06-00	1	01	REVISION 34	ALL
1-06-00	2	01	REVISION 17	
1-06-10	1	01	SEP 20, 1999	ALL
1-06-10	2	01	SEP 20, 1999	
1-06-10	3	01	SEP 20, 1999	
1-06-10	4	01	SEP 20, 1999	
1-06-15	1	02	REVISION 37	135/140/145 lb
1-06-15	2	02	REVISION 37	
1-06-15	3	02	REVISION 37	
1-06-15	4	02	REVISION 37	
1-06-15	5	02	REVISION 37	
1-06-15	6	02	REVISION 37	
1-06-15	7	02	REVISION 37	
1-06-15	8	02	REVISION 39	
1-06-15	9	02	REVISION 37	
1-06-15	10	02	REVISION 37	
1-06-15	11	02	REVISION 37	
1-06-15	12	02	REVISION 38	
1-06-15	13	02	REVISION 38	
1-06-15	14	02	REVISION 37	
1-06-30	1	02	REVISION 42	lb
1-06-30	2	02	REVISION 42	
1-06-30	3	02	REVISION 42	
1-06-30	4	02	REVISION 42	
1-06-30	5	02	REVISION 42	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-06-30	6	02	REVISION 42	
1-06-30	7	02	REVISION 42	
1-06-30	8	02	REVISION 42	
1-06-30	9	02	REVISION 42	
1-06-30	10	02	REVISION 42	
1-06-30	11	02	REVISION 42	
1-06-30	12	02	REVISION 42	
1-06-30	13	02	REVISION 42	
1-06-30	14	02	REVISION 42	
1-06-40	1	03	REVISION 31	FAA lb
1-06-40	2	03	REVISION 29	
1-06-40	3	03	REVISION 29	
1-06-40	4	03	REVISION 29	
1-06-40	5	03	REVISION 29	
1-06-40	6	03	REVISION 29	
1-06-40	7	03	REVISION 29	
1-06-40	8	03	REVISION 29	
1-06-40	9	03	REVISION 29	
1-06-40	10	03	REVISION 29	
1-06-40	11	03	REVISION 29	
1-06-40	12	03	REVISION 29	
1-06-40	13	03	REVISION 29	
1-06-40	14	03	REVISION 29	
1-06-40	15	03	REVISION 29	
1-06-40	16	03	REVISION 29	
1-06-40	17	03	REVISION 29	
1-06-40	18	03	REVISION 29	
1-06-40	19	03	REVISION 29	
1-06-40	20	03	REVISION 29	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-06-40	21	03	REVISION 29	
1-06-40	22	03	REVISION 29	
1-06-40	23	03	REVISION 29	
1-06-40	24	03	REVISION 29	
1-06-50	1	01	SEP 20, 1999	Balance Chart
1-06-50	2	01	SEP 20, 1999	
1-06-50	3	01	JUN 28, 2002	
1-06-50	4	01	SEP 20, 1999	
1-07-00	1	01	REVISION 38	ALL
1-07-00	2	01	REVISION 38	
1-07-10	1	40	REVISION 23	145
1-07-10	2	40	REVISION 26	
1-07-10	3	40	MAR 30, 2001	
1-07-10	4	40	JUN 28, 2002	
1-07-20	1	01	SEP 20, 1999	ALL
1-07-20	2	01	SEP 20, 1999	
1-07-30	1	41	REVISION 38	145 Interior 1A
1-07-30	2	41	REVISION 38	
1-07-30	1	42	REVISION 37	145 Interior 2
1-07-30	2	42	REVISION 37	
1-07-30	1	43	REVISION 38	145 Interior 3
1-07-30	2	43	REVISION 38	
1-07-30	1	44	REVISION 37	145 Interior 4
1-07-30	2	44	REVISION 37	
1-07-30	1	45	REVISION 38	145 Interior 5
1-07-30	2	45	REVISION 38	
1-07-30	1	46	REVISION 42	145 Interior 6
1-07-30	2	46	REVISION 42	
1-07-30	1	47	REVISION 38	145 Interior Std

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-07-30	2	47	REVISION 38	
1-07-30	1	48	REVISION 26	145 BAF corporate
1-07-30	2	48	REVISION 25	
1-07-30	3	48	REVISION 26	
1-07-30	4	48	REVISION 26	
1-07-30	1	49	REVISION 26	145 BAF shuttle
1-07-30	2	49	REVISION 26	
1-07-30	1	50	REVISION 26	145 BAF medevac
1-07-30	2	50	REVISION 26	
1-07-30	3	50	REVISION 26	
1-07-30	4	50	REVISION 26	
1-07-30	1	61	REVISION 38	145 Interior 4A
1-07-30	2	61	REVISION 38	
1-07-30	1	70	REVISION 36	145 Interior 1 +145 XR
1-07-30	2	70	REVISION 36	
1-07-30	3	70	REVISION 36	
1-07-30	4	70	REVISION 36	
1-07-30	1	71	REVISION 38	145 Interior 1B
1-07-30	2	71	REVISION 38	
1-07-30	1	72	REVISION 38	145 Interior XZ
1-07-30	2	72	REVISION 38	
1-07-30	1	73	REVISION 38	145 Interior CZ
1-07-30	2	73	REVISION 39	
1-07-30	1	74	REVISION 31	145 Configuration FAB VIP
1-07-30	2	74	REVISION 31	
1-07-30	1	75	REVISION 36	145 Configuration 6A
1-07-30	2	75	REVISION 38	
1-07-30	1	76	REVISION 39	145 Configuration 7
1-07-30	2	76	REVISION 38	

* Asterisk indicates pages revised, added or deleted by the current revision.

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Page Block	Page	Code			Change	Applicability (model, engine, certification, other)
1-07-30	1	79			REVISION 36	145 Configuration 8
1-07-30	2	79			REVISION 36	
1-07-30	1	81			REVISION 37	145 Interior 4B
1-07-30	2	81			REVISION 37	
1-07-50	1	01			REVISION 19	ALL
1-07-50	2	01			REVISION 25	
1-07-60	1	01			OCT 02, 2001	ALL
1-07-60	2	01			SEP 20, 1999	
1-07-70	1	01	*		REVISION 46	All but cart stowage unit
1-07-70	2	01	*		REVISION 46	
1-07-70	3	01	*		REVISION 46	
1-07-70	4	01	*		REVISION 46	
1-07-70	5	01	*		REVISION 46	
1-07-70	6	01	*		REVISION 46	
1-07-70	7	01	*		REVISION 46	
1-07-70	8	01	*		REVISION 46	
1-07-70	1	02	*		REVISION 46	Cart stowage unit
1-07-70	2	02	*		REVISION 46	
1-07-70	3	02	*		REVISION 46	
1-07-70	4	02	*		REVISION 46	
1-07-70	5	02	*		REVISION 46	
1-07-70	6	02	*		REVISION 46	
1-07-70	7	02	*	new	REVISION 46	
1-07-70	8	02	*	new	REVISION 46	
1-07-80	1	01			DEC 20, 2002	ALL
1-07-80	2	01			DEC 20, 2002	
1-07-80	3	01			DEC 20, 2002	
1-07-80	4	01			DEC 20, 2002	
1-07-80	5	01			DEC 20, 2002	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-07-80	6	01	DEC 20, 2002	
1-07-80	7	01	DEC 20, 2002	
1-07-80	8	01	DEC 20, 2002	
1-07-90	1	01	REVISION 30	ALL
1-07-90	2	01	REVISION 30	
1-07-90	3	01	REVISION 30	
1-07-90	4	01	REVISION 30	
1-07-95	1	01	REVISION 39	135, 140, 145
1-07-95	2	01	REVISION 39	
1-08-00	1	01	REVISION 40	ALL
1-08-00	2	01	REVISION 40	
1-08-00	3	01	REVISION 40	
1-08-00	4	01	REVISION 40	
1-08-06	1	01	REVISION 36	ANAC/FAA
1-08-06	2	01	REVISION 36	
1-08-06	3	01	REVISION 38	
1-08-06	4	01	REVISION 36	
1-08-06	5	01	REVISION 36	
1-08-06	6	01	REVISION 36	
1-08-06	7	01	REVISION 36	
1-08-06	8	01	REVISION 36	
1-08-06	9	01	REVISION 36	
1-08-06	10	01	REVISION 36	
1-08-23	1	02	REVISION 40	FAA/EASA
1-08-23	2	02	REVISION 39	
1-08-28	1	01	REVISION 40	ALL
1-08-28	2	01	REVISION 36	
1-08-28	3	01	REVISION 36	
1-08-28	4	01	REVISION 36	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-08-32	1	01	REVISION 27	ALL
1-08-32	2	01	REVISION 27	
1-08-33	1	01	REVISION 40	ALL
1-08-33	2	01	REVISION 40	
1-08-33	3	01	REVISION 40	
1-08-33	4	01	REVISION 40	
1-08-33	5	01	REVISION 40	
1-08-33	6	01	REVISION 40	
1-08-33	7	01	REVISION 40	
1-08-33	8	01	REVISION 40	
1-08-49	1	01	REVISION 27	ALL
1-08-49	2	01	REVISION 27	
1-08-52	1	01	REVISION 27	ALL
1-08-52	2	01	REVISION 27	
1-08-54	1	01	REVISION 27	ALL
1-08-54	2	01	REVISION 27	
1-08-54	3	01	REVISION 27	
1-08-54	4	01	REVISION 13	
1-08-55	1	01	REVISION 27	ALL
1-08-55	2	01	REVISION 27	
1-08-55	3	01	REVISION 27	
1-08-55	4	01	REVISION 27	
1-08-55	5	01	REVISION 27	
1-08-55	6	01	REVISION 27	
1-08-57	1	01	REVISION 27	ALL
1-08-57	2	01	REVISION 27	
1-08-57	3	01	REVISION 27	
1-08-57	4	01	REVISION 27	
1-08-57	5	01	REVISION 27	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-08-57	6	01	REVISION 27	
1-08-78	1	01	REVISION 27	ALL
1-08-78	2	01	REVISION 27	
1-09-00	1	03	REVISION 36	ALL
1-09-00	2	03	REVISION 36	
1-10-00	1	01	REVISION 30	ALL
1-10-00	2	01	REVISION 13	
1-10-05	1	01	REVISION 36	ALL except shuttle
1-10-05	2	01	REVISION 36	
1-10-05	3	01	REVISION 36	
1-10-05	4	01	REVISION 36	
1-10-05	5	01	REVISION 36	
1-10-05	6	01	REVISION 36	
1-10-05	7	01	REVISION 36	
1-10-05	8	01	REVISION 36	
1-10-08	1	01	SEP 29, 2000	145 Interior 1 - 50 pax
1-10-08	2	01	SEP 29, 2000	
1-10-08	1	02	SEP 29, 2000	145 Interior 2 - 50 pax
1-10-08	2	02	SEP 29, 2000	
1-10-08	1	03	SEP 29, 2000	145 Interior 3 - 50 pax
1-10-08	2	03	SEP 29, 2000	
1-10-08	1	04	SEP 29, 2000	145 Interior 3 - 50 pax
1-10-08	2	04	SEP 29, 2000	
1-10-08	1	05	SEP 29, 2000	145 Interior 4 - 49 pax
1-10-08	2	05	SEP 29, 2000	
1-10-08	1	06	SEP 29, 2000	145 Interior 4 - 49 pax
1-10-08	2	06	SEP 29, 2000	
1-10-08	1	07	SEP 29, 2000	145 Interior 5 - 48 pax
1-10-08	2	07	SEP 29, 2000	

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User: fnhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-10-08	1	08	SEP 29, 2000	145 Interior 5 - 48 pax
1-10-08	2	08	SEP 29, 2000	
1-10-08	1	09	SEP 29, 2000	145 Interior 6 - 50 pax
1-10-08	2	09	SEP 29, 2000	
1-10-08	1	12	SEP 29, 2000	145 Interior 4 - 49 pax
1-10-08	2	12	SEP 29, 2000	
1-10-08	1	13	SEP 29, 2000	145 Interior 6 - 50 pax
1-10-08	2	13	SEP 29, 2000	
1-10-08	1	17	DEC 20, 2002	145 Interior 1 - 50 pax
1-10-08	2	17	DEC 20, 2002	
1-10-08	1	20	REVISION 30	145 FAB
1-10-08	2	20	REVISION 30	
1-10-08	1	21	REVISION 33	145 Interior 6A - 50 pax
1-10-08	2	21	REVISION 33	
1-10-08	1	22	REVISION 33	145 Interior Option 3
1-10-08	2	22	REVISION 33	
1-10-08	1	23	REVISION 34	145 Interior Option 2A
1-10-08	2	23	REVISION 34	
1-10-10	1	01	REVISION 13	ALL
1-10-10	2	01	REVISION 31	
1-10-15	1	01	DEC 20, 2002	ALL
1-10-15	2	01	DEC 20, 2002	
1-10-15	3	01	DEC 20, 2002	
1-10-15	4	01	DEC 20, 2002	
1-10-20	1	01	SEP 20, 1999	ELT 110-4 (ARTEX)
1-10-20	2	01	SEP 20, 1999	
1-10-20	3	01	SEP 20, 1999	
1-10-20	4	01	SEP 20, 1999	
1-10-20	1	02	REVISION 34	ELT 96 OR 97 (SATORI)

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-10-20	2	02	REVISION 13	
1-10-20	3	02	REVISION 34	
1-10-20	4	02	REVISION 13	
1-10-20	1	03	REVISION 31	ELT C406-2
1-10-20	2	03	REVISION 31	
1-10-20	3	03	REVISION 31	
1-10-20	4	03	REVISION 31	
1-10-25	1	01	SEP 20, 1999	ALL
1-10-25	2	01	SEP 20, 1999	
1-10-30	1	01	SEP 20, 1999	ALL except Shuttle
1-10-30	2	01	SEP 20, 1999	
1-10-35	1	01	REVISION 30	ALL
1-10-35	2	01	REVISION 30	
1-10-35	3	01	REVISION 31	
1-10-35	4	01	REVISION 31	
1-11-00	1	01	REVISION 26	ALL
1-11-00	2	01	REVISION 13	
1-11-05	1	02	REVISION 30	FAA
1-11-05	2	02	REVISION 13	
1-11-40	1	03	REVISION 31	Airstair/Jetway
1-11-40	2	03	REVISION 29	
1-11-40	3	03	REVISION 19	
1-11-40	4	03	REVISION 35	
1-11-40	5	03	REVISION 19	
1-11-40	6	03	REVISION 29	
1-11-40	7	03	AUG 24, 2001	
1-11-40	8	03	SEP 20, 1999	
1-11-40	9	03	REVISION 31	
1-11-40	10	03	REVISION 30	

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User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-11-40	11	03	REVISION 30	
1-11-40	12	03	REVISION 25	
1-11-40	13	03	REVISION 30	
1-11-40	14	03	REVISION 30	
1-11-45	1	01	REVISION 18	ALL
1-11-45	2	01	REVISION 33	
1-11-45	3	01	REVISION 31	
1-11-45	4	01	REVISION 18	
1-12-00	1	01	REVISION 42	ALL
1-12-00	2	01	REVISION 42	
1-12-00	3	01	REVISION 42	
1-12-00	4	01	REVISION 42	
1-12-05	1	01	REVISION 31	ALL
1-12-05	2	01	REVISION 13	
1-12-05	3	01	OCT 02, 2001	
1-12-05	4	01	SEP 20, 1999	
1-12-05	5	01	SEP 20, 1999	
1-12-05	6	01	SEP 20, 1999	
1-12-10	1	01	REVISION 39	ALL
1-12-10	2	01	REVISION 39	
1-12-10	3	01	REVISION 39	
1-12-10	4	01	REVISION 39	
1-12-10	5	01	REVISION 39	
1-12-10	6	01	REVISION 39	
1-12-10	7	01	REVISION 39	
1-12-10	8	01	REVISION 39	
1-12-10	9	01	REVISION 39	
1-12-10	10	01	REVISION 39	
1-12-10	11	01	REVISION 39	

User: fnhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-12-10	12	01	REVISION 39	
1-12-15	1	01	REVISION 30	ALL
1-12-15	2	01	REVISION 23	
1-12-15	3	01	APR 28, 2000	
1-12-15	4	01	APR 28, 2000	
1-12-20	1	01	REVISION 42	ALL
1-12-20	2	01	REVISION 42	
1-12-20	3	01	REVISION 42	
1-12-20	4	01	REVISION 42	
1-12-20	5	01	REVISION 42	
1-12-20	6	01	REVISION 42	
1-12-20	7	01	REVISION 42	
1-12-20	8	01	REVISION 42	
1-12-20	9	01	REVISION 42	
1-12-20	10	01	REVISION 42	
1-12-20	11	01	REVISION 42	
1-12-20	12	01	REVISION 42	
1-12-20	13	01	REVISION 42	
1-12-20	14	01	REVISION 42	
1-12-25	1	04	REVISION 38	All with and without Stub Tank except XR
1-12-25	2	04	REVISION 38	
1-12-25	3	04	REVISION 38	
1-12-25	4	04	REVISION 38	
1-12-25	5	04	REVISION 38	
1-12-25	6	04	REVISION 38	
1-12-25	7	04	REVISION 38	
1-12-25	8	04	REVISION 38	
1-12-25	9	04	REVISION 38	
1-12-25	10	04	REVISION 38	

User: fnhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-12-25	11	04	REVISION 38	
1-12-25	12	04	REVISION 38	
1-12-25	13	04	REVISION 38	
1-12-25	14	04	REVISION 38	
1-12-25	15	04	REVISION 38	
1-12-25	16	04	REVISION 38	
1-12-25	17	04	REVISION 38	
1-12-25	18	04	REVISION 38	
1-12-25	19	04	REVISION 38	
1-12-25	20	04	REVISION 38	
1-12-30	1	01	REVISION 38	ALL
1-12-30	2	01	REVISION 37	
1-12-30	3	01	REVISION 37	
1-12-30	4	01	REVISION 37	
1-12-35	1	01	REVISION 37	ALL
1-12-35	2	01	REVISION 37	
1-12-40	1	01	SEP 20, 1999	ALL
1-12-40	2	01	SEP 20, 1999	
1-12-40	3	01	DEC 20, 2002	
1-12-40	4	01	DEC 20, 2002	
1-12-40	5	01	DEC 20, 2002	
1-12-40	6	01	DEC 20, 2002	
1-12-43	1	01	REVISION 42	ALL
1-12-43	2	01	REVISION 42	
1-12-45	1	01	REVISION 38	ALL
1-12-45	2	01	REVISION 38	
1-12-50	1	01	REVISION 29	ALL
1-12-50	2	01	REVISION 13	
1-12-50	3	01	SEP 20, 1999	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-12-50	4	01	SEP 20, 1999	
1-12-60	1	01	REVISION 42	ALL
1-12-60	2	01	REVISION 42	
1-12-60	3	01	REVISION 42	
1-12-60	4	01	REVISION 42	
1-12-60	5	01	REVISION 42	
1-12-60	6	01	REVISION 42	
1-12-60	7	01	REVISION 42	
1-12-60	8	01	REVISION 42	
1-12-60	9	01	REVISION 42	
1-12-60	10	01	REVISION 42	
1-12-60	11	01	REVISION 42	
1-12-60	12	01	REVISION 42	
1-12-60	13	01	REVISION 42	
1-12-60	14	01	REVISION 42	
1-12-60	15	01	REVISION 42	
1-12-60	16	01	REVISION 42	
1-12-60	17	01	REVISION 42	
1-12-60	18	01	REVISION 42	
1-12-60	19	01	REVISION 42	
1-12-60	20	01	REVISION 42	
1-12-60	21	01	REVISION 42	
1-12-60	22	01	REVISION 42	
1-12-60	23	01	REVISION 42	
1-12-60	24	01	REVISION 42	
1-12-60	25	01	REVISION 42	
1-12-60	26	01	REVISION 42	
1-12-60	27	01	REVISION 42	
1-12-60	28	01	REVISION 42	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
1-12-60	29	01	REVISION 42	
1-12-60	30	01	REVISION 42	
1-12-60	31	01	REVISION 42	
1-12-60	32	01	REVISION 42	

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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TABLE OF CONTENTS

AOM - VOLUME 1

1-00 - GENERAL INFORMATION AND DEFINITION OF TERMS

1-01 - LIMITATIONS

1-02 - NORMAL PROCEDURES

1-03 - EMERGENCY AND ABNORMAL PROCEDURES

1-04 - PERFORMANCE

1-05 - FLIGHT PLANNING

1-06 - WEIGHT AND BALANCE

1-07 - LOADING

1-08 - CONFIGURATION DEVIATION LIST

1-09 - DISPATCH DEVIATIONS PROCEDURES MANUAL

1-10 - EMERGENCY INFORMATION

1-11 - EMERGENCY EVACUATION

1-12 - GROUND SERVICING

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User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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SECTION 1-00

GENERAL INFORMATION AND DEFINITION OF TERMS

TABLE OF CONTENTS

Page Block

General Information 1-00-00
Definition of Terms 1-00-10
Units Conversion 1-00-20
EICAS Versions 1-00-30
Service Bulletin Table 1-00-35

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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GENERAL INFORMATION

This Airplane Operations Manual provides useful information to complement the Airplane Flight Manual, Weight and Balance Manual and the Master Minimum Equipment List. It must be used in combination with those publications to safe and efficiently operate the airplane.

The information contained herein is based on the airplane as delivered and further modifications developed and supplied by Embraer, as well as customizations requested by the original owner/operator.

It is the owner/operator sole responsibility to guarantee that Embraer has complete and accurate information on any modifications made to the delivered configuration. Any modifications, improvements, add-ons or any other changes made to the airplane without the involvement of Embraer will not be reflected in this AOM.

This AOM is not suitable to be used for any other airplanes and it may not be appropriate for use if the airplanes are transferred to other owners/operators. In this case, its applicability shall be confirmed with Embraer.

Owners/operators are solely responsible for ensuring that the operational documentation used is complete and accurate and corresponds entirely to the current configuration of the operated airplanes.

In case of conflicting information between this AOM and the AFM, the AFM must prevail.

The Airplane Operations Manual philosophy and structure are described on the next pages.

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In the EMBRAER Operational Manuals, the Brazilian Civil Aviation authority is identified as both ANAC and CTA. Therefore, whenever you find either, it corresponds to Brazilian certification. This is because since March 21, 2006, the Brazilian Civil Aviation authority was replaced by Civil Aviation National Agency (ANAC) instead of CTA.

Similarly, the European Aviation Safety Agency is identified as both EASA and JAA. Therefore, whenever you find either, it corresponds to European certification. This is because since September 28, 2003, EASA took over responsibility for the airworthiness and environmental certification of all aeronautical products, parts, and appliances designed, manufactured, maintained or used by persons under the regulatory oversight of EU Member States. This includes all post-certification activities, such as the approval of changes to aeronautical products and their components. Therefore, the revisions issued after that date were approved by EASA instead of JAA. The original approval was made by JAA.

INDENTATION

Indentation exists when the information is displaced to the right relative to the paragraph that immediately precedes it. The indentation is used to establish a relationship between the indented and the preceding information.

An indented information is normally preceded by a condition (e.g. “during landing”, “if something is true”, “when something happens”). When this is the case, observe the indented information when the preceding condition is satisfied.

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OPERATIONAL REQUIREMENTS AND THE AIRPLANE OPERATIONS MANUAL

The existence of fleets composed of airplanes or other kind of airplane made by different manufacturers, led the Airworthiness Authorities to require operators' certification, in addition to the airplane's certification.

The idea is to standardize manuals, training and operation, so as to make it easier for a pilot to change equipment. As an example, if a pilot used to fly an EMBRAER airplane (ERJ-145) is scheduled to fly another EMBRAER airplane (EMBRAER 170/175/190/195), the training syllabus required for both airplane families/models needs to be very similar; the operator's normal, abnormal and emergency procedures presentation must be similar for all airplanes even when there are different AFMs with different presentation for those procedures, as well as the manuals for both airplanes. By doing so, the operator will assure that human factors/errors are minimized.

Some operational requirements just define the main subjects that must be presented in an Airplane Operations Manual matter. However, even detailing the Airplane Operations Manual at that level, all the requirements let the operators free to use different Airplane Operations Manual structures, depending on the manuals that have been already issued. Therefore, EMBRAER has developed this Airplane Operations Manual trying to cover, in the best possible way, the most currently used requirements. By doing so, it is possible for an operator to use the EMBRAER Airplane Operations Manual by just adding some missing information that is specific to that operator.

Following is a suggested Airplane Operations Manual structure to comply with most of the Operation Requirements:

PART A

Presents operator's administrative information, such as who are the president , vice-president, the managers, who is the chief pilot for the EMB-145, who is the responsible for revising manuals, where the offices and bases are located, etc.

PART B

Presents airplane related information, like procedures, performance, dispatch procedures, Weight and Balance, bulletins and systems description.

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PART C

Presents the operator's airport and route information (performance and navigation).

PART D

Presents training information.

EMBRAER AIRPLANE OPERATIONS MANUAL

This EMBRAER Airplane Operations Manual covers only Part B. Parts A and D should be generated by the operator only. Part C can be generated by the operator with the help of EMBRAER operations software (runway analysis, driftdown and route analysis).

AIRPLANE OPERATIONS MANUAL STRUCTURE

The EMBRAER Airplane Operations Manual is organized in two volumes, with the following contents:

- Volume 1:
  - 1-00 General Information and Definition of Terms
  - 1-01 Limitations
  - 1-02 Normal Procedures
  - 1-03 Emergency and Abnormal Procedures
  - 1-04 Performance
  - 1-05 Flight Planning
  - 1-06 Weight and Balance
  - 1-07 Loading
  - 1-08 Configuration Deviation List
  - 1-09 Dispatch Deviations Procedures Manual
  - 1-10 Emergency Information
  - 1-11 Emergency Evacuation
  - 1-12 Ground Servicing

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- Volume 2:
  - 2-1 Airplane Description
  - 2-2 Equipment and Furnishings
  - 2-3 Emergency Equipment
  - 2-4 Crew Awareness
  - 2-5 Electrical
  - 2-6 Lighting
  - 2-7 Fire Protection
  - 2-8 Fuel
  - 2-9 Auxiliary Power Unit
  - 2-10 Powerplant
  - 2-11 Hydraulic
  - 2-12 Landing Gear and Brakes
  - 2-13 Flight Controls
  - 2-14 Pneumatics, Air Conditioning and Pressurization
  - 2-15 Ice and Rain Protection
  - 2-16 Oxygen
  - 2-17 Flight Instruments
  - 2-18 Navigation and Communication
  - 2-19 Autopilot

Each of the above sections may be divided into smaller parts, called blocks. Such blocks are identified by the number of the section followed by a two-digit number.

For example:

Section 1-04 can be divided as follows:

- 1-04-00 Introduction
- 1-04-05 Wind and altitude
- 1-04-10 Thrust Setting
- 1-04-15 Takeoff
- 1-04-20 Supplementary Takeoff
- 1-04-25 Approach
- 1-04-30 Landing

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The page numbering of each part is independent from the remaining parts. Each page number is presented just to the right of the block number.

As a complement, a code number is provided, to help identifying to which configuration each block is applicable. Some codes may be applicable to more than one configuration, whilst more than one code may be specific to one configuration.

As an example, there could be:

Block	Codes	Number of pages	Numbering
1-04-00	01	2	1 to 2
1-04-05	01	6	1 to 6
1-04-10	01	20	1 to 20
	02	20	1 to 20
	03	20	1 to 20
1-04-15	01	6	1 to 6
	02	6	1 to 6
	03	10	1 to 10
	04	4	1 to 4
1-04-20	01	24	1 to 24
	02	24	1 to 24
	05	20	1 to 20
1-04-25	01	4	1 to 4
	03	4	1 to 4
	04	4	1 to 4
	07	4	1 to 4
1-04-30	01	6	1 to 6
	02	4	1 to 4
	03	6	1 to 6
	04	4	1 to 4

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REVISIONS

EMBRAER may revise this manual periodically as required to update information or to provide information not available at the time of printing the original issue. Revised data may result from EMBRAER approved airplane modifications or from improved techniques gained through operational experience. They are either replacements or additional pages. A vertical line in the outside margin indicates changes to the text.

A vertical line adjacent to the page number indicates relocated or rearranged text or illustrations.

The basic issuance date of this Manual is presented in the title page. The revisions affecting this Manual to be issued from the basic issuance date onwards, will be numbered sequentially (Rev. 1, 2, 3 etc.), even for such pages bearing those earlier revision-denoting symbols.

LIST OF EFFECTIVE PAGES

A list of Effective Pages for all Sections is located at the beginning of this Manual. This list presents the issuance date of each page and it is revised together with the Manual. Its purpose is to check if all the revised pages of a revision have been correctly sent to the purchaser.

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DEFINITION OF TERMS

The following definitions apply to the terms below:

WARNING: **OPERATING PROCEDURES, TECHNIQUES AND OTHER RELATED INFORMATION WHICH MAY RESULT IN PERSONAL INJURY OR LOSS OF LIFE, IF NOT CAREFULLY FOLLOWED.**

CAUTION: OPERATING PROCEDURES, TECHNIQUES AND OTHER RELATED INFORMATION WHICH MAY RESULT IN DAMAGE OR DESTRUCTION OF EQUIPMENT, IF NOT CAREFULLY FOLLOWED.

NOTE: Operating procedures, techniques and other related information which are considered essential to emphasize.

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ABBREVIATIONS AND ACRONYMS

ABBREVIATIONS OR ACRONYMS	MEANING
ºC	Degree Celsius
ºF	Degree Fahrenheit
ft	Feet
g	Gravity Acceleration
h	Hour
Hz	Hertz
in.Hg	Inches of Mercury
kg	Kilogram
km	Kilometer
kph	Kilograms per Hour
kt	Knot
lb	Pounds
m	Meter
mb	Milibar
min	Minute
mm	Millimeter
mph	Miles per Hour
nm	Nautical Mile
psi	Pound per Square Inch
sec	Second
A	
A	Ampere
A/C	Aircraft
AC	Alternating Current
ACM	Air Cycle Machine

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ABBREVIATIONS OR ACRONYMS	MEANING
ACOC	Air Cooled Oil Cooler
ACT	Actuation, Active
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADJ	Adjustment
ADV	Advance
AFM	Airplane Flight Manual
AFS	Autoflight System
AGL	Above Ground Level
AHC	Attitude and Heading Computer
AHRS	Attitude and Heading Reference System
AIL	Aileron
ALC	APU Line Contactor
ALT	Altitude
ALTN	Alternate
AM	Amplitude Modulation
ANAC	Agência Nacional de Aviação Civil (Brazilian Civil Aviation Authority)
ANR	Automatic Navigation Realignment
ANT	Antenna
AOA	Angle of Attack
AP	Autopilot
API	Antenna Position Indicator
APR	Automatic Power Reserve
APU	Auxiliary Power Unit
ASC	APU Starting Contactor
ATC	Air Traffic Control
ATDT, ATTD	Attendant

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ABBREVIATIONS OR ACRONYMS	MEANING
ATS	Air Turbine Starter
ATT	Attitude
ATTCS	Automatic Takeoff Thrust Control System
AUTO	Automatic
AUX	Auxiliary
AVAIL	Available
AWU	Aural Warning Unit
B	
B/C	Back Course
BACV	Bleed Air Check Valve
BAGG	Baggage
BATT	Battery
BBC	Backup Battery Contactor
BC	Battery Contactor
BCU	Brake Control Unit
BCV	Brake Control Valve
BFO	Beat Frequency Oscillator
BIT	Built In Test
BKUP INPH	Back-Up Interphone
BLD	Bleed
BTC	Bus Tie Contactor
BTL	Bottle
C	
CAB EMERG	Cabin Emergency

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ABBREVIATIONS OR ACRONYMS	MEANING
CAS	Calibrated Airspeed, Crew Alerting System
CBV	Cross Bleed Valve
CCDL	Cross-Channel Data Link
CDH	Clearance Delivery Head
CDL	Configuration Deviation List
CCW	Counterclockwise
CG	Center of Gravity
CIS	Cabin Interphone System
CL	Climb
CLB	Climb
CLR	Clear
CLSD	Closed
CMC	Central Maintenance Computer
COMM, COM	Communication
CON	Continuous
CPAM	Cabin Pressure Acquisition Module
CPCS	Cabin Pressure Control System
CR	Cruise
CRZ	Cruise
CVG	Compressor Variable Geometry
CVR	Cockpit Voice Recorder
CW	Clockwise
D	
DAP	Digital Audio Panel

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ABBREVIATIONS OR ACRONYMS	MEANING
DAU	Data Acquisition Unit
DC	Direct Current, Digital Controller
DEC	Decrease
DET	Detector
DFDR	Digital Flight Data Recorder
DG	Directional Gyro
DH	Decision Height
DISC	Disconnect
DME	Distance Measurement Equipment
DMU	Data Management Unit
DN	Down
E	
EADI	Electronic Attitude Director Indicator
EBC	Essential Bus Contactor
EBV	Engine Bleed Valve
ECM	Electronic Control Module
ECS	Environmental Control System
ECU	Environmental Control Unit
EDL	Electrical Distribution Logic
EDS	Electrical Distribution System
EFIS	Electronic Flight Instrument System
EGPWS	Enhanced Ground Position Warning System
EGT	Exhaust Gas Temperature
EHSI	Electronic Horizontal Situation Indicator

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ABBREVIATIONS OR ACRONYMS	MEANING
EIC	Essential Interconnection Contactor
EICAS	Engine Indication and Crew Alerting System
ELEC	Electrical
ELEV	Elevator
ELT	Emergency Locator Transmitter
EMG, EMERG	Emergency
EMER PILOT	Emergency Pilot
ENG	Engine
ERR	Error
ESU	Electronic Sequence Unit
ET	Elapsed Time
EXT	External
EXTG	Extinguish
F	
FADEC	Full Authority Digital Electronic Control
FCOC	Fuel Cooled Oil Cooler
FDAU	Flight Data Acquisition Unit
FDRS	Flight Data Recorder System
FECU	Flap Electronic Control Unit
FLC	Flight Level Change Mode
FLX	Flexible
FMS	Flight Management System
FPDU	Flap Power and Drive Unit
FPLN	Flight Plan
FPMU	Fuel Pump and Metering Unit
FQIS	Fuel Quantity Indicating System

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ABBREVIATIONS OR ACRONYMS	MEANING
FR	Fuel Remaining
FSBY	Forced Standby
FTB	Flap Transmission Brake
FU	Fuel Used
FVS	Flap Velocity Sensor
FWD	Forward
G	
G/S, GS	Glide Slope
GCU	Generator Control Unit
GI	Ground Idle
GLC	Generator Line Contactor
GMAP	Ground Mapping
GMT	Greenwich Mean Time
GND	Ground
GPC	Ground Power Contactor
GPS	Global Positioning System
GPU	Ground Power Unit
GPWS	Ground Proximity Warning System
H	
HDG	Heading
HF	High Frequency
HP	High Pressure
hPa	HectoPascal
HSCU	Horizontal Stabilizer Control Unit

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ABBREVIATIONS OR ACRONYMS	MEANING
HSI	Horizontal Situation Indicator
HSV	High Stage Valve
HYDR	Hydraulic
I	
IAC	Integrated Avionics Computer
IAS	Indicated Airspeed
IC	Integrated Computer
ICAO	International Civil Aviation Organization
ICU	Integrated Communication Unit Interphone Control Unit
IFR	Instrument Flight Rules
IFOG	Interferometer Fiber Optic Gyros
ILS	Instrument Landing System
IM	Integrated Computer Configuration Module
INBD	Inboard
INC	Increase
INOP	Inoperative
INTPH	Interphone
INU	Integrated Navigation Unit
IPS	Inches Per Second
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISA	International Standard Atmosphere
ISIS	Integrated Standby Instrument System
ITT	Interturbine Temperature
K	
KCAS	Calibrated Airspeed in Knots
KEAS	Equivalent Airspeed in Knots
kHz	Kilohertz

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ABBREVIATIONS OR ACRONYMS	MEANING
K	
KIAS	Indicated Airspeed in Knots
L	
LAV	Lavatory
LEI	Local Engine Inoperative
LGEU	Landing Gear Electronic Unit
LH	Left-hand
LOC	Localizer
LOGO	Logotype
LP	Low Pressure
LRN	Long Range
LSB	Lower Sideband
LSS	Lightning Sensor System
LX	Lightning Detection
M	
M	Mach
MAC	Mean Aerodynamic Chord
MAN	Manual
MAX	Maximum
MB	Marker Beacon
MEA	Minimum Enroute Altitude
MFD	Multifunction Display
MFDU	Magnetic Flux Detector Unit
MHz	Megahertz
MIN	Minimum
MKR	Marker
MLS	Microwave Landing System

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ABBREVIATIONS OR ACRONYMS	MEANING
MLW	Maximum Design Landing Weight
MMEL	Master Minimum Equipment List
M_{MO}	Maximum Operating Mach
MOW	Maximum Design Operating Weight
MRW	Maximum Design Ramp Weight
MSU	Mode Select Unit
MTOW	Maximum Design Takeoff Weight
MZFW	Maximum Design Zero Fuel Weight
N	
N1	Fan Speed
N2	High-Pressure-Rotor Shaft Speed
NAV	Navigation
NB	Narrow Bandwidth
NDB	Non-directional Beacon
O	
OM	Operations Manual
OUTBD	Outboard
OVHT	Overheating
OVLD	Overload
OVPRESS	Overpressure
OXY	Oxygen
P	
PAA	Passenger Address Amplifier
PAS	Passenger Address System
PAST	Pilot Activated Self Test
PAX	Passenger
PBE	Protective Breathing Equipment

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ABBREVIATIONS OR ACRONYMS	MEANING
PCU	Power Control Unit
PDSV	Pressure Drop Spill Valve
PFD	Primary Flight Display
PMA	Permanent Magnet Alternator
POST	Power On Self Test
PRCS	Process
PRESS	Pressure
PRV	Pressurizing Valve
PSU	Passenger Service Unit
PTT	Press To Transmit
Q	
QFE	Question Field Elevation - Field Elevation Pressure (Q-code)
QNE	Question Normal Elevation - Standard Pressure (1013 hPa/29.92 in.Hg) (Q-code)
QNH	Question Normal Height - Sea Level Pressure (Q-code)
QTY	Quantity
R	
RA	Radio Altimeter
RTA	Receiver/Transmitter/Antenna
REACT	Rain Echo Attenuation Compensation Technique
REF	Reference
REI	Remote Engine Inoperative
RH	Right-hand
RMI	Radio Magnetic Indicator
RMS	Radio Management System

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ABBREVIATIONS OR ACRONYMS	MEANING
RMU	Radio Management Unit
RNG	Range
RPM	Revolution Per Minute
RSB	Radio System Bus
S	
SAT	Static Air Temperature
SBC	Shed Bus Contactor
SCV	Starting Control Valve
SELCAL	Selective Call
SL	Sea Level
SLVD	Slaved
SOV	Shutoff Valve
SPC	Stall Protection Computer
SPS	Stall Protection System
SQ	Squelch
STAB	Stabilizer
STBY	Stand By
SRN	Short Range
SSB	Single Sideband
T	
TA	Traffic Advisory
TAS	True Airspeed
TAT	Total Air Temperature
TCAS	Traffic Alert and Collision Avoidance System
TDR	Transponder
TACAN	Tactical Air Navigation Aid
TEMP	Temperature

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ABBREVIATIONS OR ACRONYMS	MEANING
TGT	Target
TKNB	Turn Knob
TLA	Thrust Lever Angle
TO	Takeoff
TRB	Turbulence
TST	Test
TWA	Time Weighted Average
U	
U.S. NAS	U.S. National Airspace System
V	
V	Volt
V_1	Decision Speed
V_2	Takeoff Safety Speed
VA	Volt-Ampere
VAPP	VOR Approach Mode
V_A	Design Maneuvering Speed
V_{EF}	Critical Engine Failure Speed
V_{FE}	Maximum Flaps Extended Speed
VFR	Visual Flight Rules
VHF	Very High Frequency
V_{LE}	Maximum Landing Gear Extended Speed
VLF	Very Low Frequency
V_{LO}	Maximum Landing Gear Operating Speed
V_{LOF}	Lift Off Speed
VLV	Valve
VMC	Visual Meteorological Conditions
V_{MCA}	Air Minimum Control Speed

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ABBREVIATIONS OR ACRONYMS	MEANING
V_{MCG}	Ground Minimum Control Speed
V_{MO}	Maximum Operating Speed
VOR	VHF Omnidirectional Range
V_R	Rotation Speed
V_{REF}	Landing Reference Speed
V_{REFXX}	Landing Reference Speed associated to the flap setting XX
V_S	Stall Speed
VS	Vertical Speed
W	
W/S	Windshield
WB	Weight and Balance
WB	Wide Bandwidth
WG	Wing
WX	Weather Detection
X	
X	Cross
XFR	Transfer

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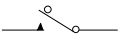
SYMBOLS AND NOTATIONS

SYMBOL	MEANING
	SHUTOFF VALVE, PRIORITY VALVE
	CHECK VALVE
	RESTRICTOR
	RELIEF VALVE
	OPTIONAL EQUIPMENT
	SYSTEM MODULE
	COMMUNICATION LINE
	ELECTRIC PUMP
	MECHANIC PUMP
	ACCUMULATOR
	ELECTRIC CONTACTOR (OPEN POSITION)
	SWITCH
	NACA AIR INLET

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UNITS CONVERSION

TO CONVERT	INTO	MULTIPLY BY	AND ADD
Degree Celsius (ºC)	Degree Fahrenheit (ºF)	1.8000	+32
Degree Fahrenheit (ºF)	Degree Celsius (ºC)	0.5556	-17.7778
Feet (ft)	Meter (m)	0.3048	-
Inches (In)	Millimeter (mm)	25.4000	-
Inches of Mercury (in.Hg)	Millibar (mb)	33.8636	-
Kilogram (kg)	Pounds (lb)	2.2046	-
Kilogram force per Square meter (kgf/m^2)	Pound per Square Inch (psi)	0.0014	-
Kilometer (km)	Nautical Mile (nm)	0.5396	-
Kilometer per hour (km/h)	Knot (kt)	0.5396	-
Knot (kt)	Kilometer per hour (km/h)	1.8532	-
Pounds (lb)	Kilogram (kg)	0.4536	-
Meter (m)	Feet (ft)	3.2808	-
Millibar (mb)	Inches of Mercury (in.Hg)	0.0295	-
Millimeter (mm)	Inches (In)	0.0394	-
Nautical Mile (nm)	Kilometer (km)	1.8532	-
Pound per Square Inch (psi)	Kilogram force per Square meter (kgf/m^2)	703.0740	-

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EICAS VERSIONS

VERSIONS 14A AND 15A

- Fix the Pitch Trim Runaway Monitoring logic (airplanes equipped with EICAS 14 or 15 are not allowed to use the Autopilot below 1500 ft).

VERSION 14

- CAT II capability.

VERSION 15

- Oil pressure green indication increased to 95 psi and red above it (on EICAS 14 it was green up to 90 psi and amber above it).
- Higher brake temperature limits for LR brakes.
- ICE/SPS ADVANCED renamed SPS/ICE SPEEDS.
- Flaps 18 capability.
- Autopilot “wing rocking” improvements.

VERSION 15B

- Fixes the nuisance “Check PFD” message.

VERSION 16

- ENG1 (2) REV DISAGREE message logic improved in order to avoid spurious alarms.
- RUD HDOV PROT FAIL message logic improved in order to avoid spurious alarms.
- Enhanced engine Time Limited Dispatch (TLD) incorporated:
  - E1 (2) CTL A (B) DEGRAD removed;
  - E1 (2) CTL A (B) FAIL revised (indicates loss of CVG/MMV control);
  - E1 (2) NO DISP incorporated;
  - E1 (2) SHORT DISP incorporated.

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- Improvements in other engine messages not TLD related:
  - E1 (2) LOW N1 revised (available only for takeoff below V1-15);
  - ENG1 (2) OUT incorporated;
  - ENG 1-2 OUT incorporated;
  - ENG1 (2) TLA FAIL revised;
  - FADEC ID NO DISP incorporated;
  - CHECK xxx PERF incorporated;
  - E1 (2) ADC DATA FAIL removed.
- New FD control laws with different gain programming for FD modes in order to improve the Flight Director capture speed.
- Incorporation of the VERTICAL and LATERAL MODE OFF messages.
- IC CONFIG FAIL cyan message (dispatchable) created to indicate a IM-600 failure and use by the IC-600 of the latest IM-600 valid data.
- CONFIG MISMATCH cyan message (no takeoff) created to indicate that there is a discrepancy in the configuration module (IM-600) of each IC-600. The configuration module stores several aircraft configuration parameters.

VERSION 16.5

- Anti-Icing system improvements (new messages and logic):
  - A/I LOW CAPACITY incorporated;
  - WG1 (2) A/ICE FAIL and WG ASYMETRY removed;
  - WG A/ICE FAIL incorporated;
  - ENG A/ICE OVERPRES incorporated;
  - ENG1 (2) A/ICE FAIL renamed to E1 (2) A/ICE FAIL.
- TAT 1-2 HEAT INOP logic changed to improve TAT and SAT indications and to increase the probes life.
- Brake messages logic changed to avoid failure messages due to power drop during APU start on ground.
- A1P and A1/3 thrust labels renamed from ALT T/O and T/O, to T/O and T/O RSV respectively.
- ATTCS NO MRGN improvements for the A3 engine.
- Support to the 8.33 kHz tune function in the FMZ 2000 FMS.
- APU FUEL LO PRESS logic changed to avoid spurious messages during APU pressure transients.
- Support to Inertial System (IRS) as an AHRS replacement.
- Improvement in the Cabin Pressure Control System (CPCS) indication in order to avoid unnecessary amber indication on the EICAS.

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- Correction of Autopilot disconnection logic discrepancy when a windshear condition is detected (removes the AFM limitation regarding use of Autopilot coupled to FD#2 below 1500 ft).
- Flight Director Altitude Pre-selection Mode Capture logic improved.
- LNAV Flight Director logic changed when PFD FMS NAV source is changed from FMS 1 to 2 or vice-versa, in order to drop the LNAV FD mode. This change makes the FMS lateral navigation modes consistent with the VOR & LOC FD modes.
- Correction of nuisance LATERAL/VERTICAL MODE OFF messages when both FD are deselected by the pilots.
- Correction of nuisance LATERAL MODE OFF message when the pilot actuates the Turn Knob with a lateral mode (HDG, NAV, APR) active.
- CHK IC CONFIG amber message (no takeoff) created to replace the CONFIG MISMATCH message in case of discrepancy between the following information stored in the IM-600: 135 or 145, Engine Type, Long Range Fuel Tank or English/Metric Units. CONFIG MISMATCH is still active in case of discrepancy of the other parameters that do not trigger the CHK IC CONFIG message.
- Oil pressure green indication increased to 115 psi in takeoff mode.

VERSION 17

- Provides interface with the Head-Up Guidance System to allow CAT IIIa operation.
- Inclusion of FDR additional parameters according to FAR 121.344.
- Autopilot improvement in the FD VOR mode capture and tracking for VOR stations without an associated DME.
- Provides crosscheck of the CAT 2 annunciators in both PFD, avoiding a green CAT 2 indication on one side and an amber CAT 2 indication on the opposite side.
- Automatic Radio Altimeter reversion in the case of one RA inop on aircraft equipped with two RA's.
- Adjustments to the Fuel Quantity indication on the MFD, adjusting scale according to the airplane version.
- Inclusion of several messages related to IRS system.
- ATTCS NO MRGN message logic improvements.
- Electrical system display improvements : valid GPU 0V voltage and valid Generator 0A amperage.
- Oil Pressure limits presented in both amber and red bands above the green one.

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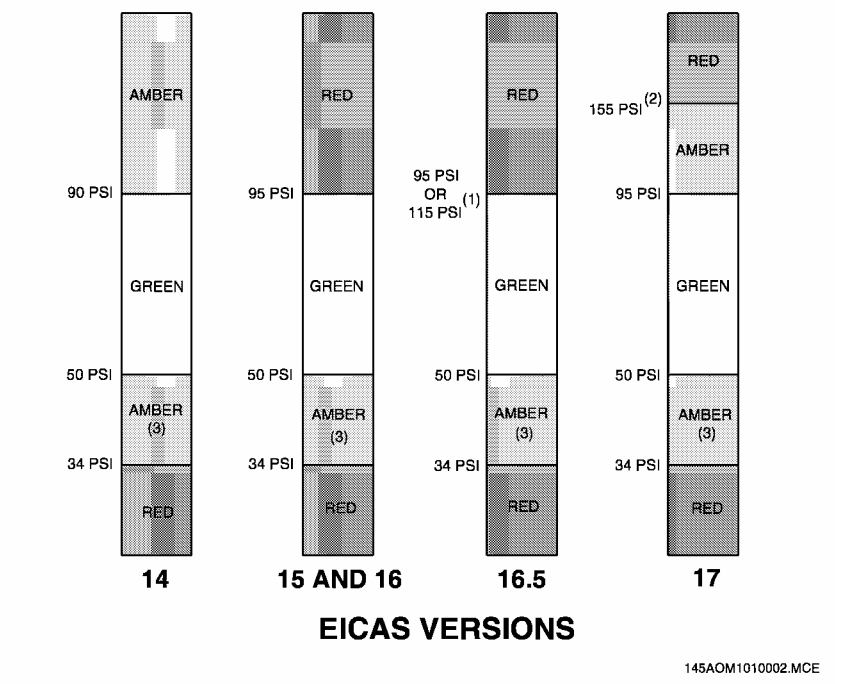
OIL PRESSURE INDICATION



(1) For any takeoff thrust mode selected and TLA higher than 65º or with thrust levers set to firewall (go-around), the upper limit of the green band is 115 psi. In all other thrust ratings it is 95 psi.

(2) For EICAS version 17 with FADEC B 5.1.1 the amber band upper limit is 155 psi.

(3) For N2 < 88% the amber band between 34 psi and 50 psi does not exist, and the green band lower limit is 34 psi.

(4) For EICAS 14, a placard is installed in the cockpit allowing the operation in the amber band, between 91 and 115 psi, during the takeoff and go-around phases, time limited to 5 minutes.

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VERSION 18 AND 18.5

- Pitch Trim System:
  - New caution messages PTRIM CPT SW FAIL, PTRIM F/O SW FAIL and PTRIM BKP SW FAIL;
  - PTRIM 1(2) INOP renamed to PTRIM MAIN INOP and PTRIM BACKUP INOP.
- Autopilot system improvements:
  - Improved localizer capture performance using AP/FD, especially when under crosswind conditions;
  - Roll Command inbound during LOC capture;
  - New Roll Rate limit (7.5 degrees/sec) and Bank Angle limit (30.0 degrees) for ILS Approach mode and LNAV mode in Terminal and Approach phases;
  - Cancellation of APR light on Flight Guidance Controller (GC550) when glide slope mode is cancelled;
  - Inhibition of VERTICAL MODE OFF message if the FD mode is cancelled by changing the preselected altitude;
  - Inhibition of VERTICAL MODE OFF and/or LATERAL MODE OFF messages if a lateral and/or a vertical FD mode is cancelled by transferring the FD control to the cross-side;
  - Improvements in the Autopilot system to prevent the AP from disconnecting when the speed brake is deployed while operating in Touch Control Steering (TCS) mode;
  - Inhibition of LATERAL MODE OFF message when the navigation source is changed from one FMS to the cross-side FMS when LNAV mode is armed.
- HGS:
  - Modification on the expanded localizer scale/display on the PFD to help pilot in Cat IIIa operations;
  - Information to HGS that TOGA button was pressed;
  - Change of HGS FAIL from ADVISORY to AMBER (caution) to comply with AC 120-28D requirements.
- AHRS:
  - New advisory messages AHRS 1-2 NO PPOS, AHRS 1-2 NO MAG HDG.

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VERSION 19

The EICAS 19 features implemented in the software are described below:

Air conditioning system

- The Bleed Temperature Pointers were modified to remain amber at all the times that the messages BLD 1(2) LOW TEMP are displayed.

Brake System

- New digital brake temperature indication on MFD **(if IM-600 Digital BRK TEMP parameter is enabled).**

EICAS Internal Logic

- New message DAU AC ID MISCMP.

Electrical System

- GPU Voltage Indication modified in order to avoid dashes when the indication should be 0 V.

Flap System

- Flap 22 indication in red on EICAS display and NO TAKEOFF CONFIG message when the aircraft is not certified to take off with flaps 22º.

Fuel System

- New Message FUEL EQ XFEED OPN to inform that the imbalance was correct and the crossfeed valve is still open.
- Fuel Test Page units label modified in order to show the correct English/Metric configuration.

General Changes

- Synchronization of the Speed Target Bug with the previous selected Speed Target instead of synchronizing with the current aircraft's speed shown on the Speed Tape when VS Vertical Flight Director Mode is de-selected.
- Windshear indication on PFD always in red when RA test button is pressed.
- Due to mandatory installation of IM-600 on this EICAS version and on, the CAT II Operation is available and indicated.

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Anti Ice System

- PITOT 1-2-3 INOP messages modified in order to avoid spurious occurrences during APU starting.

Powerplant System

- ENG NO TO DATA message modified in order to avoid an unlikely scenario of a takeoff performed with only one engine running.
- New messages :
  - CHECK A1E PERF **(only applicable to EMB-145 XR model)**,
  - E1-2 FPMU NO DISP **(only applicable to EMB-145 XR model)**,
  - E1-2 EXCEEDANCE.
- A1E thrust rating modes included on EICAS/RMU/MFD.
- New upper range limit for fuel flow indication due to A1E engine.
- ITT and N2 Dynamic Redlines.
- Oil Pressure Indication modified in order to avoid spurious indication of low oil pressure values.
- ENG 1-2 REV DISAGREE message change in order to avoid a failure without indication on EICAS.

Pressurization System

- Changes to Cabin Altitude Rate.
- New function HIGH ALT on MFD Bezel **(only applicable to EMB-145 XR model).**
- New message HI ALT LDG-T/O **(only applicable to EMB-145 XR model).**
- Changes to cabin altitude indication on EICAS display.

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VERSION 20.5

The EICAS 20.5 features implemented in the software are described below:

Air conditioning system

- "BLEED 1(2) VLV CLSD" message logic improved in order to avoid spurious alarms.

Fuel System

- "FUEL VENT OPEN" and "FUEL XFER INOP" messages logic improved in order to avoid spurious alarms **(only applicable to EMB-145 XR model)**.

Powerplant System

- "ENG1(2) REV DISAGREE" message logic improved in order to avoid spurious alarms.

Pressurization System

- "HI ALT LDG-T/O" message changed from caution to advisory **(only applicable to airplanes properly equipped for High Altitude Operation)**.

Navigation System

- The Radio Altimeter indication was modified in order to reduce the discrepancy between the current altitude of the airplane and the PFD Radio Altitude indication.

Autopilot System

- Pitch Wheel Command Integrator - Correction to avoid poor Autopilot response when using the Pitch Wheel while coupled to the copilot's Flight Director, which may cause the Autopilot logic to reset an integrator, resulting in sluggish Autopilot response.
- Pitch Axes - Correction to avoid Autopilot nuisance disconnection due to the Pitch Primary Monitor during the Coupled Autopilot Go-Around test **(only applicable to EMB-145 XR model)**.

General Changes

- New AZ-950 MADC Maintenance Page on PFD.

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VERSION 20.7

The EICAS 20.7 features implemented in the software are described below:

Autopilot:

- Autopilot disengagement without aural warning Correction: It was verified that under certain circumstances the autopilot can disengage without aural warning. It occurs when autopilot is engaged and TCS button pressed. If any pitch trim switch is commanded while the TCS is being released the autopilot disengages with no aural warning. The same situation can occurs when deploying/retracting speed brake simultaneously to TCS releasing, due to the automatic pitch trim command during speed brake actuation.
- Symbol Generator Reversion Correction: It was verified an abnormal behavior in the Automatic Flight Control System when a Symbol Generator reversion occurs on the pilot side. In this case the Autopilot reverts to basic mode and automatically couples to the co-pilot Flight Director as expected. If a vertical mode is selected to either climbing or descending following the Symbol Generator reversion, the Autopilot will not hold the pre-selected altitude although the Flight Director bars indicate level off and the PFD shows the correct mode transition from the selected vertical mode to ASEL mode and from ASEL mode to ALT HOLD mode.
- CAT II operation at Providence Airport: Automatic Flight Control System changes were required in order to allow CAT II operation at Providence Airport, which has a RA Minimums of 80 ft. The current RA Minimums interval does not include 80 ft. Therefore, the 80 ft RA Minimums was included in the CAT II logic to allow proper operation in this airport.
- Roll Oscillation Solution at high altitudes: Yaw Damper control law was modified in order to minimize the roll oscillation observed at high altitudes when autopilot is engaged. This modification is enabled only in the 135 family airplane (EMB-135ER, EMB-135LR and EMB-135BJ) via IM-600 new parameter called RUDDER BIAS.

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HGS:

- HGS compatibility issue: version 20.7 (Phase 10.7) shall correct the compatibility issue between EICAS Version 20.5 (Phase 10.5) and HGS equipped airplane. Therefore the RA value shall be displayed again on the HGS combiner. There will be no modifications on the HGS system.

Ice Protection:

- "ICE COND-A/I INOP" message logic change: in the previous logic, under ice condition on the ground, this message may undesirably appear because the Anti-Ice protection is not activated. In the current logic, on ground, if the Thrust Lever is positioned below Thrust Set, and N2 is below 53.6%, then the message is inhibited. Besides, it was included a time delay of 5 seconds to activate the message.

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VERSION 24 (ONLY APPLICABLE TO AIRPLANES POST-MOD. SB 145-34-0125)

The EICAS 24 features implemented in the software are described below:

Navigation and Communication systems

- New message:
  - CHECK XPDR.
- TCAS OFF and TCAS FAIL annunciations on PFD/MFD flash for 10 s and remain steady displayed as long as the condition persists.

Landing Gear and Brakes system

- With the conditions for Landing Gear in Transit position unchanged for more than 20 seconds, the following occurs:
  - The indication crosshatched in amber and black turns to red and black, and
  - The EICAS message LG/LEVER DISAGREE is displayed.

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SERVICE BULLETIN TABLE

SB	SUBJECT
SB 145-00-0025	Installation of a placard containing the Maximum Zero Fuel Weight (MZFW) increased from 15600 kg (34392 lb) to 16000 kg (35274 lb).
SB 145-00-0028	Increases the MTOW of the EMB-135ER Model.
SB 145DGR-34-0002	Installation of the ADS-B (Automatic Dependent Surveillance - Broadcast) out system (Universal FMS).
SB 145-00-0031	Configures airplane for Operations on Runways up to 8500 ft.
SB 145-00-0032	Modifications to meet increased MTOW and MZFW requirements.
SB 145-00-0033	Installation of a placard stating certification for Operations on Runways up to 8500 ft.
SB 145-21-0006	Replaces the Air Conditioning Digital Controller.
SB 145-21-0011	Improves the air conditioning in the Passenger Cabin.
SB 145-21-0050	Modification for airplane Operations on Runways up to 10000 ft.
SB 145-22-0001	Configures airplane for CAT II Operation.
SB 145-23-0003	Introduces VHF Channel Spacing of 8.33 KHz.
SB 145-23-0028	Incorporates aural alert for CMU message.
SB 145-25-0261	Baggage Compartment Liner reinforcement.
SB 145-25-0287	Installs cut out access to unlock jammed Slide Door.
SB 145-25-0302	Improvements on the Lavatory Bifold Door.
SB 145-26-0004	Replacement of the Smoke Detector Sensor in the Baggage Compartment for Class “C”.
SB 145-26-0007	Engine and APU Fire Extinguish Bottle Monitoring Systems - modification to Electrical Circuitry.

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SERVICE BULLETIN TABLE

SB	SUBJECT
SB 145-26-0014	Smoke Detector Sensor replacement.
SB 145-27-0015	Inclusion of movable primary stop on Rudder Control System.
SB 145-27-0100	HSCU replacement.
SB 145-27-0101	Electromechanical Gust Lock new logic.
SB 145-27-0115	Electromechanical Gust Lock Lever redesign.
SB 145-27-0125	Electromechanical Gust Lock Caution Light new operation logic.
SB 145-27-0126	Electromechanical Gust Lock Lever redesign.
SB 145-28-0018	Installation of High Level Exceeding Indication System.
SB 145-30-0019	Improves the Piccolo Burst Monitoring System.
SB 145-30-0021	Replaces the Anti-Icing System Valves.
SB 145-30-0028	Installs the new TAT Sensor Heater Electrical Configuration.
SB 145-30-0033	Incorporates changes to the Windshield Heating System.
SB 145-30-0054	Cockpit Windshield Wiper System removal and rain repellent coating application.
SB 145-30-0055	Cockpit Windshield Wiper System reinstallation.
SB 145-31-0009	Incorporates EICAS 15A Version.
SB 145-31-0016	Incorporates EICAS 16.5 Version.
SB 145-31-0020	Incorporates EICAS 17 Version.
SB 145-31-0021	Includes a new Oil Pressure Sensor.
SB 145-31-0022	Improves the strap for CAT II configuration for EICAS 16.5 Version.
SB 145-31-0028	Replaces AWU.

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SERVICE BULLETIN TABLE

SB	SUBJECT
SB 145-31-0038	Incorporates Modifications to Extend the Speed Envelope of the EMB-145XR Model.
SB 145-31-0040	Configures the EMB-145XR Model for CAT II Operation.
SB 145-31-0042	Incorporates EICAS 20.5 Version.
SB 145-31-0051	Replaces AWU-5 and previous versions by AWU-6.
SB 145-31-0057	IC-600 upgrade to version 24.
SB 145-32-0002	Changes the Travel Limits of the Nose Wheel Steering System.
SB 145-32-0030	Replaces Brakes, Tires and Wheels for the LR Version.
SB 145-32-0057	Nose Wheel Steering Disengagement Switch installation.
SB 145-32-0065	Incorporates the use of Towbarless Tug.
SB 145-32-0086	Incorporates the use of Towbarless Tug.
SB 145-32-0102	Incorporates the use of Towbarless Tug.
SB 145-32-0104	Changes Nose Wheel Steering System logic.
SB 145-33-0040	Provides instructions to disable temporarily and enable the Dim Mode of the Cabin Lighting System.
SB 145-34-0046	Improves TCAS/AWU interface.
SB 145-34-0049	Changes the Integrated Standby Instrument System (ISIS) into new P/N C16221GC03 - Amendment A.
SB 145-34-0088	Introduces time delay in the transition from Landing to Go-Around configuration.
SB 145-34-0089	Incorporates modifications related to Mode S Elementary Surveillance Transponders.

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SERVICE BULLETIN TABLE

SB	SUBJECT
SB 145-34-0096	Incorporates modifications related to Mode S Enhanced Surveillance Transponders.
SB 145-34-0106	Reconfiguration of the TCAS Performance Limit.
SB 145-34-0112	Direct connect EGPWS to GPS Universal information and upgrades EGPWS software version to -228.
SB 145-34-0116	Electronic Flight Bag (EFB) Upgrade from WINDOWS XP to WINDOWS 7.
SB 145-34-0117	EGPWS upgrade to PN 965-0976-003-228-228.
SB 145-34-0118	Installs the ADS-B Out on airplanes equipped with Honeywell FMS (FMZ2000).
SB 145-34-0121	Installs the ADS-B Out on airplanes equipped with Universal FMS (UNS-1K).
SB 145-34-0123	Installs the FMZ2010 Honeywell FMS (FMS 6.1.1).
SB 145-34-0125	Installs LPV and Baro-VNAV.
SB 145-35-0008	Rework of the Oxygen Module Assembly.
SB 145-36-0028	Changes EBV S/O Valve by a Pressure Regulator Valve.
SB 145-36-0030	Improves the Bleed Air Leak Detection System.
SB 145-49-0010	Improves the Auxiliary Power Unit (APU).
SB 145-49-0012	Changes Auxiliary Power Unit (APU) Electronic Sequence Unit (ESU) feeder bus.
SB 145-49-0014	Replaces the APU Air Inlet Frame.
SB 145-49-0025	Improvement of APU starting conditions.
SB 145-52-0040	Lock Pin installation.
SB 145-53-0064	Increases the MZFW of the EMB-145ER and EP Models.
SB 145-53-0065	Reduces MTOW of the EMB-145LR Model.
SB 145-53-0066	Updates MTOW of the EMB-145LR Model.

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SERVICE BULLETIN TABLE

SB	SUBJECT
SB 145-53-0068	Increases the maximum gross weights of the EMB-145LR Model.
SB 145-71-0003	Implements the Protection Guard for the Engine Start Switches.
SB 145-73-0010	Incorporates FADEC B5.1.1 Version on AE3007A and A1/1 Engines.
SB 145-73-0011	Incorporates FADEC B5.1.1 Version on AE3007A1 Engines.
SB 145-73-0012	Incorporates FADEC B5.1.1 Version on AE3007A1P Engines.
SB 145-73-0013	Incorporates FADEC B5.1.1 Version on AE3007A1/3 Engines.
SB 145-73-0014	Incorporates FADEC B5.1.1 Version on AE3007A3 Engines.
SB 145-73-0021	Incorporates FADEC B7.6 Version on AE3007A and A1/1 Engines.
SB 145-73-0022	Incorporates FADEC B7.6 Version on AE3007A1 Engines.
SB 145-73-0023	Incorporates FADEC B7.6 Version on AE3007A1P Engines.
SB 145-73-0024	Incorporates FADEC B7.6 Version on AE3007A1/3 Engines.
SB 145-73-0025	Incorporates FADEC B7.6 Version on AE3007A3 Engines.
SB 145-73-0026	Incorporates FADEC B7.6 Version on AE3007A1E Engines.
SB 145-73-0027	Incorporates FADEC B8.0 Version on AE3007A1P Engines.
SB 145-73-0028	Incorporates FADEC B8.0 Version on AE3007A1E Engines.
SB 145-73-0029	Incorporates FADEC B8.0 Version on AE3007A1 Engines.

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SERVICE BULLETIN TABLE

SB	SUBJECT
SB 145-73-0030	Incorporates FADEC B8.0 Version on AE3007A1/1 Engines.
SB 145-73-0031	Incorporates FADEC B8.0 Version on AE3007A1/3 Engines.
SB 145-77-0002	Includes Placard for 95 psi Oil Pressure Limit.
SB 145-77-0003	Includes Placard for 115 psi Oil Pressure Limit.
SB 145-77-0004	New EICAS N2 Red Line Margin for A1 and A1/3 Engines.
SB T-62T-49-152	Incorporates Modification to Permit APU Start Above 25000 ft.

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SECTION 1-01

LIMITATIONS

TABLE OF CONTENTS

	Page Block
Introduction	1-01-00
General Limitations	1-01-01
Weight and CG	1-01-05
Operational Limitations	1-01-10
Supplementary Operational Limitations (*)	1-01-12
Systems:	
Crew Alerting	1-01-30
Electrical	1-01-32
Fuel	1-01-36
APU	1-01-38
Powerplant	1-01-40
Pressurization	1-01-48
Ice and Rain Protection	1-01-50
Ozone Concentration	1-01-52
Navigation, Communication and Autopilot	1-01-56
FMS	1-01-60
Doors (*)	1-01-70
Cat II Operation	1-01-80

NOTE: Items marked with an asterisk (*) may not be present in this manual.

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INTRODUCTION

The airplane must be operated in accordance with the limitations presented in this Section. These limitations also apply to operations in accordance with an approved Supplement or Appendix to the AFM, except as modified by such Supplement or Appendix.

The information contained in this section is derived from the Approved Airplane Flight Manual.

Flight crewmembers should have all limitations committed to memory (except tables and charts). Some items may not be included herein, as they may be identified in a panel/placard or annunciated by some kind of alarm/warning. Compliance to the Emergency and Abnormal Procedures will also assure that certain limitations are complied with.

In the event that a limitation in this manual disagrees with the AFM limitation, the AFM must prevail.

In the event that a placard or instrument marking disagrees with the limitations shown in this manual, the more restrictive limitation must prevail.

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GENERAL

MINIMUM CREW

Minimum Flight Crew ..... PILOT AND COPILOT

KINDS OF OPERATION

This airplane may be flown day and night in the following conditions, when the appropriate equipment and instruments required by airworthiness and operating regulations are approved, installed and in an operable condition:

- Visual (VFR);
- Instrument (IFR);
- Icing conditions.

MAXIMUM NUMBER OF SEATS (NON-AFM)

The maximum number of available seats is 42 on the EMB-135, 49 on the ERJ-140, and 55 on the EMB-145. It includes 2 seats for pilots, 2 for attendants (1 optional), 1 for cockpit observer, and up to 37 passenger seats on the EMB-135, up to 44 passenger seats on the ERJ-140, and up to 50 passenger seats on the EMB-145.

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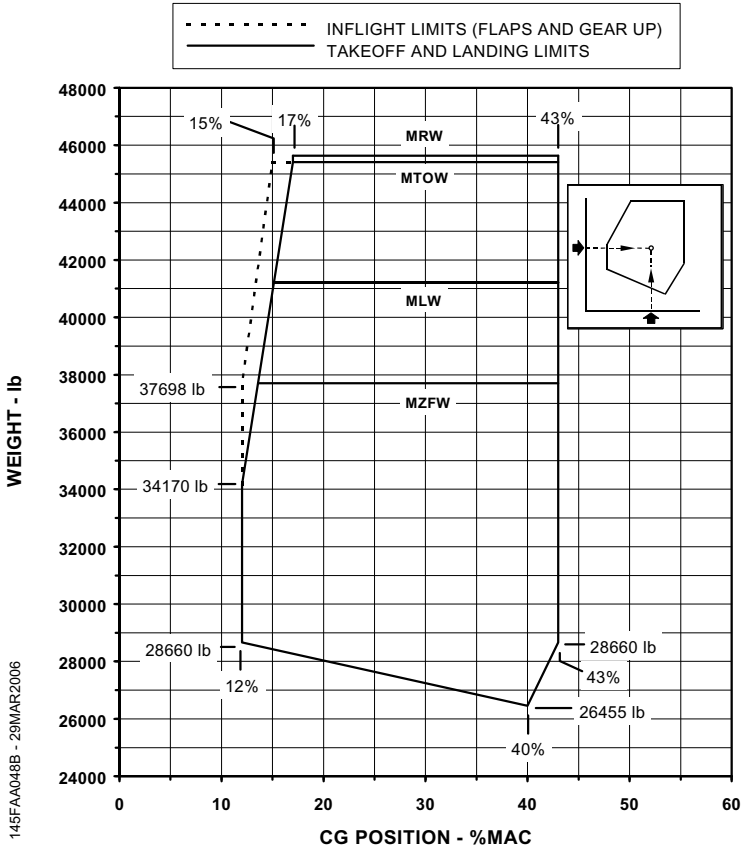
WEIGHT AND CENTER OF GRAVITY

EMB-145 ER MODEL - TAKEOFF WITH FLAPS 9°

APPLICABLE TO AIRPLANES PRE-MOD. SB 145-53-0064.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
45635 lb	45414 lb	41226 lb	37698 lb



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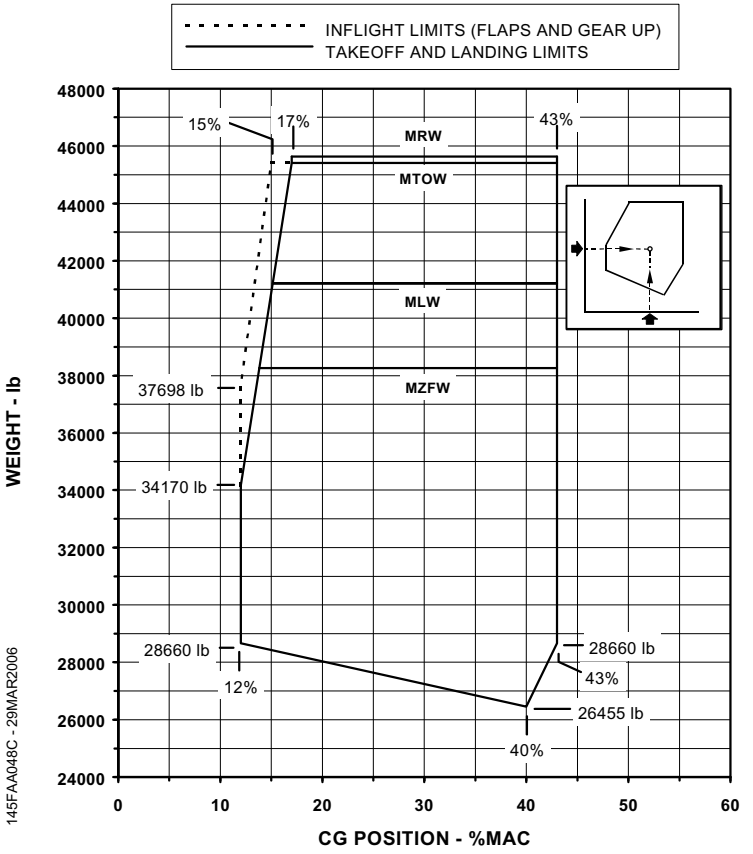
APPLICABLE TO AIRPLANES POST-MOD. SB 145-53-0064 OR EQUIPPED WITH AN EQUIVALENT MODIFICATION FACTORY INCORPORATED.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
45635 lb	45414 lb	41226 lb	38250 lb



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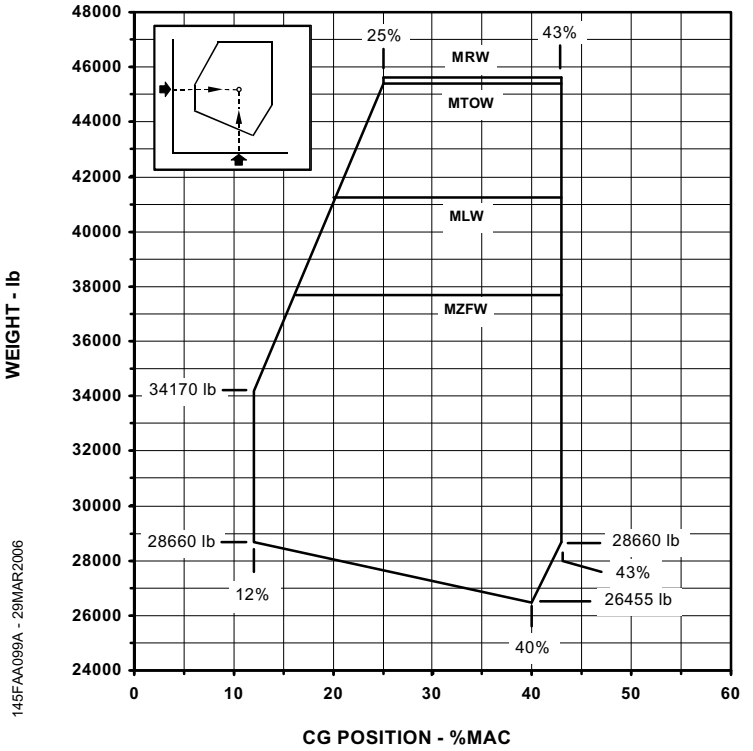
EMB-145 ER MODEL - TAKEOFF WITH FLAPS 22°

APPLICABLE TO AIRPLANES PRE-MOD. SB 145-53-0064.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
45635 lb	45414 lb	41226 lb	37698 lb



NOTE: For inflight and landing limits refer to standard CG Envelope.

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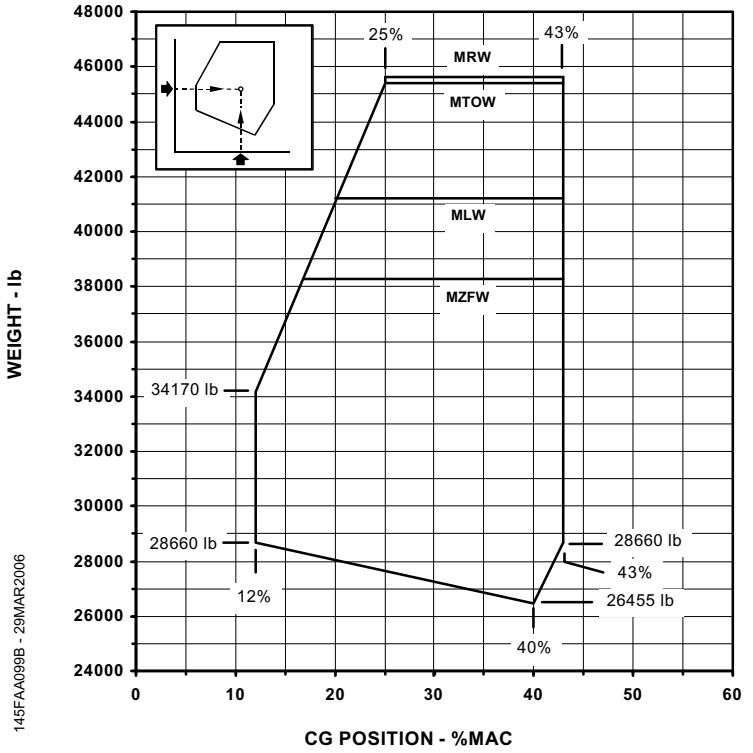
APPLICABLE TO AIRPLANES POST-MOD. SB 145-53-0064 OR EQUIPPED WITH AN EQUIVALENT MODIFICATION FACTORY INCORPORATED.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
45635 lb	45414 lb	41226 lb	38250 lb



NOTE: For inflight and landing limits refer to standard CG Envelope.

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To comply with the performance and operating limitations of the regulations, the maximum allowable takeoff and landing operational weights may be equal to, but not greater than, the design limits.

The takeoff weight (weight at brake release or at start of takeoff run) is the lowest among MTOW and the following weights:

- Maximum takeoff weight for altitude and temperature determined from Maximum Takeoff Weight - Climb Limited chart.
- Maximum takeoff weight, as limited by runway length and determined from Maximum Takeoff Weight - Field Length Limited chart.
- Maximum takeoff weight, as limited by brake energy and determined from Maximum Takeoff Weight - Brake Energy Limited chart.
- Maximum takeoff weight, as limited by obstacle clearance, enroute, and landing operating requirements.

The landing weight is the lowest among MLW and the following weights:

- Maximum approach and landing weight for altitude and temperature determined from Maximum Landing Weight - Climb Limited charts.
- Maximum landing weight, as limited by runway length and determined from Maximum Landing Weight - Field Length Limited chart.

LOADING

The airplane must be loaded in accordance with the information contained in the Weight and Balance Manual.

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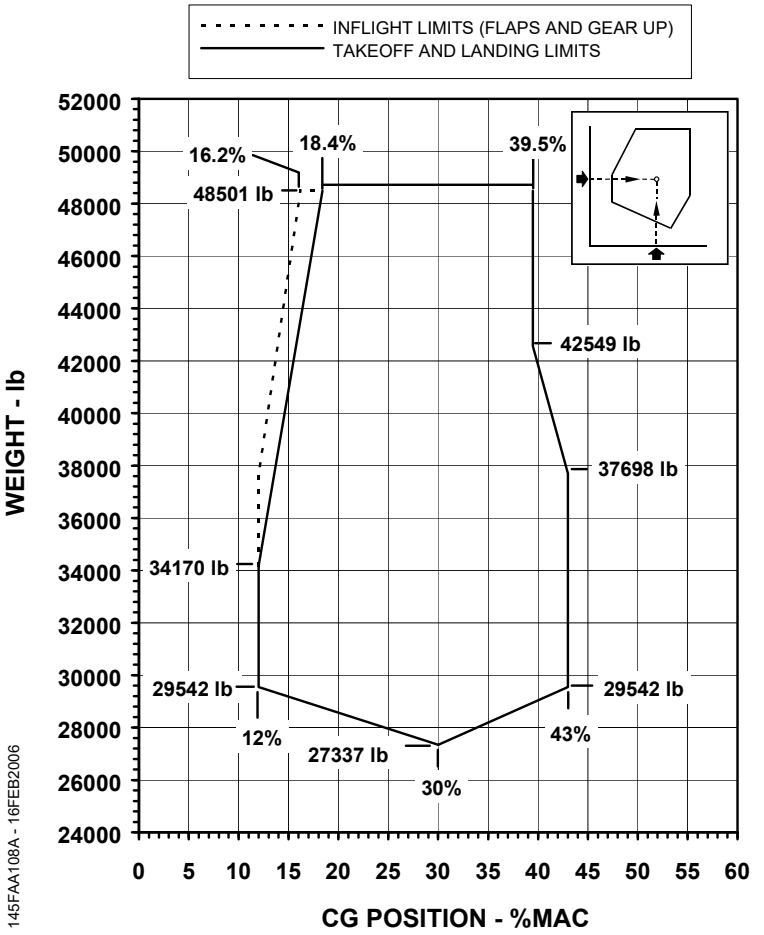
WEIGHT AND CENTER OF GRAVITY

EMB-145 LR MODEL - TAKEOFF WITH FLAPS 9° OR 18º

APPLICABLE TO AIRPLANES PRE-MOD. SB 145-53-0068.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
48722 lb	48501 lb	42549 lb	39462 lb



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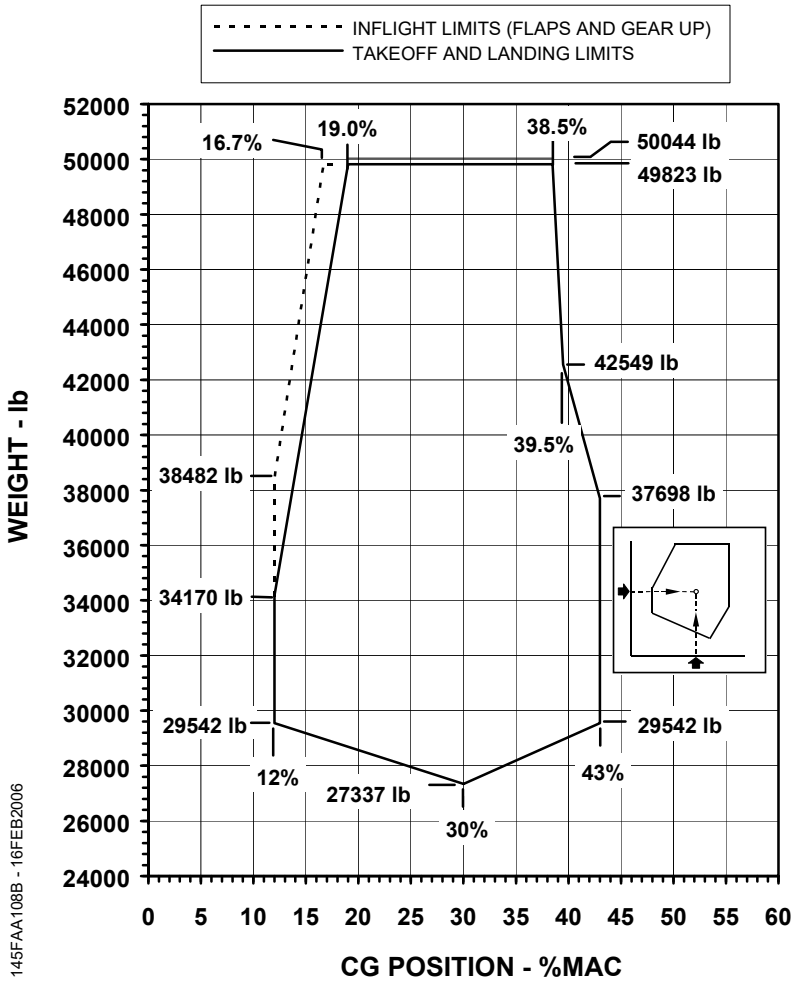
APPLICABLE TO AIRPLANES POST-MOD. SB 145-53-0068 OR EQUIPPED WITH AN EQUIVALENT MODIFICATION FACTORY INCORPORATED.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
50044 lb	49823 lb	43651 lb	40564 lb



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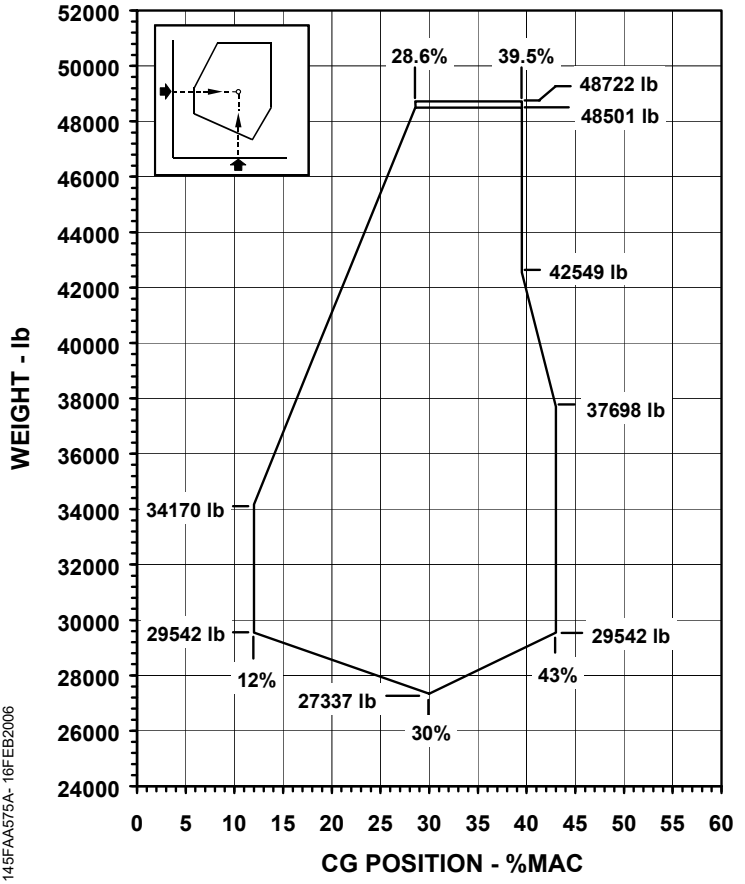
EMB-145 LR MODEL - TAKEOFF WITH FLAPS 22°

APPLICABLE TO AIRPLANES PRE-MOD. SB 145-53-0068.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
48722 lb	48501 lb	42549 lb	39462 lb



NOTE: For inflight and landing limits refer to standard CG Envelope.

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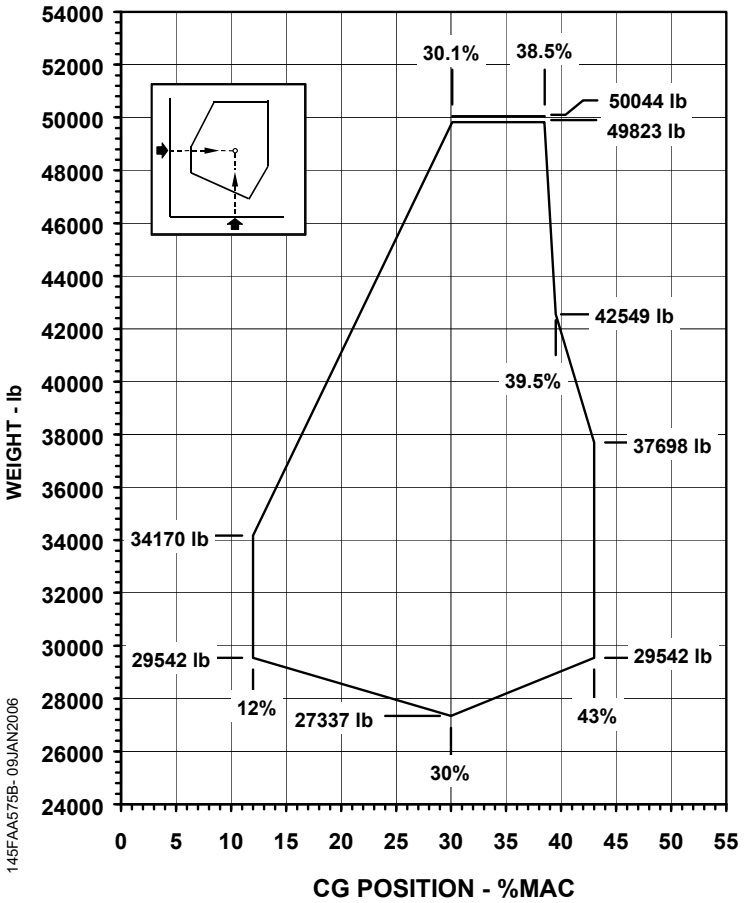
APPLICABLE TO AIRPLANES POST-MOD. SB 145-53-0068 OR EQUIPPED WITH AN EQUIVALENT MODIFICATION FACTORY INCORPORATED.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
50044 lb	49823 lb	43651 lb	40564 lb



NOTE: For inflight and landing limits refer to standard CG Envelope.

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To comply with the performance and operating limitations of the regulations, the maximum allowable takeoff and landing operational weights may be equal to, but not greater than, the design limits.

The takeoff weight (weight at brake release or at start of takeoff run) is the lowest among MTOW and the following weights:

- Maximum takeoff weight for altitude and temperature determined from Maximum Takeoff Weight - Climb Limited chart.
- Maximum takeoff weight, as limited by runway length and determined from Maximum Takeoff Weight - Field Length Limited chart.
- Maximum takeoff weight, as limited by brake energy and determined from Maximum Takeoff Weight - Brake Energy Limited chart.
- Maximum takeoff weight, as limited by obstacle clearance, enroute, and landing operating requirements.

The landing weight is the lowest among MLW and the following weights:

- Maximum approach and landing weight for altitude and temperature determined from Maximum Landing Weight - Climb Limited charts.
- Maximum landing weight, as limited by runway length and determined from Maximum Landing Weight - Field Length Limited chart.
-

LOADING

The airplane must be loaded in accordance with the information contained in the Weight and Balance Manual.

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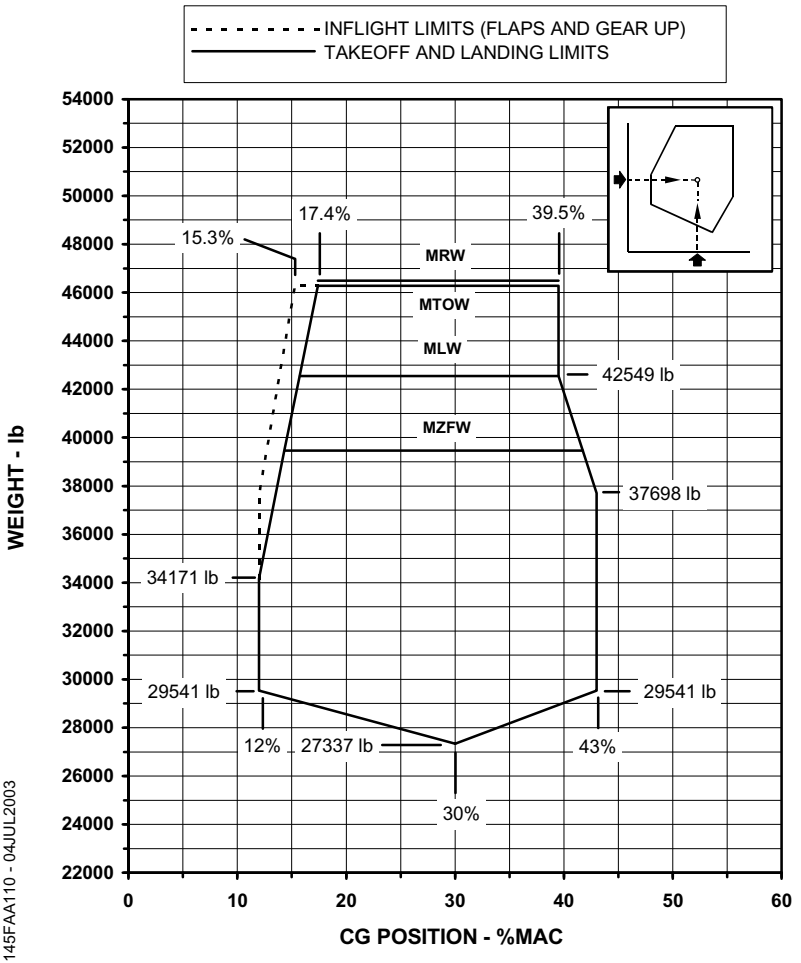
WEIGHT AND CENTER OF GRAVITY

EMB-145 MP MODEL - TAKEOFF WITH FLAPS 9°

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	Max. Takeoff Weight (MTOW)	Max. Landing Weight (MLW)	Max. Zero Fuel Weight (MZFW)
46495 lb	46275 lb	42549 lb	39462 lb



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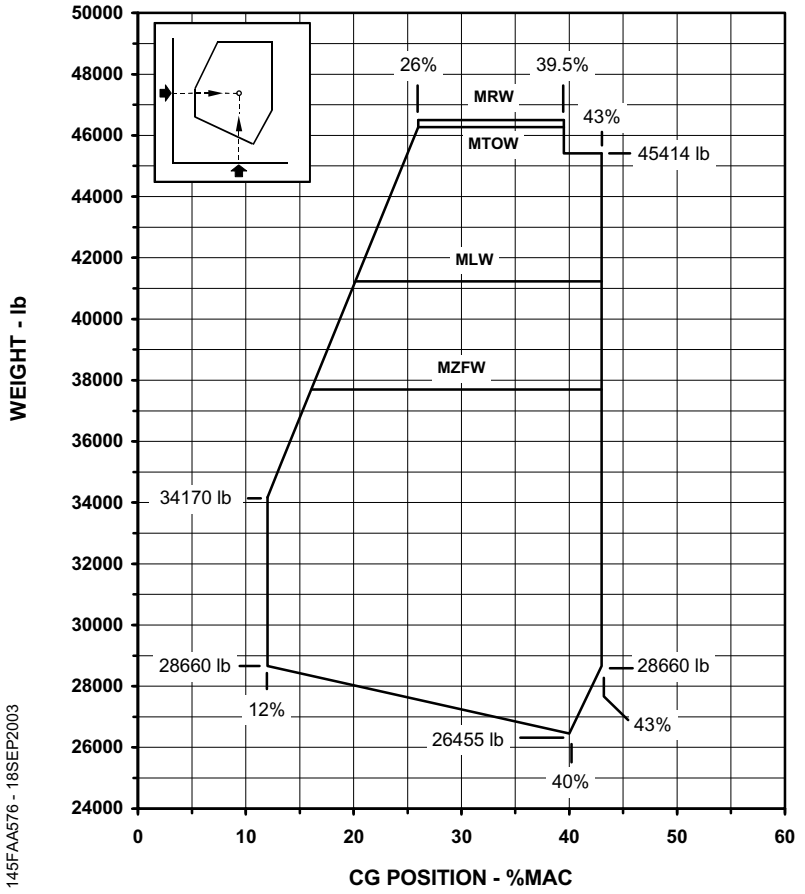
EMB-145 MP MODEL - TAKEOFF WITH FLAPS 22°

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	Max. Takeoff Weight (MTOW)	Max. Landing Weight (MLW)	Max. Zero Fuel Weight (MZFW)
46495 lb	46275 lb	42549 lb	39462 lb



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The takeoff weight (weight at brake release or at start of takeoff run) is the lowest among MTOW and the following weights:

- Maximum takeoff weight for altitude and temperature determined from Maximum Takeoff Weight - Climb Limited chart.
- Maximum takeoff weight, as limited by (dry or wet) runway length and determined from Maximum Takeoff Weight - Field Length Limited chart (if applicable, determined from Takeoff Distance on Contaminated Runway and Accelerate Stop Distance on Contaminated Runway charts).
- Maximum takeoff weight, as limited by brake energy and determined from Maximum Takeoff Weight - Brake Energy Limited chart.
- Maximum takeoff weight, as limited by obstacle clearance, enroute, and landing operating requirements.

The landing weight is the lowest among MLW and the following weights:

- Maximum approach and landing weight for altitude and temperature determined from Maximum Landing Weight - Climb Limited charts.
- Maximum landing weight, as limited by (dry or wet) runway length and determined from Maximum Landing Weight - Field Length Limited chart (if applicable, determined from Landing Distance on Contaminated Runway charts).

LOADING

The airplane must be loaded in accordance with the information contained in the Weight and Balance Manual.

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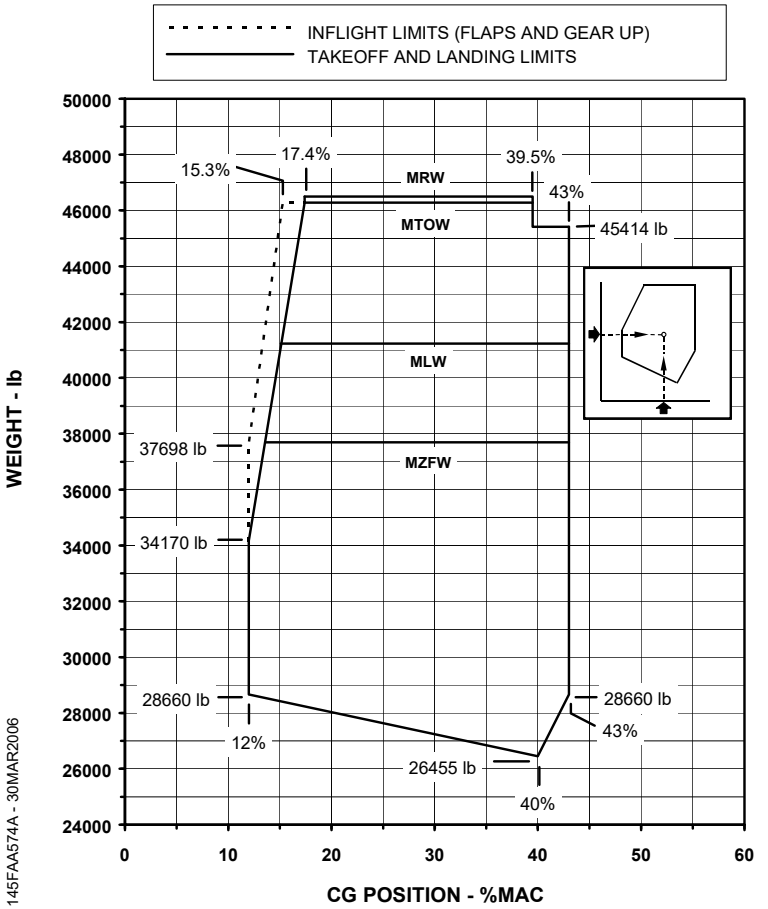
WEIGHT AND CENTER OF GRAVITY

EMB-145 EP MODEL - TAKEOFF WITH FLAPS 9° OR 18º

APPLICABLE TO AIRPLANES PRE-MOD. SB 145-53-0064.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
46495 lb	46275 lb	41226 lb	37698 lb



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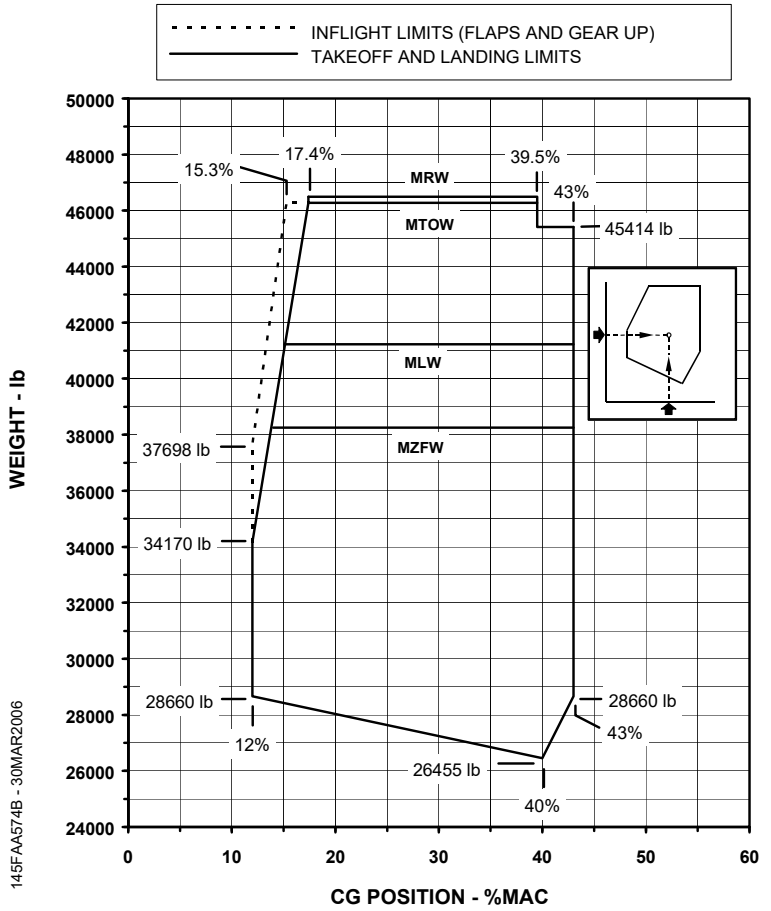
APPLICABLE TO AIRPLANES POST-MOD. SB 145-53-0064 OR EQUIPPED WITH AN EQUIVALENT MODIFICATION FACTORY INCORPORATED.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
46495 lb	46275 lb	41226 lb	38250 lb



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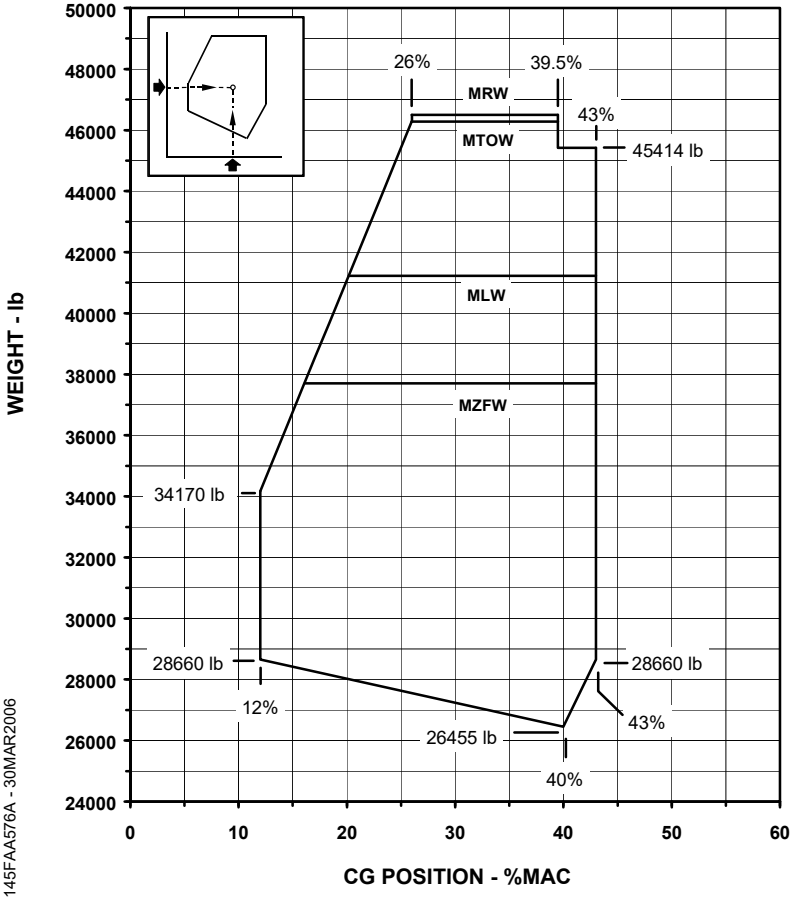
EMB-145 EP MODEL - TAKEOFF WITH FLAPS 22°

APPLICABLE TO AIRPLANES PRE-MOD. SB 145-53-0064.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
46495 lb	46275 lb	41226 lb	37698 lb



NOTE: For inflight and landing limits refer to standard CG Envelope.

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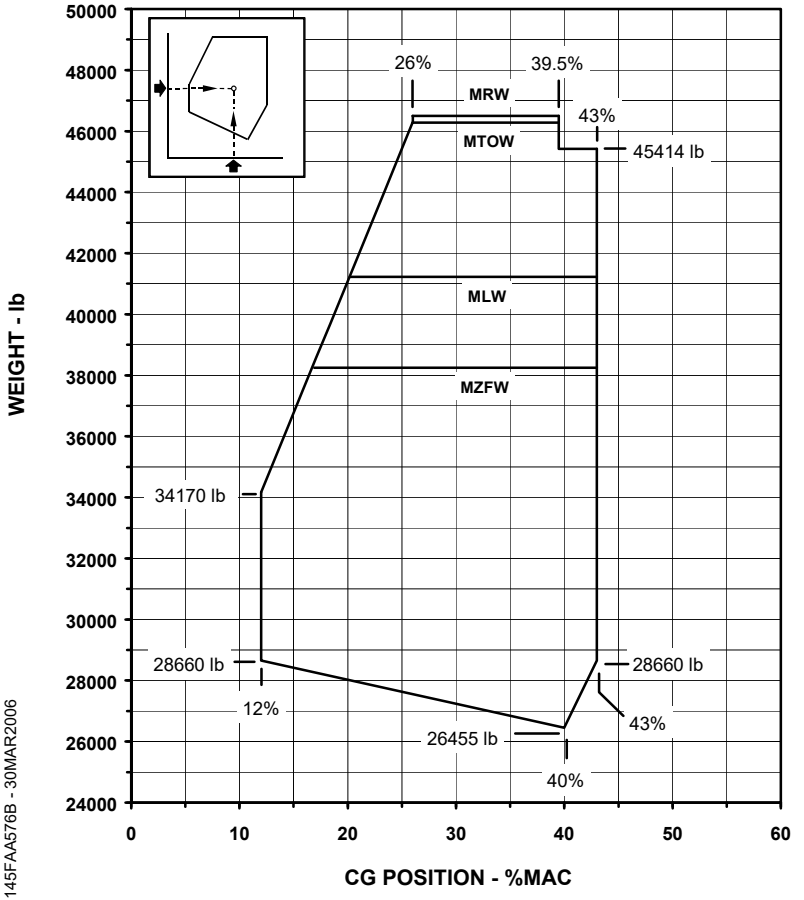
APPLICABLE TO AIRPLANES POST-MOD. SB 145-53-0064 OR EQUIPPED WITH AN EQUIVALENT MODIFICATION FACTORY INCORPORATED.

MAXIMUM WEIGHT			
Max. Ramp Weight (MRW)	**Max. Takeoff Weight (MTOW)**	**Max. Landing Weight (MLW)**	**Max. Zero Fuel Weight (MZFW)**
46495 lb	46275 lb	41226 lb	38250 lb



145FAA576B - 30MAR2006

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- Maximum takeoff weight, as limited by brake energy and determined from Maximum Takeoff Weight - Brake Energy Limited chart.
- Maximum takeoff weight, as limited by obstacle clearance, enroute, and landing operating requirements.

The landing weight is the lowest among MLW and the following weights:

- Maximum approach and landing weight for altitude and temperature determined from Maximum Landing Weight - Climb Limited charts.
- Maximum landing weight, as limited by (dry or wet) runway length and determined from Maximum Landing Weight - Field Length Limited chart (if applicable, determined from Landing Distance on Contaminated Runway charts).

LOADING

The airplane must be loaded in accordance with the information contained in the Weight and Balance Manual.

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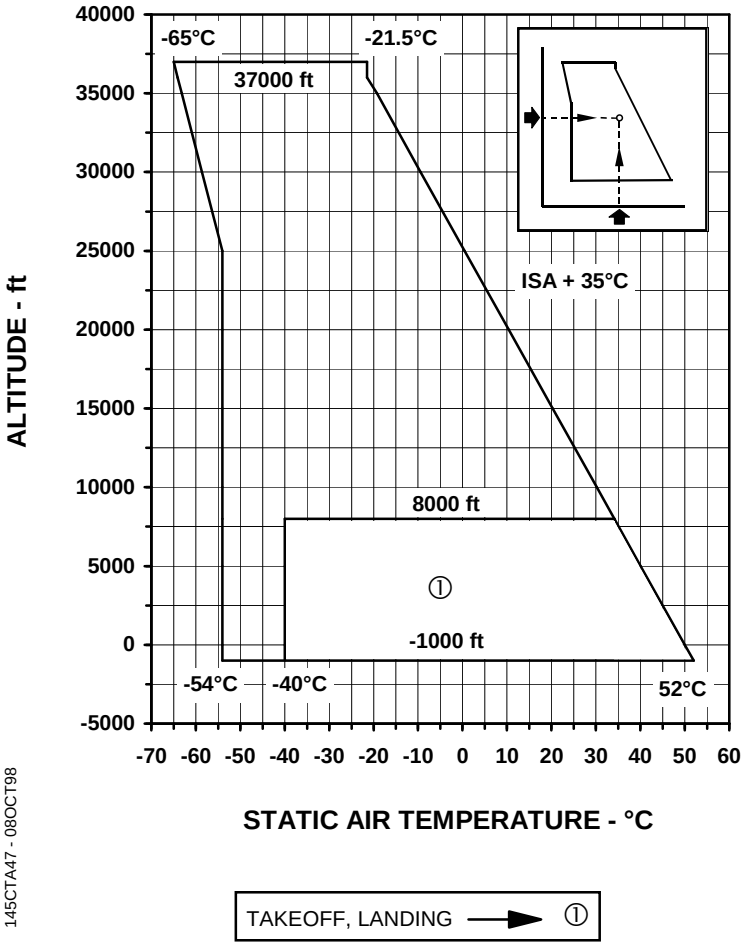
OPERATIONAL LIMITATIONS

OPERATIONAL ENVELOPE



NOTE: - In the event of a landing below -40°C, the airplane may not takeoff without further maintenance inspection.

- Total Air Temperature in cruise flight above 25000 ft is limited to -45°C. However, if momentary deviations happen to temperature up to -50°C, no maintenance action is required.

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AIRSPEEDS

LANDING GEAR OPERATION/EXTENDED SPEED (V_{LO} AND V_{LE})

V_{LO} for retraction ..... 200 KIAS
V_{LO} for extension ..... 250 KIAS
V_{LE} ..... 250 KIAS

NOTE: - V_{LO} for retraction is the maximum speed at which the landing gear can be safely retracted.
- V_{LO} for extension is the maximum speed at which the landing gear can be safely extended.
- V_{LE} is the maximum speed at which the airplane can be safely flown with the landing gear extended and locked.

MANEUVERING SPEED (V_A)

V_A ..... 200 KIAS

NOTE: Maneuvers that involve angle of attack near the stall or full application of rudder, elevator, and aileron controls should be confined to speeds below V_A. In addition, the maneuvering flight load factor limits, presented in this Section, should not be exceeded.

WARNING: RAPID AND LARGE ALTERNATING CONTROL INPUTS, ESPECIALLY IN COMBINATION WITH LARGE CHANGES IN PITCH, ROLL, OR YAW (E.G.LARGE SIDE SLIP ANGLES) MAY RESULT IN STRUCTURAL FAILURES AT ANY SPEED, EVEN BELOW V_A.

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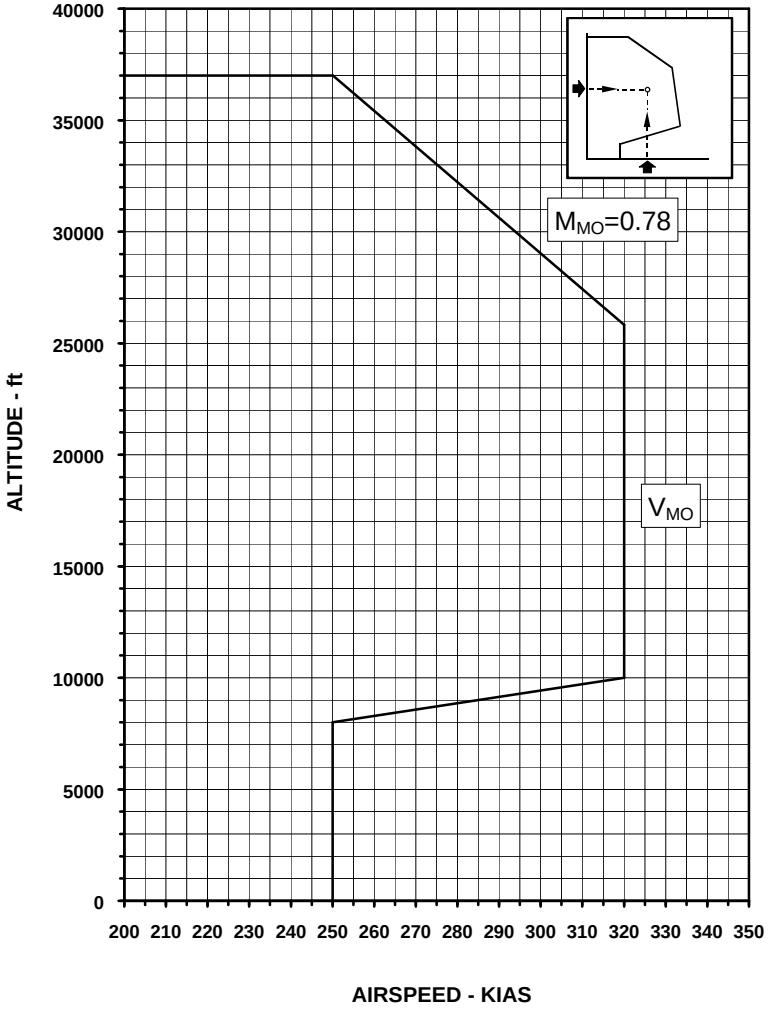
MAXIMUM OPERATING SPEED

APPLICABLE TO ALL MODELS EXCEPT EMB-145 XR MODEL POST-MOD. SB 145-31-0038



145CTA49 - 27JAN1997

NOTE: The V_{MO}/M_{MO} may not be deliberated exceeded in any regime of flight (climb, cruise, or descent).

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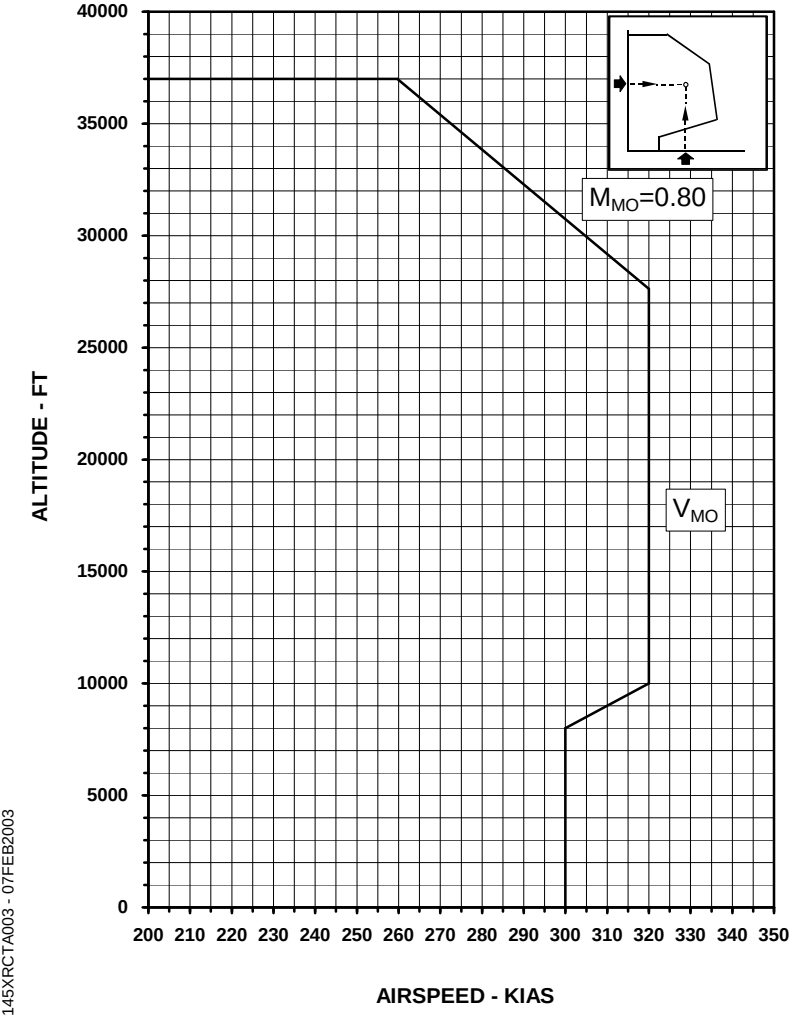
APPLICABLE TO EMB-145 XR MODEL POST-MOD. SB 145-31-0038 OR WITH AN EQUIVALENT MODIFICATION FACTORY INCORPORATED



NOTE: The V_{MO}/M_{MO} may not be deliberated exceeded in any regime of flight (climb, cruise, or descent).

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FLIGHT CONTROLS

MAXIMUM FLAP EXTENDED SPEED (V_{FE}) - FOR EMB-135, ERJ-140 AND EMB-145 MODELS, EXCEPT EMB-145 XR

Flaps 9° ..... 250 KIAS
Flaps 18° ..... 200 KIAS
Flaps 22° ..... 200 KIAS
Flaps 45° ..... 145 KIAS

MAXIMUM FLAP EXTENDED SPEED (V_{FE}) - FOR EMB-145 XR MODEL

Flaps 9° ..... 250 KIAS
Flaps 18° ..... 200 KIAS
Flaps 22° ..... 200 KIAS
Flaps 45° ..... 160 KIAS

Above 10000 ft with Yaw Damper disengaged:

Flaps 22° ..... 180 KIAS
Flaps 45° ..... 145 KIAS

ELECTROMECHANICAL GUST LOCK

Each time electromechanical gust lock lever is set to unlocked (FREE) position elevator movement must be checked. This check must be performed at least 10 seconds after positioning the gust lock lever to the unlocked (FREE) position by moving the control column from the full up stop to the full down stop and back to the full up stop position.

MAXIMUM FLAP EXTENDED ALTITUDE

Maximum Altitude for Flap Extension ..... 20000 ft

PITCH TRIM

Maximum Airspeed after Takeoff/During Climb
without Retrimming..... 160 KIAS

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TAILWIND

Maximum Takeoff and Landing Tailwind Component..... 10 kt

DIRECT VISION WINDOW (AFM PROCEDURES)

Maximum recommended speed to remove direct vision windows is 140 KIAS.

UNPRESSURIZED FLIGHT (NON-AFM)

Maximum altitude for operation after an in-flight depressurization, is 10000 ft MSL unless MEA or otherwise required.

Maximum altitude for dispatch for an unpressurized flight is 10000 ft.

TURBULENT AIR PENETRATION SPEED (AFM PROCEDURES)

At or below 10000 ft..... 200 KIAS

Above 10000 ft..... 250 KIAS/0.63M, WHICHEVER IS LOWER

MAXIMUM RECOMMENDED CROSSWIND (NON-AFM)

Embraer aerodynamics analysis have resulted in the following maximum recommended crosswinds for takeoff and landing:

Dry runway..... 30 kt

Wet runway..... 30 kt

Runway with Compacted Snow..... 25 kt

Runway with Standing Water/Slush/Dry Snow..... 20 kt

Runway with Ice (no melting) ..... 10 kt

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MANEUVERING FLIGHT LOAD FACTORS

These corresponding accelerations limit the bank angle during turns and limit the pull-up maneuvers.

LOAD FACTOR LIMIT	FLAPS UP	FLAPS DOWN (9°,18°, 22° and 45°)
Positive	2.50 g	2.00 g
Negative	-1.00 g	0 g

RUNWAY

Runway Slope ..... -2% TO +2%

Runway Surface Type ..... PAVED

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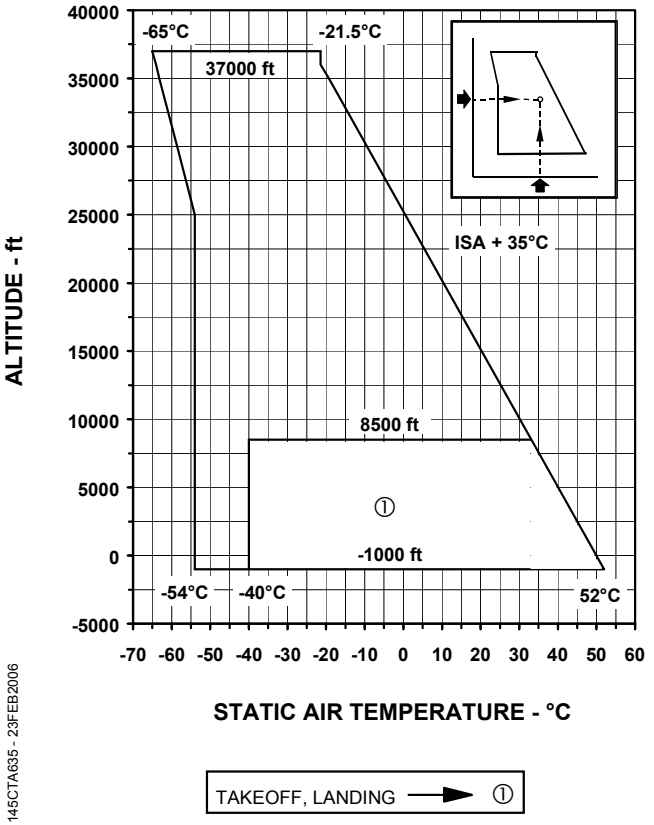
SUPPLEMENTARY OPERATIONAL LIMITATIONS

OPERATIONAL ENVELOPE

APPLICABLE ONLY TO EMB-145ER, EP, EU AND MP MODELS POST-MOD. SB 145-00-0031 OR EQUIPPED WITH AN EQUIVALENT MODIFICATION FACTORY INCORPORATED



NOTE: - In the event of a landing below -40°C, the airplane may not takeoff without further hard landing maintenance inspection (Refer to AMM Task 5-50-02).

- Minimum Total Air Temperature in cruise flight above 25000 ft is -45°C.

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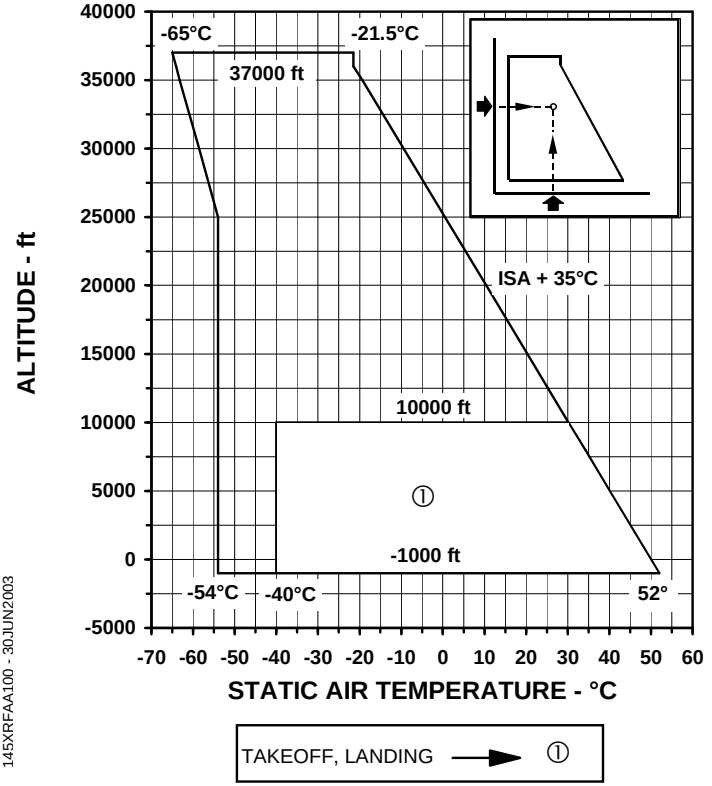
SUPPLEMENTARY OPERATIONAL LIMITATIONS

OPERATIONAL ENVELOPE

APPLICABLE ONLY TO EMB-145XR AND LR MODELS POST-MOD. SB 145-21-0050 OR EQUIPPED WITH AN EQUIVALENT MODIFICATION FACTORY INCORPORATED



NOTE: - In the event of a landing below -40°C, the airplane may not takeoff without further hard landing maintenance inspection (Refer to AMM Task 5-50-02).

- Minimum Total Air Temperature in cruise flight above 25000 ft is -45°C.
- Only APU T-62T-40C14 is allowed for operations on ground above 8000 ft.

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ENHANCED GROUND PROXIMITY WARNING SYSTEM (EGPWS)

The following limitations are applicable to the Enhanced Ground Proximity Warning System (EGPWS):

- The Allied-Signal Enhanced Ground Proximity Warning System Pilot's Guide, Document Number 060-4241-000, March 1997 edition (or later revision of the manual) or accepted Operating Manual, must be available to the flight crew.
- Allied-Signal Application Software version 202 and Configuration Software version 202 or later must be installed.
- Navigation is not to be predicated on the use of the Terrain Awareness Display.
- The Terrain Display is intended to be used as a situational tool only and may not provide the accuracy and/or fidelity on which to solely base terrain avoidance maneuvering.
- The EGPWS data base, displays, and alerting algorithms currently do not account for man-made obstructions.
- The EGPWS must be inhibited in the following conditions:

  NOTE: To inhibit the Terrain Awareness Alerting and Display function, press the TERRAIN SYS OVRD button.

  - Within 15 NM of takeoff or landing at airports that have no approved instrument approach procedure or not included in the EGPWS Allied Signal database (encompasses airports which runways are shorter than 1070 m).
  - When FMS is operating in Dead Reckoning Mode.

    NOTE: This will not affect the basic GPWS functions (modes 1 to 7). If the FMS is restored after a period of inadequacy, the EGPWS may be enabled by pressing again the TERRAIN SYS OVRD button.

  - If GPS data is unavailable or inoperative, the use of predictive EGPWS software functions should be manually inhibited during QFE operations.
  - For airplanes equipped with FMS Honeywell and with EGPWS software prior to version 216, Terrain Awareness Alerting and Display functionality must be manually inhibited when below the

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transition altitude while flying QFE on approach into an airport which is more than 200 ft above or below Sea Level.

NOTE: QFE operation with EGPWS enable is allowed with FMS Honeywell when featuring EGPWS software versions -216 and on or with FMS Universal Post-Mod. SB 145-34-0112.

- Pilots are authorized to deviate from their current Air Traffic Control (ATC) clearance to the extent necessary to comply with an EGPWS warning.
- In case of a conflict between the terrain alerts and an auto popped-up picture, pilots must check:
  - The sweeping marker movement on the horizontal line below the terrain picture. If the marker is frozen, the MFD terrain indication must be deselected on MFD bezel panel.
  - The MDF 2 terrain information. If the terrain picture bus fail is not annunciated (TERR amber annunciation), the MDF 2 must be used as terrain picture reference.

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ELECTRICAL

Maximum Load on Main Generator ..... 400 A

Maximum Load on APU Generator:

Up to 30000 ft ..... 400 A

Above 30000 ft..... 300 A

Maximum Battery Temperature ..... 70°C

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FUEL

(ER, EP, MP MODEL)

Maximum usable quantity per tank	679.8 US Gal (4600 lb)
Unusable quantity per tank	7.1 US Gal (48 lb)
Unusable quantity per tank (Any electric fuel pump inoperative)	39.3 US Gal (266 lb)

Maximum permitted imbalance between tanks ..... 800 lb

NOTE: - When the EICAS fuel quantity is zero in level flight, any fuel remaining in the tanks can not be used safely in flight.
- The values above have been determined for an adopted fuel density of 6.767 lb/US Gal.
- When performing pressure refueling, the usable fuel quantity in each tank may be reduced by 7.9 US Gal maximum.

FUEL SPECIFICATION

Brazilian Specification..... QAV1
ASTM Specification ..... D1655-JET A AND JET A-1
American Specification ..... MIL-T-83133A-JP8 AND MIL-DTL-5624-JP5

NOTE: The use of Red Dye contaminated fuel is restricted to emergency conditions and must comply with Rolls-Royce's recommendations.

FUEL TANK TEMPERATURE

Minimum ..... -40°C
Maximum ..... 52°C

NOTE: If fuel does not contain an icing inhibitor, the temperature of fuel leaving FCOC must be above 4°C. If this condition is satisfied, the caution message "E1(2) LO TEMP" is not presented (refer to FUEL LOW TEMPERATURE Procedure).

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FUEL (LR MODEL)

Maximum usable quantity per tank	844.9 US Gal (5717 lb)
Unusable quantity per tank	5.8 US Gal (39 lb)
Unusable quantity per tank (Any electric fuel pumps inoperative)	53.9 US Gal (365 lb)

Maximum permitted imbalance between tanks ..... 800 lb

NOTE: - When the EICAS fuel quantity is zero in level flight, any fuel remaining in the tanks can not be used safely in flight.
- The values above have been determined for an adopted fuel density of 6.767 lb/US Gal.
- When performing pressure refueling, the usable fuel quantity in each tank may be reduced by 13.2 US Gal maximum.

FUEL SPECIFICATION

Brazilian Specification..... QAV1
ASTM Specification ..... D1655-JET A AND JET A-1
American Specification ..... MIL-T-83133A-JP8 AND MIL-DTL-5624-JP5

NOTE: The use of Red Dye contaminated fuel is restricted to emergency conditions and must comply with Rolls-Royce's recommendations.

FUEL TANK TEMPERATURE

Minimum ..... -40°C
Maximum ..... 52°C

NOTE: If fuel does not contain an icing inhibitor, the temperature of fuel leaving FCOC must be above 4°C. If this condition is satisfied, the caution message "E1(2) LO TEMP" is not presented (refer to FUEL LOW TEMPERATURE Procedure).

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AUXILIARY POWER UNIT

OPERATIONAL LIMITS

APU Model	T-62T-40C11		T-62T-40C14	
PARAMETER	**MIN**	**MAX**	**MIN**	**MAX**
TEMPERATURE (3)	-54°C	-	-	-
ALTITUDE FOR START	-	25000 ft or	-	-
	-	30000 ft (2)	-	30000 ft
OPERATION ALTITUDE	-	37000 ft	-	37000 ft
ROTOR SPEED	-	108%	-	108% (5)
EGT:	-	-	-	-
START	-	884°C (1)	-	884°C
CONTINUOUS	-	680°C (6)	-	680°C (6)

NOTE: 1) May be exceeded up to 925°C above 25000 ft during 10 seconds.

2) For airplanes Post-Mod. SB 145-49-0010 or equipped with an equivalent modification factory incorporated. In this case, the minimum temperature for APU start is -54°C up to 30000 ft.

3) Minimum battery temperature for starting the APU by batteries is -20°C.

4) Refer to Fuel Tank Temperature limitations for other APU starting related limits.

5) The APU automatically shuts down at 104% rotor speed.

6) The APU EGT may be exceeded up to 717°C for 5 minutes maximum.

APU STARTER LIMITS

Cooling period between each starting attempt:

Between Three Consecutive Attempts..... 1 MINUTE OFF
Between Two Series of
Three Consecutive Attempts..... 30 MINUTES OFF

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POWER PLANT

WARNING: ALL FOUR FADECS INSTALLED ON THE AIRPLANE MUST BE THE SAME PART NUMBER. INCORRECT ENGINE OPERATION CAN RESULT FROM USING FADECS WITH TWO DIFFERENT PART NUMBERS.

OPERATIONAL LIMITS (ROLLS-ROYCE AE3007A1P)

PARAMETER (5)	MIN	MAX
N1	-	100%
N2	-	102.4% (8)
ITT:		
START	-	800°C
TAKEOFF (1)	-	948°C
CONTINUOUS	-	901°C
OIL PRESSURE:		
BELOW 88% N2	34 psi	95 psi (2)(6) 110 psi (2)(7)
AT OR ABOVE 88% N2	50 psi (9)	95 psi (6) 110 psi (7)
OIL TEMPERATURE	21°C (3)	126°C
FUEL TEMPERATURE	-54°C	52°C
VIBRATION:		
LP SPOOL	-	1.8 IPS (4)
HP SPOOL	-	1.1 IPS (4)

NOTE: 1) Takeoff Thrust is time limited to 5 minutes.

2) May be exceeded during starts if oil temperature is below 21°C. The engine must remain at IDLE until the oil pressure is less than 95 psi (110 psi for airplanes Post-Mod. SB 145-73-0023 or equipped with an equivalent modification factory incorporated).

3) Minimum oil temperature for starting is -40°C for lubrication oil specified by MIL-L-23699D and -54°C for lubrication oil specified by MIL-L-7808K.

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4) Vibration in the amber range below 2.5 IPS is time limited to 5 minutes during the takeoff or go-around phases or 10 seconds during the remainder flight phases.
High vibration indicates a malfunction which may worsen and increase vibration severity. Therefore, continuous engine operation with vibration in the amber range is not recommended. According to engine vibration limits, the pilot may elect not to reduce TLA for vibration below 2.5 IPS time limited to 5 minutes during takeoff or go-around or 10 seconds during the remainder flight phases. If vibration returns to the green range within 5 minutes, the flight may continue but vibration causes should be investigated before the next flight. Vibration in any flight phase in the amber range up to 1.5 IPS for less than 30 seconds does not require maintenance action.

5) Any engine exceedance or peak must be monitored and logged by the crew.

6) Operation in oil pressure amber range is permitted between 96 and 115 psi in all operational modes and time limited to 5 minutes, or between 116 and 155 psi in all operational modes time limited to 2 minutes. Total time above 95 psi may not exceed 5 minutes.

7) For airplanes Post-Mod. SB 145-73-0023 or equipped with an equivalent modification factory incorporated the upper limit of the oil pressure green band is 110 psi. Operation in oil pressure amber range is permitted between 111 and 115 psi in all operational modes time limited to 5 minutes, or between 116 and 155 psi in all operational modes time limited to 2 minutes. Total time above 110 psi may not exceed 5 minutes.

8) For airplanes Pre-Mod. SB 145-73-0027, the N2 limit is 102.5%.

9) While this is an abnormal condition, operation between 50 and 34 psi is permitted during takeoff and go-around phases.

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STARTER LIMITS

On Ground:

Starting or Dry Motoring	UP TO 5 MINUTES ON, 5 MINUTES OFF
OR	
First to Fourth Cycles	1 MINUTE ON, 1 MINUTE OFF
Following Cycles	1 MINUTE ON, 5 MINUTES OFF

In Flight:

Maximum Continuous Operation Time	5 MINUTES ON

NOTE: No cool down time is required should an in-flight start be re-attempted.

AUTOMATIC TAKEOFF THRUST CONTROL SYSTEM (ATTCS)

ATTCS must be operative to select ALT T/O-1 or T/O modes.

For airplanes equipped with FADEC versions previous than B8.0:

At least once a week a Thrust Assurance Check must be performed by selecting maximum takeoff mode during takeoff and checking engine parameters.

The Thrust Assurance Check is not required if the owner/operator actively participate in Engine Condition Monitoring, as described Chapter 5 of the AE3007A Series Engine Maintenance Manual.

For airplanes equipped with FADEC versions B8.0 and on, the Thrust Assurance Check is not required.

THRUST REVERSER

Thrust reversers are intended for use during rejected takeoff or landing only. Do not attempt a go-around procedure after deployment of the thrust reversers following a landing.

Selection of thrust reversers in flight or their preselection before touchdown is prohibited.

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ENGINE WARM-UP

Prior to takeoff, the engines must be allowed to run at low thrust to stabilize the engine temperatures before takeoff thrust is selected.

After start, the engines must run at idle or taxi thrust for at least 4 minutes for cold engines or 2 minutes for warm engines.

Before takeoff, to increase N2 above 83% the engine oil temperature must be at 40°C minimum. In lieu of this limit, it is acceptable to either:

- run the engine for at least 8 minutes in idle or taxi thrust and check if the temperature is at least 21°C or,
- for airplanes Pre-Mod. Rolls-Royce SB AE3007A-79-025, complete a static run-up to 88% N2, stabilize, and check to ensure that oil pressure is equal to or less than 83 psi.

NOTE: The engine is considered cold if it has been shutdown for more than 90 minutes.

ENGINE COOL DOWN

The engines must run for at least 1 minute at idle or taxi thrust before shutdown.

PERFORMANCE

APPROACH CLIMB GRADIENT AND APPROACH CLIMB LIMITED WEIGHTS

Airplanes equipped with FADEC software version B5.1.1 must decrease the Approach Climb Gradient by 1.1% and decrease the Approach Climb Limited Weight by 1920 lb.

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PNEUMATIC, AIR CONDITIONING AND PRESSURIZATION

PRESSURIZATION

Maximum differential pressure..... 7.8 psi

Maximum differential overpressure..... 8.1 psi

Maximum differential negative pressure ..... -0.3 psi

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ICE AND RAIN PROTECTION

OPERATION IN ICING CONDITIONS

Maximum Temperature for Anti-icing Operation ..... 10°C
Minimum Temperature for Manual Anti-Icing Operation ..... -40°C
Single engine or single bleed maximum altitude operation in icing conditions..... 15000 ft
Holding configuration:
- Landing Gear..... UP
- Flaps..... UP
- Minimum Airspeed..... 200 KIAS

NOTE: - There is no temperature limitation for anti-icing system automatic operation.

- Use Static Air Temperature (SAT) on ground or for takeoff operations and Total Air Temperature (TAT) for operations in flight.
- Icing conditions may exist whenever the Static Air Temperature (SAT) on the ground or for takeoff, or Total Air Temperature (TAT) in flight, is 10°C or below and visible moisture in any form is present (such as clouds, fog with visibility of one mile or less, rain, snow, sleet, and ice crystals).
- Icing conditions may also exist when the SAT on the ground and for takeoff is 10°C or below when operating on ramps, taxi ways, or runways where surface snow, ice, standing water, or slush may be ingested by the engines, or freeze on engines, nacelles, or engine sensor probes.
- Takeoff is prohibited with frost, ice, snow or slush adhering to wings, control surfaces, engine inlets, or other critical surfaces (refer to the applicable requirements).
- There are many methods to ensure the wing is clear of ice. If visual inspection or installed clear ice detectors do not indicate wing contamination, a tactile (hand on surface) check of the wing leading edge and the upper surface must be accomplished prior to takeoff. The tactile check must also be performed when the holdover time is exceeded after airplane de/anti-icing fluids are applied. This check should be performed whenever the outside temperature is less than 6°C or if it cannot be ascertained that the wing fuel temperature is above 0°C, and:
  - there is visible moisture,
  - water is present on the wing,

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- the difference between the dew point and the outside air temperature is 3°C or less, or
- the atmospheric conditions have been conducive to frost formation.

CAUTION:
- ON GROUND, DO NOT RELY ON VISUAL ICING EVIDENCE OR ICE DETECTOR ACTUATION TO TURN ON THE ANTI-ICING SYSTEM. USE THE TEMPERATURE AND VISUAL MOISTURE CRITERIA AS SPECIFIED ABOVE. DELAYING THE USE OF THE ANTI-ICING SYSTEM UNTIL ICE BUILD-UP IS VISIBLE FROM THE COCKPIT MAY RESULT IN ICE INGESTION AND POSSIBLE ENGINE DAMAGE OR FLAME-OUT.
- DO NOT USE APU BLEED AS PNEUMATIC SOURCE FOR ANTI-ICING SYSTEM.

WINDSHIELD WIPER OPERATION

Maximum Airspeed for Windshield Wiper Operation .... 170 KIAS

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OZONE CONCENTRATION

The tables below show the airplane altitude limitations due to ozone concentration in atmosphere.

NOTE: - These tables are based on FAA ADVISORY CIRCULAR 120.38.

- The tables show altitude limitations calculated for constant ozone concentration, cabin stabilized at 8000 ft, and both recirculation fans turned on.
- For conditions other than those specified in item 2 above, an optimized flight plan must be approved by regulatory agencies.
- For longitudes, the following apply:

  W = Western

  E = Eastern

  Reference = 100°W longitude

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NORTH AMERICA - MAXIMUM OZONE CRITERIA

FLIGHT LEVEL	JAN		FEB		MAR		APR		MAY		JUN	
LATITUDE	W	E	W	E	W	E	W	E	W	E	W	E
80°N	-	330	-	330	-	320	-	320	-	-	-	340
75°N	-	330	-	330	-	330	-	320	-	320	-	340
70°N	-	350	-	330	-	330	-	330	-	320	-	340
65°N	-	360	340	330	330	340	330	330	330	330	340	350
60°N	-	-	360	350	340	340	330	330	340	330	350	350
55°N	-	-	-	360	350	350	340	340	340	340	350	-
50°N	-	-	-	-	-	360	340	350	340	350	-	-
45°N	-	-	-	-	-	-	360	360	360	-	-	-
40°N	-	-	-	-	-	-	-	-	-	-	-	-
35°N	-	-	-	-	-	-	-	-	-	-	-	-

FLIGHT LEVEL	JUL		AUG		SEP		OCT		NOV		DEC	
LATITUDE	W	E	W	E	W	E	W	E	W	E	W	E
80°N	-	350	-	-	-	-	-	-	-	-	-	-
75°N	-	360	-	-	-	-	-	-	-	-	-	-
70°N	-	-	-	-	-	-	-	-	-	-	-	-
65°N	360	-	-	-	-	-	-	-	-	-	-	-
60°N	360	-	-	-	-	-	-	-	-	-	-	-
55°N	-	-	-	-	-	-	-	-	-	-	-	-
50°N	-	-	-	-	-	-	-	-	-	-	-	-
45°N	-	-	-	-	-	-	-	-	-	-	-	-
40°N	-	-	-	-	-	-	-	-	-	-	-	-
35°N	-	-	-	-	-	-	-	-	-	-	-	-

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NORTH AMERICA - TWA OZONE CRITERIA

NOTE: Values below are the altitude limitations in which the airplane is allowed to fly more than 3 continuous hours.

FLIGHT LEVEL	JAN		FEB		MAR		APR		MAY		JUN	
LATITUDE	W	E	W	E	W	E	W	E	W	E	W	E
80°N	-	290	-	290	-	-	-	-	-	-	-	270
75°N	-	290	-	290	-	270	-	270	-	-	-	270
70°N	-	300	-	290	-	270	-	270	-	-	-	290
65°N	320	310	310	270	310	290	300	270	270	270	310	290
60°N	330	310	310	290	310	300	290	270	270	270	310	290
55°N	340	310	330	300	310	300	290	290	290	290	310	300
50°N	350	320	350	310	320	310	270	290	290	290	310	320
45°N	350	330	320	320	320	320	290	310	310	310	330	330
40°N	340	350	-	320	320	330	310	310	330	330	350	350
35°N	-	-	-	-	350	-	-	350	-	350	-	-
30°N	-	-	-	-	-	-	-	-	-	-	-	-

FLIGHT LEVEL	JUL		AUG		SEP		OCT		NOV		DEC	
LATITUDE	W	E	W	E	W	E	W	E	W	E	W	E
80°N	-	270	-	310	-	310	-	310	-	300	-	310
75°N	-	290	-	330	-	320	-	310	-	310	-	310
70°N	-	290	-	330	-	330	-	320	-	310	-	310
65°N	310	310	340	340	350	330	330	330	350	310	330	310
60°N	310	320	340	350	350	350	330	330	350	310	330	320
55°N	310	320	340	350	-	350	350	350	350	330	350	330
50°N	320	330	340	350	-	-	-	-	350	350	-	350
45°N	330	350	-	-	-	-	-	-	-	-	-	350
40°N	-	-	-	-	-	-	-	-	-	-	-	350
35°N	-	-	-	-	-	-	-	-	-	-	-	-
30°N	-	-	-	-	-	-	-	-	-	-	-	-

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NAVIGATION EQUIPMENT

RADAR

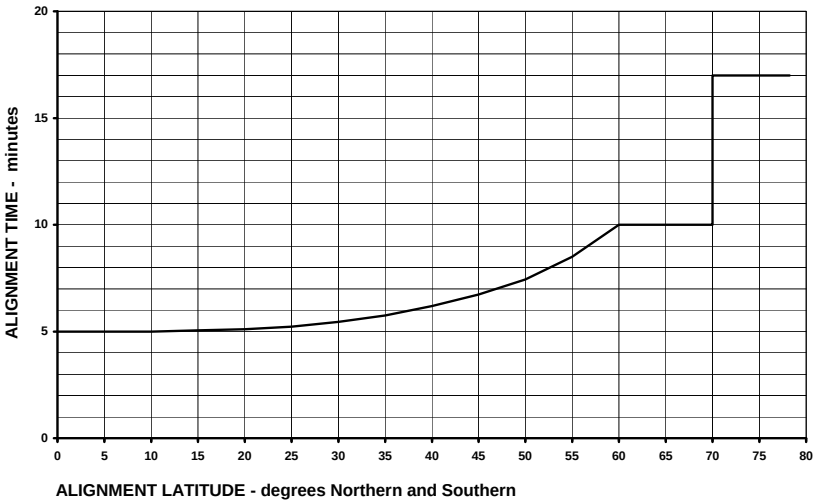
Do not operate weather radar during refueling, near fuel spills or people.

ATTITUDE AND HEADING REFERENCE SYSTEM

Airplane must not be moved until all attitude and heading information presented on PFD is valid.

For the AH-900 AHRS version the following limits are applicable:

- Maximum latitude for alignment .....78°15' Northern and Southern
- AHRS alignment will complete only after a valid airplane present position (latitude and longitude) is received from the FMS.
- Time to Alignment:



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- The airplanes may not be operated within the following North and South magnetic polar cut-out regions:

MAGNETIC CUT-OUT REGIONS	LATITUDE	LONGITUDE
North	Between 70°N and 82°N	Between 80°W and 135°W
	North of 82°N	Between 0° and 180°W/E
South	Between 60°S and 82°S	Between 118°30'E and 160°E
	South of 82°S	Between 0° and 180°W/E

NOTE: Within the magnetic polar cut-out regions AHRS heading data is not available.

INSTRUMENT LANDING SYSTEM (ILS)

This limitation applies to airplanes equipped with Mod. L of the Honeywell Primus II NV-850 Navigation Receiver Module P/N 7510134-831; which is part of the Honeywell Primus II RNZ-851 Integrated Navigation Unit P/N 7510100-831, -832, -833 and -834.

When crossing the Outer Marker on glideslope, the altitude must be verified with the value on the published procedure.

For airplanes with a single operating glideslope receiver, the approach may be flown using normal procedures no lower than Localizer Only Minimum Descent Altitude (MDA).

For airplanes with two operating glideslope receivers, the airplane may be flown to the published minimums for the approach using normal procedures if both glideslope receivers are tuned to the approach and both crew members are monitoring the approach using independent data and displays.

INTEGRATED STANDBY INSTRUMENT SYSTEM (ISIS)

Maximum duration of ISIS when operating on batteries only is 40 minutes.

NOTE: The maximum duration of battery power can be extended to 45 minutes if the Pitot 3 Sensor Heating Button is turned off when not operating in icing conditions.

Airplane must not be moved during power-up initialization.
Do not cage attitude in turning flight.

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COMMUNICATION EQUIPMENT

HF

- Do not rely on ADF indications shown on PFD while transmitting in HF.
- Do not transmit through HF Radio during airplane fueling.

TRANSPONDER MODE S ENHANCED SURVEILLANCE

For airplanes Post-Mod. SB 145-34-0096 or equipped with an equivalent modification factory incorporated, the installed Mode S system satisfies the data requirements of ICAO Doc 7030/4, Regional Supplementary Procedures for SSR Mode S Enhanced Surveillance in designated European airspace.

The system is not capable to transmit the Track Angle Rate parameter.

AUTOPILOT (APPLICABLE TO ERJ-140)

The following limitations are applicable to the Autopilot:

Minimum Decision Altitude During
ILS Approach ..... 200 ft AGL

Minimum Engagement Height
(Takeoff or Go-around) ..... 500 ft

Minimum Use Height..... 160 ft

Malfunction altitude loss:

- Cruise ..... 50 ft
- Maneuver ..... 40 ft
- ILS Approach..... 15 ft

Descent below Minimum Descent Altitude on a non-precision approach with autopilot engaged is prohibited.

Single engine go-around with autopilot engaged is prohibited.

Approach mode selection during Localizer capture is allowed only when airplane is inbound.

NOTE: Coupled go-around height loss may be 40 ft.

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AUTOPILOT (APPLICABLE TO ERJ-145 MODELS EXCEPT EMB-145 XR)

The following limitations are applicable to the Autopilot:

For airplanes Pre-Mod. SB 145-31-0016, the use of the Autopilot below 1500 ft AGL is only permitted when coupled to the captain's Flight Director.

Minimum Decision Altitude During
ILS Approach..... 200 ft AGL

Minimum Engagement Height
(Takeoff or Go-around)..... 500 ft

Minimum Use Height ..... 160 ft

Malfunction altitude loss:

- Cruise..... 80 ft
- Maneuver..... 40 ft
- ILS Approach ..... 15 ft

Descent below Minimum Descent Altitude on a non-precision approach with autopilot engaged is prohibited.

Single engine go-around with autopilot engaged is prohibited.

Approach mode selection during Localizer capture is allowed only when airplane is inbound.

For airplanes Pre-Mod. SB 145-31-0014, go-around in basic mode (roll and pitch) is allowed only with wings level.

NOTE: Coupled go-around height loss may be 75 ft.

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AUTOPILOT (APPLICABLE TO EMB-145 XR MODEL ONLY)

The following limitations are applicable to the Autopilot:

- Minimum Decision Altitude During
  ILS Approach ..... 200 ft AGL
- Minimum Engagement Height
  (Takeoff or Go-around) ..... 500 ft
- Minimum Use Height..... 160 ft
- Malfunction altitude loss:
  Cruise..... 80 ft
  Maneuver ..... 40 ft
  ILS Approach ..... 35 ft
- Descent below Minimum Decision Altitude on a non-precision approach with autopilot engaged is prohibited.
- Single engine go-around with autopilot engaged is prohibited.
- Approach mode selection during Localizer capture is allowed only when airplane is inbound.

NOTE: Coupled go-around height loss may be 40 ft.

AUTOMATIC DEPENDENT SURVEILLANCE - BROADCAST (ADS-B) OUT

For airplanes Post-Mod. SB 145-34-0118 or Post-Mod. SB 145-34-0121, or equipped with an equivalent modification factory incorporated, the installed ADS-B Out system complies with FAA AC 20-165B. The installed ADS-B Out system has also been shown to meet the equipment requirements of 14 CFR 91.227.

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NAVIGATION EQUIPMENT

RADAR

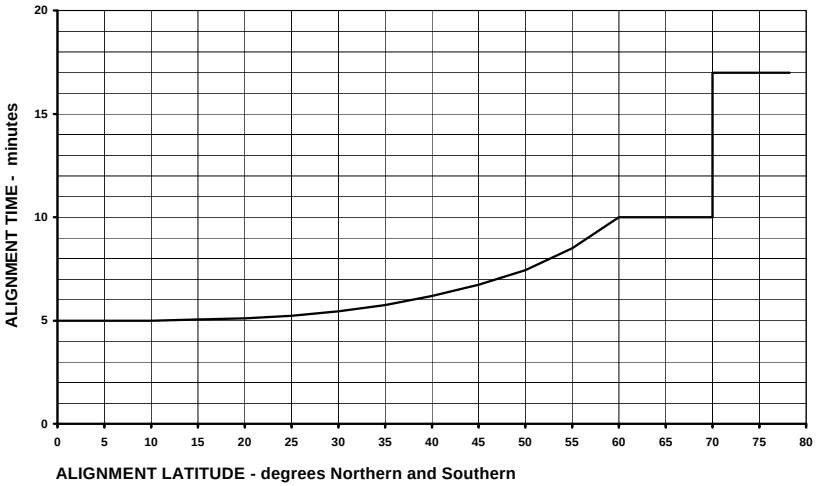
Do not operate weather radar during refueling, near fuel spills or people.

ATTITUDE AND HEADING REFERENCE SYSTEM

Airplane must not be moved until all attitude and heading information presented on PFD is valid.

For the AH-900 AHRS version the following limits are applicable:

- Maximum latitude for alignment..... 78°15' Northern and Southern
- AHRS alignment will complete only after a valid airplane present position (latitude and longitude) is received from the FMS.
- Time to Alignment:



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– The airplanes may not be operated within the following North and South magnetic polar cut-out regions:

MAGNETIC CUT-OUT REGIONS	LATITUDE	LONGITUDE
North	Between 70°N and 82°N	Between 80°W and 135°W
	North of 82°N	Between 0° and 180°W/E
South	Between 60°S and 82°S	Between 118°30'E and 160°E
	South of 82°S	Between 0° and 180°W/E

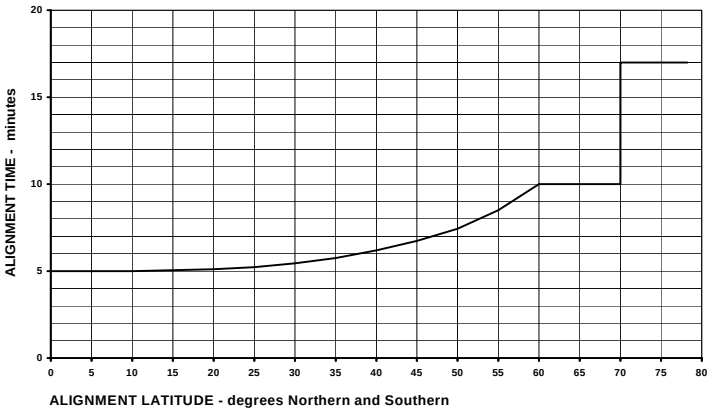
NOTE: Within the magnetic polar cut-out regions AHRS heading data is not available.

INERTIAL REFERENCE SYSTEM

– Maximum latitude for alignment ..... 78°15' Northern and Southern

– IRS alignment will complete only after a valid airplane present position (latitude and longitude) is received from the FMS.

– Time to Alignment:



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– The airplanes may not be operated within the following North and South magnetic polar cut-out regions:

MAGNETIC CUT-OUT REGIONS	LATITUDE	LONGITUDE
North	Between 70°N and 82°N	Between 90°W and 120°W
	North of 82°N	Between 0° and 180°W/E
South	Between 60°S and 82°S	Between 120°E and 160°E
	South of 82°S	Between 0° and 180°W/E

NOTE: Within the magnetic polar cut-out regions IRS heading data is not available.

INSTRUMENT LANDING SYSTEM (ILS)

This limitation applies to airplanes equipped with Mod. L of the Honeywell Primus II NV-850 Navigation Receiver Module P/N 7510134-831; which is part of the Honeywell Primus II RNZ-851 Integrated Navigation Unit P/N 7510100-831, -832, -833 and -834.

When crossing the Outer Marker on glideslope, the altitude must be verified with the value on the published procedure.

For airplanes with a single operating glideslope receiver, the approach may be flown using normal procedures no lower than Localizer Only Minimum Descent Altitude (MDA).

For airplanes with two operating glideslope receivers, the airplane may be flown to the published minimums for the approach using normal procedures if both glideslope receivers are tuned to the approach and both crew members are monitoring the approach using independent data and displays.

INTEGRATED STANDBY INSTRUMENT SYSTEM (ISIS)

Maximum duration of ISIS when operating on batteries only is 40 minutes.

NOTE: The maximum duration of battery power can be extended to 45 minutes if the Pitot 3 Sensor Heating Button is turned off when not operating in icing conditions.

Airplane must not be moved during power-up initialization.
Do not cage attitude in turning flight.

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COMMUNICATION EQUIPMENT

HF

- Do not rely on ADF indications shown on PFD while transmitting in HF.
- Do not transmit through HF Radio during airplane fueling.

TRANSPONDER MODE S ENHANCED SURVEILLANCE

For airplanes Post-Mod. SB 145-34-0096 or equipped with an equivalent modification factory incorporated, the installed Mode S system satisfies the data requirements of ICAO Doc 7030/4, Regional Supplementary Procedures for SSR Mode S Enhanced Surveillance in designated European airspace.
The system is not capable to transmit the Track Angle Rate parameter.

AUTOPILOT (APPLICABLE TO ERJ-140 MODELS)

The following limitations are applicable to the Autopilot:

Minimum Decision Altitude During
ILS Approach ..... 200 ft AGL

Minimum Engagement Height
(Takeoff or Go-around) ..... 500 ft

Minimum Use Height ..... 160 ft

Malfunction altitude loss:

- Cruise ..... 50 ft
- Maneuver ..... 40 ft
- ILS Approach ..... 15 ft

Descent below Minimum Descent Altitude on a non-precision approach with autopilot engaged is prohibited.

Single engine go-around with autopilot engaged is prohibited.

Approach mode selection during Localizer capture is allowed only when airplane is inbound.

NOTE: Coupled go-around height loss may be 40 ft.

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AUTOPILOT (APPLICABLE TO EMB-145 MODELS)

The following limitations are applicable to the Autopilot:

For airplanes Pre-Mod. SB 145-31-0016, the use of the Autopilot below 1500 ft AGL is only permitted when coupled to the captain's Flight Director.

Minimum Decision Altitude During

ILS Approach ..... 200 ft AGL

Minimum Engagement Height

(Takeoff or Go-around) ..... 500 ft

Minimum Use Height ..... 160 ft

Malfunction altitude loss:

- Cruise ..... 80 ft
- Maneuver ..... 40 ft
- ILS Approach..... 15 ft

Descent below Minimum Descent Altitude on a non-precision approach with autopilot engaged is prohibited.

Single engine go-around with autopilot engaged is prohibited.

Approach mode selection during Localizer capture is allowed only when airplane is inbound.

For airplanes Pre-Mod. SB 145-31-0014, go-around in basic mode (roll and pitch) is allowed only with wings level.

NOTE: Coupled go-around height loss may be 75 ft.

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AUTOMATIC DEPENDENT SURVEILLANCE - BROADCAST (ADS-B) OUT

For airplanes Post-Mod. SB 145-34-0118 or Post-Mod. SB 145-34-0121, or equipped with an equivalent modification factory incorporated, the installed ADS-B Out system complies with FAA AC 20-165B. The installed ADS-B Out system has also been shown to meet the equipment requirements of 14 CFR 91.227.

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FMZ2000 FLIGHT MANAGEMENT SYSTEM

The following limitations are applicable to the FMS:

- The Honeywell Flight Management System (FMS) Pilot's Operating Manual, Honeywell Publication Number A28-1146-122-00, August 1997 edition (or later revision of the manual) for the software version NZ4.8, Honeywell Publication Number A28-1146-133-00, February 1999 edition (or later revision of the manual) for the software version NZ5.2 or FAA accepted Operating Manual, must be immediately available to the flight crew whenever navigation is predicated on the use of the FMS. The software status stated in the Pilot's Manual must match that displayed on the FMS Control Display Unit (CDU).
- Honeywell software version NZ4.8 or NZ5.2 must be installed.
- FMS instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the FMS navigation data base. The FMS data base must incorporate the current update cycle.
- Use of FMS guidance for conducting instrument approach procedures is prohibited with the FMS operating in the degrade or dead reckoning mode (DGR or DR annunciation set on PFD).
- Operation above 72° 30.0' north latitude and below 59° 30.0' south latitude is prohibited due to unreliable magnetic heading.
- The pilot must review the complete transition-approach, comparing the waypoints and altitudes displayed on the FMS with those on the published procedure prior to activation to insure that the correct procedure and transition are selected.
- The Flight Director must be coupled to the LNAV mode (autopilot coupled or not coupled), to accomplish GPS only approaches.

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- When using FMS guidance for conducting instrument approach procedures that do not include a GPS reference in the title of the published procedure, the flight crew must verify that the procedure specified navaid and associated avionics are operational.
- For airplanes equipped with single FMS, when using FMS guidance for conducting instrument approach procedures, the procedure navaid must be tuned and valid, and the raw data must be displayed in the cockpit, under the following conditions:
  - For VOR approaches (where the procedure specified navaid is a VOR only navaid - no DME capability) and NDB approaches, without GPS (GPS failed or RAIM out of limits or unavailable).
  - For any instrument approach (other than a GPS stand alone approach), outside the Brazilian Airspace, with GPS as the navigation sensor.
- ILS, LOC, LOC-BC, LDA, SDF and MLS approaches, using the FMS for guidance, are prohibited.
- When flying to an airport where GPS (non-overlay) is the intended approach, prior to dispatch, the crew is required to verify that the predictive RAIM at the destination ETA is within the approach criteria. This information (RAIM AVAILABLE), is displayed on the PREDICTIVE RAIM page, accessed via the GPS STATUS page.
- When the approach at the destination is based on GPS and an alternate airport is required by the applicable operating rules, the alternate must be served by an approach based on a navigation aid other than GPS. The navigation aid must be operational and the airplane must have operational equipment capable of using that navigation aid.
- IFR non-precision approach approval is limited to published approaches in the WGS-84 coordinate datum within US airspace. Approaches to airports in other airspace are not approved unless authorized by the appropriate governing authority.

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- The FMS is approved for those oceanic and North Atlantic (NAT) Minimum Navigation Performance Specification (MNPS) routes requiring only a single FMS and a single GPS in accordance with AC 20-130A.
- The pilot must check for leg gaps in the Flight Plan Display on EFIS and input waypoints to fill in any gaps as necessary.
- IFR enroute and terminal navigation is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.
- The fuel flow and fuel used presented on the FMS are supplementary information only. The flight crew must use fuel information primarily from the MFD and EICAS display.
- Coupled FMS vertical guidance is not available. Therefore, during FMS operation with Autopilot coupled, the pilot must use the Flight Guidance Controller for vertical control. Advisory vertical guidance is available only in descent.
- During oceanic, North Atlantic (NAT) Minimum Navigation Performance Specification (MNPS), enroute and terminal area operation with DR or DGR annunciated on the PFD, the flight crew must verify the FMS position using VOR/DME raw data or other appropriate means.
- The airplane must have other navigation equipment installed and operating, appropriate to the route of flight.
- The FMS approaches and missed approaches are prohibited for airplanes with NZ4.8 Mod A software installed.
- FMS missed approaches using the CDU Mode Select Button is prohibited.

NOTE: The NZ4.8 Mod C software version may be identified by checking if the RTN TO SRVC maintenance page is available. This page may be accessed by pressing the NAV mode select button, then NEXT, then selecting the MAINTENANCE submode through the respective line select button, and finally pressing the NEXT mode select button twice. This page is not available for NZ4.8 Mod A.

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NAVIGATION OPERATIONAL APPROVALS

The single Honeywell FMZ2000 Flight Management System, with the software version NZ4.8 Mod A or Mod C, and the single or dual Honeywell FMZ2000 Flight Management System software version NZ5.2 Mod B, Mod C, Mod D and Mod E have been demonstrated capable of and have been shown to meet the requirements for the following operations:

OCEANIC AND REMOTE

In accordance with AC 20-130A and FAA Notice 8110.60 the dual FMS is approved as a two independent Long Range Navigation (LRN) System on these routes, provided it is receiving usable signals from the GPS which meets requirements of AC 90-94 for use as the only LRN System sensor. The dual FMZ2000 installation with dual GPS sensors as installed has been found to comply with the requirements for GPS primary means of navigation in oceanic and remote airspace, when used in conjunction with Honeywell Off Line RAIM prediction program. For single FMS installation, in accordance with AC 20-130A, along routes requiring a single Long Range Navigation (LRN) System, provided it is receiving usable signals from the GPS which meets requirements of AC 90-94 for use as the only LRN System sensor on these routes.

NORTH ATLANTIC (NAT) MINIMUM NAVIGATION PERFORMANCE SPECIFICATION (MNPS) AIRSPACE

- Provided two FMS installations are operating with each receiving information from two inertial reference systems (IRS) or from two global positioning systems (GPS) when used in conjunction with Honeywell Off Line RAIM prediction program, the FMS is capable of unrestricted flight into North Atlantic (NAT) Minimum Navigation Performance Specification (MNPS) airspace and has been shown to meet the accuracy specification in accordance with AC 120-33 or AC 91-49.
- For single FMS installation as defined in AC 91-49 and AC 91-70, along the special routes requiring a single LRN (Long Range Navigation System), provided it is receiving usable signals from the GPS which meets requirements of AC 90-94 for use as the only LRN System sensor on these routes.

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RNP-10 - REQUIRED NAVIGATION PERFORMANCE

- The dual FMZ2000 installation with dual Global Positioning System (GPS) sensors as installed has been found to comply with the requirements of FAA Order 8400.12A, as amended, as a primary means of navigation with no time limitation, when used in conjunction with Honeywell Off Line RAIM prediction program.
- The dual FMZ2000 installation with dual Inertial Reference Systems (IRS) as installed has been found to comply with the requirements of FAA Order 8400.12A, as amended, as a primary means of navigation for flights up to 6.2 hours after the system is placed in the navigation mode.
- The dual FMZ2000 installation with dual Global Positioning System (GPS) sensors and dual Inertial Reference Systems (IRS) as installed has been found to comply with the requirements of FAA Order 8400.12A, as amended, as a primary means of navigation with no time limitation.

ENROUTE AND TERMINAL

In accordance with AC 20-130A, TSO C129a C1, TSO C145c and TSO C146c provided it is receiving usable signals from:

- One VOR/DME or multiple DME's;
- GPS.

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NON-PRECISION APPROACH

In accordance with AC 20-130A, TSO C129a C1, TSO C145c, TSO C146c and AC 90-94 (Phase II and III overlay approaches and GPS only approaches), provided:

- The APP annunciation is set on the PFD at the Final Approach Fix.
- The DGR or DR is not annunciated on the PFD.
- The flight director is coupled to the LNAV mode (GPS only approaches).

NOTE: AC 90-94 deals with the use of GPS in the US National Airspace System (NAS) and in oceanic areas. The general approval to use GPS to fly overlay instrument approaches as described in the AC, is initially limited to the NAS. Refer to Limitations Section of this Supplement, for use of GPS for non-precision approaches outside the NAS.

RNAV OPERATION

In accordance with AC 90-100A, provided FMS is receiving automatic update from GPS or DME/DME/IRS.

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UNS-1K FLIGHT MANAGEMENT SYSTEM

- The Universal UNS1 Operator's Manual or an Operating Manual accepted by the Certification Authority must be immediately available to the flight crew whenever navigation is predicated on the use of FMS. The software status stated in the Operator's Manual must match that displayed on the FMS Control Display Unit (CDU).
- Universal FMS Software version 603.0 (or later approved version) must be installed.
- FMS instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the FMS navigation data base. The FMS data base must incorporate the current update cycle.
- Instrument approaches must be conducted in the approach mode, and GPS integrity monitoring (when using GPS for approach guidance) must be available at the Final Approach Fix, as indicated to the pilot by the INTEG amber annunciator being off and APP annunciator displayed on PFD.
- Use of FMS guidance for conducting instrument approach procedures is prohibited with the FMS operating in the dead reckoning mode (DR annunciation set on PFD).
- The pilot must review the complete transition-approach, comparing the waypoints and altitudes displayed on the FMS with those on the published procedure prior to activation to insure that the correct procedure and transition are selected.
- VNAV is advisory only, and the aircraft altimeter should be the primary source of altitude information at all times.
- When using FMS guidance for conducting instrument approach procedures that do not include a GPS reference in the title of the published procedure, the flight crew must verify that the procedure specified navaid and associated avionics are operational.

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- For airplanes equipped with single FMS, when using FMS guidance for conducting instrument approach procedures, the procedure navaid must be tuned and valid, and the raw data must be displayed in the cockpit, under the following conditions:
  - For VOR approaches (where the procedure specified navaid is a VOR only navaid no-DME capability) and NDB approaches, without GPS (GPS failed or RAIM out of limits or unavailable).
  - For any instrument approach (other than GPS stand alone approach), outside the airspace of countries operating under FAA jurisdiction, with the GPS as the navigation sensor.
- ILS, LDA, SDF and MLS approaches, using the FMS for guidance, are prohibited.
- When conducting FMS guided missed approach procedures, autopilot coupled operation is prohibited until the flight crew has established a rate of climb that ensures all altitudes requirements of the procedure will be met.
- When flying to an airport where GPS (non-overlay) is the intended approach, prior to dispatch, the flight crew is required to verify that the predictive RAIM at the destination ETA is within the approach criteria.
- When the approach at the destination is based on GPS and an alternate airport is required by the applicable operating rules, the alternate airport must be served by an approach based on a navigation aid other than GPS. The navigation aid must be operational and the aircraft must have operational equipment capable of using that navigation aid.
- IFR non-precision approach approval is limited to published approaches within the airspace of countries operating under FAA jurisdiction. Approaches to airports in other airspace are not approved unless authorized by the appropriate governing authority.
- IFR enroute and terminal navigation is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.
- The fuel flow and fuel used presented on the FMS are supplementary information only. The flight crew must use fuel information primarily from the MFD and EICAS display.

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- Coupled FMS vertical guidance is not available. Therefore, during FMS operation with Autopilot coupled, the pilot must use the Flight Guidance Controller for vertical control. Advisory vertical guidance is available only in descent.
- During oceanic, North Atlantic (NAT) Minimum Performance Specification (MNPS), enroute and terminal area operation with DR annunciated on the PFD, the flight crew must verify the FMS position using VOR/DME raw data or other appropriate means.
- The airplane must have other navigation equipment installed and operating, appropriate to the route of flight.
- Operation above 73° north latitude and below 60° south latitude is prohibited due to unreliable magnetic heading.
- FMS PVOR outbound function is prohibited.
- FMS missed approach using the CDU Mode Select Buttons is prohibited.
- During FMS Fuel Management initialization, the flight crew must enter manually the fuel on board data.

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NAVIGATION OPERATIONAL APPROVALS

The Universal UNS-1K Flight Management System, with the version 603.X software, has been demonstrated capable of and has been shown to meet the requirements for the following operations:

- **Oceanic and Remote** - In accordance with AC 20-130A, along routes requiring a Long Range Navigation (LRN) System, provided it is receiving usable signals from the GPS which meets requirements of AC 90-94 for use as the only LRN System sensor on these routes.
- **North Atlantic (NAT) Minimum Navigation Performance Specification (MNPS) airspace** - As defined in AC 91-49 and AC 91-70, along the special routes requiring a single LRN, provided it is receiving usable signals from the GPS which meets requirements of AC 90-94 for use as the only LRN System sensor on these routes.
- **Enroute and Terminal** - In accordance with AC 20-130A and TSO C129a B1 provided it is receiving usable signals from:
  - One VOR/DME or multiple DME's.
  - GPS.
- **Instrument Approach** - LOC and BC approaches in accordance with AC 25-15 and RNAV, VOR, VOR/DME, NDB and GPS approaches in accordance with AC 20-130A, TSO C129a B1, TSO C115b and AC 90-94 (Phase II and III overlay approaches and GPS only approaches), provided:
  - The APP annunciation is set on the PFD at the Final Approach Fix.
  - The DR is not annunciated on the PFD.
  - The flight director is coupled to the LNAV mode (GPS only approaches).

NOTE: AC 90-94 deals with the use of GPS in the US National Airspace System (NAS) and in oceanic areas. The general approval to use GPS to fly overlay instrument approaches as described in the AC, is initially limited to the NAS. Refer to LIMITATIONS Section of this Supplement, for use of GPS for non-precision approaches outside the NAS.

- **RNAV Operation -** In accordance with AC 90-100A, provided FMS is receiving automatic update from GPS.

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FMZ 2010 FLIGHT MANAGEMENT SYSTEM

GENERAL LIMITATIONS

The following limitations are applicable to Honeywell Flight Management System version NZ 6.1.1:

- The Honeywell Flight Management System (FMS) Pilot's Operating Manual, Honeywell Publication Number D200802000002 (or later revision of the manual) for the software version NZ 6.1.1 or an Operating Manual accepted by the certification authority, must be immediately available to the flight crew whenever navigation is predicated on the use of the FMS. The software status stated in the Pilot's Manual must match that displayed on the FMS Control Display Unit (CDU).
- Honeywell software version NZ 6.1.1 must be installed.
- RNAV equipment has a performance limitation necessitating alternate airport flight planning operational mitigation.
- Availability of suitable approved backup navigation equipment to divert and land at an alternate destination is required for RNP terminal and approach operations with single FMS or single GPS.
- Approved GPS FDE availability prediction program and suitable backup navigation to divert and land at an alternate destination is required for RNP operations with TSO-C129/129a sensor and to TSO-C145c/146c sensor operating outside SBAS coverage area. Operations requiring use of GPS enroute/remote coverage prediction must rely on approved offline prediction program.
- GPS/SBAS service availability is required to be confirmed for RNP operations with TSO-C145c/146c sensor operating within SBAS coverage area.
- The Flight Director must be coupled to the LNAV mode (autopilot coupled or not coupled), to accomplish instrument RNAV operations based on FMS guidance.
- RNAV/RNP operations must not be performed following the guidance from HGS Model 3300.

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- FMS-coupled vertical guidance is not available. During FMS operation with autopilot engaged, the pilot must select the appropriate vertical guidance mode through the Flight Guidance Controller.
- Advisory vertical guidance deviation information is only an aid to help pilots comply with altitude restrictions. When using advisory vertical guidance, the pilot must use the primary barometric altimeter to ensure compliance with all altitude restrictions, particularly during instrument approach operations.
- It is required coordination with the ATC prior to employing the temperature compensation feature.
- FMS instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the FMS navigation database. The FMS database must incorporate the current update cycle.
- IFR operation based on FMS guidance is prohibited unless the pilot verifies the currency of the database or verifies each selected waypoint for accuracy by reference to current approved data.
- The pilots must compare any procedures/route retrieved from the FMS database with those published on the procedure charts. Differences between the charts and the FMS information up to 3° are acceptable. Otherwise, the coded procedure must not be used.
- Operation in the following region using FMS as primary navigation source is prohibited: north of 72°30.0' N and south of 59°30.0' S.
- For areas in which the magnetic database error may differ in more than 3° from the published charts, the following functions must be performed using true heading:
  - Manual creation of waypoints by place/bearing/distance,
  - Manual creation of waypoints by place/bearing/place/bearing,
  - Holding inbound course,

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- FIX INFO bearings, and
- DIRECT-TO with intercept course.

NOTE: To define course and bearing references to TRUE north in the FMS, insert the character "T" after the course/bearing value.

- The regions where the magnetic database error may differ in more than 3° from published charts are the following:

Until December 31, 2024	
LATITUDE	**LONGITUDE**
North of 55°00' N	East of 180°00' W West of 105°00' W
North of 58°30' N	East of 100°00' W West of 020°00' W
North of 65°00' N	East of 020°00' W West of 005°00'E
North of 65°00' N	East of 170°00' E West of 180°00' E
South of 50°00' S	East of 120°00' E West of 165°00' E

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From January 01, 2025, until December 31, 2029	
LATITUDE	**LONGITUDE**
North of 50°00' N	East of 180°00' W West of 130°00' W
North of 55°00' N	East of 130°00' W West of 080°00' W
North of 47°30' N	East of 080°00' W West of 000°00'
North of 55°00' N	East of 000°00' West of 030°00' E
North of 65°00' N	East of 030°00' E West of 070°00' E
North of 70°00' N	East of 110°00' E West of 125°00' E
North of 60°00' N	East of 140°00' E West of 170°00' E
North of 55°00' N	East of 170°00' E West of 180°00' E
South of 10°00' S North of 30°00' S	East of 075°00' W West of 057°00' W
South of 05°00' S North of 30°00' S	East of 010°00' W West of 015°00' E
South of 50°00' S	East of 115°00' E West of 180°00' E

- RNAV/RNP operations with DGR or DR annunciated on the PFD are prohibited.
- FMS performance management information is only supplementary. The flight crew must use fuel information primarily from the MFD and EICAS display.
- Use of the UNDO function is prohibited with departure and arrival procedures and approaches linked in the flight plan.
- Airplane is not approved for RNP less than 0.3 operations.
- Airplane is not approved for RNP AR operations.
- Airplane is not approved for procedures containing RF legs.
- Airplane is not approved for FRT leg transitions.

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- Airplane is not approved for pre-planned parallel offsets.
- Airplane is not approved for TOAC.
- Airplane is not approved for RNAV Holding.
- For operations using RNP 1 to RNP less than 2 the use of Flight Director is required.
- For operations using RNP 0.3 to RNP less than 1 the use of GPS and Flight Director is required.
- Airplane is not approved for missed approach operations less than RNP 1.

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APPROACH LIMITATIONS

- LP, LNAV/VNAV, LPV, ILS, LOC, LOC-BC, LDA, SDF, and MLS approaches, using the FMS for guidance, are prohibited.
- Approved GPS FDE availability prediction program and suitable backup navigation to divert and land at an alternate destination is required for RNP approach operations with TSO-C129/129a sensor and to TSO-C145c/146c sensor operating outside SBAS coverage area.
- GPS/SBAS service availability is required to be confirmed for RNP approach operations with dual FMS and dual TSO-C145c/146c GPS sensor operating within SBAS coverage area.
- Use of FMS guidance for conducting instrument approach operations is conditioned to the display of the APP annunciator set on PFD once within 2 NM from the final approach fix.
- Use of FMS guidance for conducting instrument approach procedures is prohibited with the FMS operating in the degrade or dead-reckoning mode (DGR or DR annunciation set on PFD).
- The pilot must review the complete transition-approach, comparing the waypoints and altitudes displayed on the FMS with those on the published procedure prior to activation to insure that the correct procedure and transition are selected.
- The Flight Director must be coupled to the LNAV mode (autopilot coupled or not coupled), to accomplish approach operations based on FMS guidance.
- Advisory vertical guidance deviation information is only an aid to help pilots comply with altitude restrictions. When using advisory vertical guidance, the pilot must rely on the altimeter as the primary vertical reference during the final approach segment, including step down fixes.
- FMS Missed Approaches using the CDU Mode Select Button during the final approach segment is prohibited.

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REMOTE OPERATIONS LIMITATIONS

- RNP remote operations are conditioned by approved dispatch GPS FDE availability prediction for airplanes not equipped with optional dual IRS configuration. The maximum allowable for a predicted loss of GPS FDE capability is 34 minutes. Operations requiring use of GPS enroute/remote coverage prediction must rely on approved offline prediction program.
- RNP 10 operations for airplanes equipped with optional dual IRS configuration meet the applicable performance criteria for up to 6.2 hours of flight time without GPS position update.

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NAVIGATION OPERATIONAL APPROVALS

The Honeywell Flight Management System, with the software version NZ 6.1.1 (identified on the FMS NAV IDENT PAGE) has been demonstrated capable of and has been shown to meet the requirements for the following operations:

ENROUTE, TERMINAL, AND APPROACH OPERATIONS

The installed single or dual FMZ 2010 equipment complies with FAA AC 20-138D for navigation using GPS and GPS/SBAS (within the coverage of a satellite-based augmentation system complying with ICAO Annex 10) for enroute, terminal area, non-precision approach, when the following equipment is installed and operative:

- For RNAV 1 and 2, and RNP 1:
  - 1 FMS,
  - 1 AHRS/IRS,
  - 1 CDU,
  - 4 Displays Units,
  - 1 GPS (1),
  - 1 VOR/DME module (1), and
  - 1 Flight Director.

NOTE: 1) Requirement for VOR/DME may be replaced by dual FMS and dual GPS/SBAS equipment.

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- For RNP 2:
  - 2 FMS,
  - 2 AHRS/IRS,
  - 2 CDU,
  - 4 Displays Units,
  - 2 GPS (1), and
  - 1 Flight Director.

  NOTE: 1) Dual GPS is the primary navigation system to support RNP 2.

- For RNP APCH operations with LNAV minima:
  - 1 FMS (1),
  - 1 AHRS/IRS,
  - 1 CDU (2),
  - 4 Displays Units,
  - 1 GPS (1),
  - 1 VOR/DME module (1), and
  - 1 Flight Director.

  NOTE: 1) GPS is the only approved sensor for RNP APCH operation. Although replacing the requirement for retaining VOR/DME as backup navigation equipment by dual FMS and dual GPS/SBAS may be considered acceptable by some local authorities.

  2) In case of dispatch with single FMS, the available CDU must control the available FMS.

REMOTE/OCEANIC OPERATIONS

The installed dual FMZ 2010 equipment complies with the requirements of the FAA AC 20-138D regarding multi-sensor system operation in remote and oceanic flight, when the following equipment is installed and operative:

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- For RNP 4 and RNP 10 (1):
  - 2 FMS,
  - 2 AHRS/IRS (2),
  - 2 CDU,
  - 4 Displays Units,
  - 2 GPS (2), and
  - 1 Flight Director.

NOTE: 1) The term RNP 10 must be understood as RNAV 10 as per ICAO nomenclature.

2) Two long range sensors are required. Dual GPS is the primary navigation system to support RNP 4. Dual GPS and/or dual IRS meet the criteria for RNP 10 operations.

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FMZ 2010 FLIGHT MANAGEMENT SYSTEM

GENERAL LIMITATIONS

The following limitations are applicable to Honeywell Flight Management System version NZ 6.1.1:

- The Honeywell Flight Management System (FMS) Pilot's Operating Manual, Honeywell Publication Number D200802000002 (or later revision of the manual) for the software version NZ 6.1.1 or an Operating Manual accepted by the certification authority, must be immediately available to the flight crew whenever navigation is predicated on the use of the FMS. The software status stated in the Pilot's Manual must match that displayed on the FMS Control Display Unit (CDU).
- Honeywell software version NZ 6.1.1 must be installed.
- RNAV equipment has a performance limitation necessitating alternate airport flight planning operational mitigation.
- Availability of suitable approved backup navigation equipment to divert and land at an alternate destination is required for RNP terminal and approach operations with single FMS or single GPS.
- Approved GPS FDE availability prediction program and suitable backup navigation to divert and land at an alternate destination is required for RNP operations with TSO-C129/129a sensor and to TSO-C145c/146c sensor operating outside SBAS coverage area. Operations requiring use of GPS enroute/remote coverage prediction must rely on approved offline prediction program.
- If GPS/SBAS service availability can be confirmed through service provider services (e.g.: NOTAM), then the use of prediction programs may not be required for RNP/RNAV operations with TSO-C145c/146c sensor operating within SBAS coverage area.
- For airplanes Pre-Mod. SB145-34-0125, the Flight Director must be coupled to the LNAV mode (autopilot coupled or not coupled), to accomplish instrument RNAV operations based on FMS guidance.
- RNAV/RNP/Baro-VNAV operations must not be performed following the indications from HGS (raw data or flight director guidance).

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- For airplanes Pre-Mod. SB145-34-0125, FMS-coupled vertical guidance is not available. During FMS operation with autopilot engaged, the pilot must select the appropriate vertical guidance mode through the Flight Guidance Controller.
- Advisory vertical guidance deviation information is only an aid to help pilots comply with altitude restrictions. When using advisory vertical guidance, the pilot must use the primary barometric altimeter for all flight operations to ensure compliance with all altitude restrictions.
- The Flight Director must be coupled to the VNAV mode (autopilot coupled or not coupled), for coupled Baro-VNAV operations.
- During takeoff and go-around, the Baro-VNAV must not be coupled to the flight director below 400 ft or prior to reaching the applicable acceleration altitude, whichever is higher.
- Baro-VNAV must not be used with altimeter adjustments referencing height above a ground location (QFE) rather than mean sea-level (QNH).
- The FMS does not correct the speed targets during Baro-VNAV operation, including approach and go-around speeds for flap and landing gear positions, ice accretion or non-normal conditions. It is the pilot responsibility to ensure that the speeds are within the limits during all operations.
- It is required coordination with the ATC prior to employing the temperature compensation feature.
- FMS instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the FMS navigation database. The FMS database must incorporate the current update cycle.
- IFR operation based on FMS guidance is prohibited unless the pilot verifies the currency of the database or verifies each selected waypoint for accuracy by reference to current approved data.
- The pilots must compare any procedures/route retrieved from the FMS database with those published on the procedure charts. Differences between the charts and the FMS information up to 3° are acceptable. Otherwise, the coded procedure must not be used.

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- Operation in the following region using FMS as primary navigation source is prohibited: north of 72°30.0' N and south of 59°30.0' S.
- For areas in which the magnetic database error may differ in more than 3° from the published charts, the following functions must be performed using true heading:
  - Manual creation of waypoints by place/bearing/distance,
  - Manual creation of waypoints by place/bearing/place/bearing,
  - Holding inbound course,
  - FIX INFO bearings, and
  - DIRECT-TO with intercept course.

NOTE: To define course and bearing references to TRUE north in the FMS, insert the character "T" after the course/bearing value.

- The regions where the magnetic database error may differ in more than 3° from published charts are the following:

Until December 31, 2024	
LATITUDE	**LONGITUDE**
North of 55°00' N	East of 180°00' W West of 105°00' W
North of 58°30' N	East of 100°00' W West of 020°00' W
North of 65°00' N	East of 020°00' W West of 005°00' E
North of 65°00' N	East of 170°00' E West of 180°00' E
South of 50°00' S	East of 120°00' E West of 165°00' E

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From January 01, 2025, until December 31, 2029	
LATITUDE	**LONGITUDE**
North of 50°00' N	East of 180°00' W West of 130°00' W
North of 55°00' N	East of 130°00' W West of 080°00' W
North of 47°30' N	East of 080°00' W West of 000°00'
North of 55°00' N	East of 000°00' West of 030°00' E
North of 65°00' N	East of 030°00' E West of 070°00' E
North of 70°00' N	East of 110°00' E West of 125°00' E
North of 60°00' N	East of 140°00' E West of 170°00' E
North of 55°00' N	East of 170°00' E West of 180°00' E
South of 10°00' S North of 30°00' S	East of 075°00' W West of 057°00' W
South of 05°00' S North of 30°00' S	East of 010°00' W West of 015°00' E
South of 50°00' S	East of 115°00' E West of 180°00' E

- RNAV/RNP operations with DGR or DR annunciated on the PFD are prohibited.
- FMS performance management information is only supplementary. The flight crew must use fuel information primarily from the MFD and EICAS display.
- Use of the UNDO function is prohibited with departure and arrival procedures and approaches linked in the flight plan.
- Airplane is not approved for RNP less than 0.3 operations.
- Airplane is not approved for RNP AR operations.
- Airplane is not approved for procedures containing RF legs.
- Airplane is not approved for FRT leg transitions.

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- Airplane is not approved for pre-planned parallel offsets.
- Airplane is not approved for TOAC.
- Airplane is not approved for RNAV Holding.
- For airplanes Pre-Mod. SB145-34-0125, operations using RNP 1 to RNP less than 2 require the use of Flight Director.
- For operations using RNP 0.3 to RNP less than 1 the use of GPS is required. For airplanes Pre-Mod. SB145-34-0125, the use of the Flight Director is also required.
- Airplane is not approved for missed approach operations less than RNP 1.

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APPROACH LIMITATIONS

- LP, ILS, GLS, LOC, LOC-BC, LDA, SDF, and MLS approaches, using the FMS for guidance, are prohibited.
- For airplanes Pre-Mod. SB145-34-0125, LNAV/VNAV and LPV approaches, using the FMS for guidance, are prohibited.
- Approved GPS FDE availability prediction program and suitable backup navigation to divert and land at an alternate destination is required for RNP approach operations with TSO-C129/129a sensor and to TSO-C145c/146c sensor operating outside SBAS coverage area.
- If GPS/SBAS service availability can be confirmed through service provider services (e.g.: NOTAM), then the use of prediction programs may not be required for RNP/RNAV operations with TSO-C145c/146c GPS sensor operating within SBAS coverage area.
- Use of FMS guidance for conducting instrument approach operations is conditioned to the display of the APP annunciator set on PFD once within 2 NM from the final approach fix.
- Use of FMS guidance for conducting instrument approach procedures is prohibited with the FMS operating in the degrade or dead-reckoning mode (DGR or DR annunciation set on PFD).
- The pilot must review the complete transition-approach, comparing the waypoints and altitudes displayed on the FMS with those on the published procedure prior to activation to ensure that the correct procedure and transition are selected.
- For airplanes Pre-Mod. SB145-34-0125, the Flight Director must be coupled to the LNAV mode (autopilot coupled or not coupled), to accomplish approach operations based on FMS guidance.
- The Flight Director must be coupled to the LNAV/VGP mode (autopilot coupled or not coupled) to perform instrument approach operations to LNAV/VNAV or LPV line of minima.

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- Advisory vertical guidance deviation information is only an aid to help pilots comply with altitude restrictions. When using advisory vertical guidance, the pilot must rely on the altimeter as the primary vertical reference for compliance with all altitude restrictions associated with the instrument approach procedure, including compliance with all associated step-down fixes.
- Only the LNAV/VNAV or LPV line of minima on an approach chart can guarantee the vertical path. For airplanes Post-Mod. SB145-34-0125, when performing an approach to LNAV minimums and the approach chart also contains LNAV/VNAV line of minima with step-down fixes, vertical path is not guaranteed. When performing an approach to LNAV only minimums, VNAV guidance provided by the Baro-VNAV function must be considered as advisory only. The pilot must ensure compliance with ATC clearances and altitude restrictions by using the primary barometric altimeter.
- Use of Baro-VNAV to the LNAV/VNAV minimum may not be authorized at airports with remote altimeter setting. In this case, use the LNAV minimum.
- The use of temperature compensation feature is required if Baro-VNAV operation outside the temperature limits published on approach procedure chart is intended.
- FMS Missed Approaches using the CDU Mode Select Button during the final approach segment is prohibited.

REMOTE OPERATIONS LIMITATIONS

- RNP remote operations are conditioned by approved dispatch GPS FDE availability prediction for airplanes not equipped with optional dual IRS configuration. The maximum allowable for a predicted loss of GPS FDE capability is 25 minutes for RNP 4 operation and 34 minutes for RNP 10 operation. Operations requiring use of GPS enroute/remote coverage prediction must rely on approved offline prediction program.
- RNP 10 operations for airplanes equipped with optional dual IRS configuration meet the applicable performance criteria for up to 6.2 hours of flight time without GPS position update.

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AUTOPILOT (AIRPLANES POST-MOD. SB145-34-0125)

The Minimum Use Height (MUH) during LPV approach is 160 ft.

NAVIGATION OPERATIONAL APPROVALS

The Honeywell Flight Management System, with the software version NZ 6.1.1 (identified on the FMS NAV IDENT PAGE) has been demonstrated capable of and has been shown to meet the requirements for the following operations:

ENROUTE, TERMINAL, AND APPROACH OPERATIONS

The installed single or dual FMZ 2010 equipment complies with FAA AC 20-138D for navigation using GPS and GPS/SBAS (within the coverage of a satellite-based augmentation system complying with ICAO Annex 10) for enroute, terminal area, non-precision approach, and for airplanes Post-Mod. SB145-34-0125 approach procedures with vertical guidance operations when the following equipment is installed and operative:

- For RNAV 1 and 2, and RNP 1:
  - 1 FMS,
  - 1 AHRS/IRS,
  - 1 CDU,
  - 4 Displays Units,
  - 1 GPS (1),
  - 1 VOR/DME module (1), and
  - 1 Flight Director for airplanes Pre-Mod. SB145-34-0125.

NOTE: 1) Requirement for VOR/DME may be replaced by dual FMS and dual GPS/SBAS equipment.

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- For RNP 2:
  - 2 FMS,
  - 2 AHRS/IRS,
  - 2 CDU,
  - 4 Displays Units,
  - 2 GPS (1), and
  - 1 Flight Director for airplanes Pre-Mod. SB145-34-0125.

  NOTE: 1) Dual GPS is the primary navigation system to support RNP 2.

- For RNP APCH operations with LNAV minima:
  - 1 FMS (1),
  - 1 AHRS/IRS,
  - 1 CDU (2),
  - 4 Displays Units,
  - 1 GPS (1),
  - 1 VOR/DME module (1), and
  - 1 Flight Director for airplanes Pre-Mod. SB145-34-0125.

  NOTE: 1) GPS is the only approved sensor for RNP APCH operation. Although replacing the requirement for retaining VOR/DME as backup navigation equipment by dual FMS and dual GPS/SBAS may be considered acceptable by some local authorities.

  2) In case of dispatch with single FMS, the available CDU must control the available FMS.

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- For RNP APCH operations to LNAV/VNAV minima (airplanes Post-Mod. SB145-34-0125):
  - 1 FMS (1),
  - 1 AHRS/IRS,
  - 1 CDU (1),
  - 4 Displays Units,
  - 1 GPS,
  - 2 ADS RVSM compliant,
  - 1 TAT, and
  - 1 Flight Director.

  NOTE: 1) In case of dispatch with single FMS, the available CDU must control the available FMS.
- For RNP APCH operations to LPV minima (airplanes Post-Mod. SB145-34-0125):
  - 2 FMS,
  - 2 AHRS/IRS,
  - 2 CDU,
  - 4 Displays Units,
  - 2 GPS,
  - 2 ADS RVSM compliant,
  - 1 TAT, and
  - 2 Flight Directors.

REMOTE/OCEANIC OPERATIONS

The installed dual FMZ 2010 equipment complies with the requirements of the FAA AC 20-138D regarding multi-sensor system operation in remote and oceanic flight, when the following equipment is installed and operative:

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- For RNP 4 and RNP 10 (1):
  - 2 FMS,
  - 2 AHRS/IRS (2),
  - 2 CDU,
  - 4 Displays Units,
  - 2 GPS (2), and
  - 1 Flight Director for airplanes Pre-Mod. SB145-34-0125.

NOTE: 1) The term RNP 10 must be understood as RNAV 10 as per ICAO nomenclature.

2) Two long range sensors are required. Dual GPS is the primary navigation system to support RNP 4. Dual GPS and/or dual IRS meet the criteria for RNP 10 operations.

BAROMETRIC VERTICAL NAVIGATION (AIRPLANES POST-MOD. SB145-34-0125)

The airplanes Post-Mod. SB145-34-0125 have been demonstrated compliant with the requirements of the FAA AC 20-138D, regarding the barometric vertical navigation (Baro-VNAV) coupled to the Flight Director in enroute, terminal, and non-precision approach operations, when used in accordance with the limitations and operational procedures contained in this manual.

TEMPERATURE COMPENSATION (AIRPLANES POST-MOD. SB145-34-0125)

The temperature compensation feature complies with RTCA/DO-283B, Appendix H.

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DOORS

COCKPIT SECURITY DOOR

On airplanes equipped with a cockpit security door, two crewmembers must be in the cockpit during all flight phases.

If one of the pilots leaves the flight deck, he must be replaced in the cockpit by another crewmember.

Positive identification of the person wishing to enter the flight deck must be obtained before opening the door.

The security cockpit door must be kept closed and locked at all times during flight except to permit access and egress according to the operator's procedures for opening, closing and locking the door.

Any time that cockpit door is opened in flight, a challenge and response closing and locking verification procedure must be used to verify that the door is closed and locked.

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CAT II OPERATION WITH PRIMUS 1000 AUTOMATIC FLIGHT CONTROL SYSTEM

MINIMUM EQUIPMENT REQUIRED

The performance of Category II approaches requires that the following equipment and instruments be in proper operating conditions:

- 2 Attitude and Heading Reference Systems;
- 1 Yaw Damper System;
- 1 Autopilot (not required for EMB-135 and EMB-145XR models);
- 2 Flight Director Systems;
- 2 Primary Flight Displays (PFD);
- Windshield Wipers;
- 2 VHF/NAV Systems;
- 1 VHF/COMM System;
- Both Engines;
- Cat II Checklist Logic;
- 1 Electrical Trim System;
- 1 Radio Altimeter;
- 1 Ground Proximity Warning System (GPWS or EGPWS);
- 1 Aural Warning Unit (AWU) Channel;
- 2 Air Data Systems (ADS);
- 1 Standby Attitude Indicator;
- 1 Standby Airspeed Indicator;
- 1 Standby Altimeter.

NOTE: Cat II operation shall be performed by the pilot who has the Flight Director coupled to the Autopilot.

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AUTOPILOT SYSTEM

Minimum Decision Height (DH)..... 100 ft

NOTE: Although the radio altitude setting may be adjusted down to 80 ft, if requested by an ILS Cat II Approved Chart, the Decision Height (DH) is limited to 100 ft above ground level.

Minimum Use Height (MUH) ..... 50 ft

Runway Visual Range (RVR)..... 1200 ft

Maximum Tailwind (except for EMB-145XR model) ..... 10 kt

Maximum Crosswind (except for EMB-145XR model) ..... 25 kt

Maximum Tailwind (EMB-145XR model)..... 9 kt

Maximum Crosswind (EMB-145XR model) ..... 10 kt

NOTE: - Flight Director monitored manual approaches are restricted to Category I minimums (not applicable to EMB-135 and to EMB-145XR models).

- Coupled go-around height loss may be 50 ft.

APPROACH AND LANDING FLAPS

CAT II approach and landing must be performed with flaps 22°.

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HGS OPERATION

SYSTEM CAPABILITY LIMITATIONS

DEMONSTRATED MINIMUM VISIBILITY TAKEOFF LIMITS

Runway Visual Range (RVR)..... 75 m

DEMONSTRATED MINIMUM AIII MODE LIMITS

Decision Height (DH) ..... 50 ft
Runway Visual Range (RVR)..... 180 m

WIND COMPONENTS

For Low Visibility Takeoff operations the following wind components must not be exceeded:

Headwind..... 25 kt
Tailwind..... 10 kt
Crosswind ..... 15 kt

For AIII mode operations the following wind components must not be exceeded:

Headwind..... 25 kt
Tailwind..... 10 kt
Crosswind ..... 15 kt

AIII mode operations initiated with one engine inoperative has been demonstrated and following wind components must not be exceeded:

Headwind..... 25 kt
Tailwind..... 10 kt
Crosswind ..... 11 kt

NOTE: The maximum wind limits listed above include gusts.

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AIRPLANE EQUIPMENT LIMITATIONS

AIRPLANE SUN VISOR

With the HGS Combiner deployed, airplane sun visors must not be placed in a position, during takeoff, approach or landing, that will prevent the correct operation of the forward fly-away movement of the Combiner.

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MINIMUM EQUIPMENT REQUIRED

The performance of Low Visibility Takeoff requires that the following equipment and instruments be in operating conditions:

- Head-Up Guidance System (HGS);
- 1 Inertial Reference System (IRS);

  NOTE: IRS 1 must be operative in case of dual IRS installation.

- 2 Air Data Computers (ADC);
- 3 VHF/NAV Systems;
- 2 Integrated Computers (IC);
- 2 Attitude and Heading Reference System (AHRS);

  NOTE: AHRS is not applicable in case of dual IRS installation.

- Windshield Wipers;

  NOTE: For airplanes Pre-Mod. SB 145-30-0055 and Post-Mod SB 145-30-0054 (or with an equivalent modification factory incorporated), the Rain Repellent Coating replace the Windshield Wipers. Approved Rain Repellent Coatings are listed in AMM chapter 30-41-04.

- 2 Primary Flight Displays (PFD).

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The performance of AIII mode approaches requires that the following equipment and instruments be in operating conditions:

- Head-Up Guidance System (HGS);
- 2 Inertial Reference Systems (IRS);

NOTE: 1 IRS required in case of single IRS installation.

- 2 Air Data Computers (ADC);
- 3 VHF/NAV Systems;
- 2 Radio Altimeters;
- 2 Integrated Computers (IC);
- 2 Attitude and Heading Reference System (AHRS);

NOTE: AHRS is not applicable in case of dual IRS installation.

- Windshield Wipers;

NOTE: For airplanes Pre-Mod. SB 145-30-0055 and Post-Mod SB 145-30-0054 (or with an equivalent modification factory incorporated), the Rain Repellent Coating replace the Windshield Wipers. Approved Rain Repellent Coatings are listed in AMM chapter 30-41-04.

- Primary Flight Display (PFD 2);
- 1 Enhanced/Ground Proximity Warning System (EGPWS/GPWS);
- 1 Aural Warning Unit (AWU) Channel;
- 1 GPS (GPS 2 in case of dual GPS configuration).

NOTE: GPS is not required in case of dual IRS configuration.

APPROACH AND LANDING FLAPS

AIII mode approaches and landings must be performed with flaps 22°.

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SECTION 1-02

NORMAL PROCEDURES

TABLE OF CONTENTS

Page Block

Introduction 1-02-00
Checklist 1-02-01
Normal Procedures
- External Safety Inspection 1-02-05
- Internal Safety Inspection 1-02-09
- Power Up 1-02-13
- Before Start - First Flight 1-02-17
- Before Start - Through Flight 1-02-21
- Engine Start 1-02-23
- After Start 1-02-29
- Before Takeoff 1-02-33
- Cleared Into Position 1-02-37
- Takeoff 1-02-40
- After Takeoff 1-02-45
- Descent 1-02-49
- Approach 1-02-57
- Before Landing 1-02-61
- After Landing 1-02-69
- Shutdown 1-02-73
- Leaving the Airplane 1-02-77

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Supplementary Procedures Page Block

Fuel
Crossfeed Operation 1-02-78
Environmental
Operation in Icing Conditions 1-02-79
Turbulent Air Penetration 1-02-79
Volcanic Ash 1-02-79
Lightning Strike 1-02-79
Pressurization in Manual Mode 1-02-79
Bird or Hail Strike 1-02-79
Navigation
Flight Management System 1-02-80
RVSM Operation 1-02-80
Enhanced/Ground Proximity Warning 1-02-80
Windshear Prevention/Recovery 1-02-80
Traffic and Collision Avoidance 1-02-80
Transponder (*) 1-02-80
RNP Approach 1-02-80
Performance Based Navigation (PBN) 1-02-80
Engine
Engine Start with Airplane Batteries and Low Pressure Unit (LPU) 1-02-81
Cross Start 1-02-81
Engine Start Assisted by APU 1-02-81
Single Engine Taxi 1-02-81
Flight Instruments
Altimeter Miscompare Tolerances 1-02-82
CAT II Operation (*) 1-02-83
QFE Operation (*) 1-02-84
HGS Operation (*) 1-02-85
High Altitude Operation (*) 1-02-87
Steep Approach Operation (*) 1-02-90
Operation in Airports Up to 8500 ft (*) 1-02-92
Bounced Landing Recovery 1-02-94
Profiles 1-02-95

NOTE: Items marked with an asterisk (*) may not be present in this manual.

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INTRODUCTION

The operating procedures defined in this section have been defined with the purpose of providing expanded normal procedures that should be used by trained flight crew to ensure that the airplane is in a proper condition and correctly configured for each phase of flight.

The source document for all procedures contained herein is the approved Airplane Flight Manual (AFM). In the event that any procedure disagrees with the AFM, the AFM will prevail. In the event that any of the procedures are missing or unusable, operations may be continued provided the approved AFM is available for use.

The normal procedures established are based on the assumption that all equipment is operating normally. It is the crew's responsibility to verify proper system response. In case improper indications are observed, verification of the appropriate controls position, checking of circuit breakers and testing of the related system should be performed to determine whether the condition affects dispatch or compliance with the MMEL, and whether any requires maintenance action is required.

* Items marked with an asterisk are to be performed at least once a day, by flight crew or maintenance personnel, at the operator's discretion.

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CHECKLIST

INTERNAL SAFETY INSPECTION

Maintenance Status ..... CKD
Cockpit
Emergency Equip ..... CKD
Reinforced Cockpit Door
Vent Louver
(if applicable) ..... OPN
Circuit Breakers ..... CKD
ELECTRIC Panel ..... SET
Emergency Lights ..... OFF
Fire Extinguishing
Handle 1 ..... PUSHED IN
FUEL Panel ..... SET
APU ..... SET
Ignitions ..... AUTO
START /
STOP Selectors ..... STOP
Fire Extinguishing
Handle 2 ..... PUSHED IN
Ailerons & Rudders
Shutoff ..... PUSHED IN
HYDRAULIC Panel ..... SET
Windshield Heating ..... PUSHED OUT
Sensors ..... PUSHED IN
Ice Detection Override . AUTO
AIR COND /
PNEUM Panel ..... SET
Windshield Wipers
(if installed) ..... OFF
Lights ..... OFF
ELT ..... ARMED
Weather Radar ..... OFF
Landing Gear Lever ..... DOWN
Crew Oxygen ..... ON
PASSENGER OXYGEN
Panel ..... SET
Gust Lock ..... LOCKED
Speed Brake ..... CLSD
Emergency /
Parking Brake ..... AS RQRD
FLAPS
Selector Lever ..... VERIFY POS
Alternate Gear Extension
Compartment ..... CKD

POWER UP

Batteries 1 & 2 ..... AUTO
Avionics Master 1 or 2.. PUSHED IN
* Batteries Voltage ..... CKD
* Backup Battery
(EMB XR only) ..... CKD
GPU Voltage
(if available) ..... CKD
Avionics Master 1 & 2... PUSHED OUT
GPU (if available) ..... PUSHED IN
Fuel Pump
Power Tank 2 ..... AS RQRD
Navigation Light ..... ON
* FIRE EXTINGUISHER
Panel ..... CKD
APU ..... AS RQRD

Avionics Master 1 & 2... PUSHED IN

With APU Power

GPU (if available) ..... PUSHED OUT

3 minutes After APU Start

APU Bleed ..... PUSHED IN
Air Conditioning ..... AS RQRD

BEFORE START

Manuals & Documents .ON BOARD
CVR ..... CKD
Electrical Panel ..... SET
Emergency Lights ..... ARM
Push Button Lights
Test (if installed) ..... CKD
♦ Fuel Panel ..... SET
* Fire Detection ..... CKD
Fire Extinguisher Panel CKD
Powerplant Panel ..... SET
* Elec Pump Sys 1 & 2.... CKD
Elec Pump Sys 1 & 2.... OFF
♦ Pax Signs Panel ..... SET
Ice Protection Panel ..... SET
AIR COND/PNEUM Panel . SET
Oxy Masks & Regulators ... CKD
Weather Radar ..... TST/STBY
Pitch Trim
Cutout Buttons ..... CKD
Display Control Panel ... SET
♦ Flight Number &
Clocks ..... SET
AHRS (if applicable) ..... SET
IRS (if applicable) ..... NAV
Autopilot ..... CKD
Gust Lock ..... LOCKED
Reversionary Panel ..... SET
♦ Flight Instruments ..... SET/X-CKD

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- ♦ RMU ..... SET
  Thrust Levers ..... IDLE
- ♦ Stall Protection System CKD
  Trim Panel ..... CKD
- ♦ Pressurization Panel .... SET
- ♦ FMS ..... SET

- ♦ Fuel QTY ..... CKD
- ♦ FMS ..... SET
- ♦ Speed Bugs ..... SET
- ♦ TRIM Panel ..... ___SET/ ZERO/ZERO
- ♦ Doors & Windows ..... CLSD
- ♦ Takeoff Briefing ..... COMPLETED
- ♦ Fuel Pump Power ..... ON
- ♦ Red Beacon ..... ON
- ♦ Emergency/Parking Brake AS RQRD
- ♦ Steering ..... AS RQRD
  Safety Pins ..... ON BOARD

AFTER START

Ground Equipment ..... REMOVED
Electrical Panel ..... SET
APU ..... AS RQRD
FADEC ..... RST/ALTN
Elec Hyd Pumps ..... AUTO
Windshield Heating ..... AS RQRD
AIR COND/PNEUM Panel SET
FLAPS ..... ___SET
Flight Controls ..... CKD
Taxi Lights ..... ON

BEFORE TAKEOFF

Takeoff Briefing ..... PERFORM

Ice Protection Test ..... AS RQRD

Brakes Temperature .... CKD
EICAS ..... CKD
Transponder ..... TA/RA
Takeoff Configuration .. CKD
Gust Lock ..... UNLOCKED
Elevator ..... CKD

AFTER TAKEOFF

Landing Gear ..... UP
FLAPS 0
Thrust Rating ..... CLB
Windshield Heating ..... AS RQRD
AIR COND/PNEUM Panel SET
Altimeters ..... SET/X-CKD
Pressurization ..... CKD
APU ..... AS RQRD

DESCENT

Windshield Heating ..... PUSHED IN
Approach Briefing ..... COMPLETED
Speed Bugs ..... SET
PRESSURIZATION Panel SET

External Lights ..... ON
Pax Signs ..... SET

APPROACH

PASS SIGNS Panel ..... SET
Altimeters ..... SET/X-CKD
Approach Aids ..... SET/X-CKD

BEFORE LANDING

Landing Gear ..... DOWN
FLAPS ..... ___SET
Lights ..... AS RQRD
AP/YD ..... OFF

SHUTDOWN

Thrust Levers ..... IDLE
Emergency/Parking Brake SET
GPU/APU Generators .. PUSHED IN
Shed Buses ..... AS RQRD
START/STOP Selectors ... STOP
Red Beacon ..... OFF
FSTN BELTS ..... OFF
Fuel Pump Pwr ..... AS RQRD
Elec Hyd Pumps ..... OFF
Ice Protection Sys ..... OFF
AIR COND/PNEUM Panel SET

LEAVING THE AIRPLANE

IRS (if applicable) ..... OFF
Avionics
  Master 1 & 2 ..... PUSHED OUT
Emergency Lights ..... OFF
External &
  Internal Lights ..... OFF
Pax Signs Panel ..... OFF

Weather Radar ..... OFF
Standby Attitude
  (if applicable) ..... CAGED
GPU/APU ..... OFF
AIR COND /
  PNEUM Panel ..... SET
Fuel Pumps ..... OFF
Batteries ..... OFF

♦ **ON THROUGH FLIGHTS CHECKLITS.**

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NORMAL PROCEDURES

EXTERNAL SAFETY INSPECTION

When approaching the airplane, take time to watch the area where the airplane is parked. Evaluate if there is room for the taxi-out or push back maneuver. Make sure that there will be enough clearance throughout the maneuver.

Also take time to have a look at the airplane as a whole from a reasonable distance. See if the airplane looks good, level and normal. Experience shows that this "initial look" can reveal details that will otherwise go unnoticed such as fluid spots on the ground, unexpected things attached to the airplane, bent or unaligned airframe components, etc.

Make sure that the airplane has the chocks and safety pins on as required. If not, advise the ground staff immediately.

The External Safety Inspection must be carried out prior to the first flight of the day or whenever the crew-airplane combination changes. The external lights must be turned on for inspection with the exception of the ones that may be a nuisance to other people in the vicinity of the airplane. The lights must be checked and switched off before commencing the walk around.

The first officer normally accomplishes the external safety inspection, although either or both crew members may complete it.

The inspection can be done according to the following list:

Wheel Chocks..... IN PLACE

NOSE SECTION

Access Doors and Panels ..... SECURED
Static Ports ..... NO OBSTRUCTION
Sensors and Pitot Tubes ..... CONDITION, NO OBSTRUCTION
Windshield Wipers (or Rain Repellent Coating)..... CONDITION
Air Inlets..... NO OBSTRUCTION

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Radome..... SECURED
Nose Gear..... CHECK
Check if the nose wheel position indication mark is within the nose wheel position indication scale limits.
Wheels and Tires..... CONDITION
Tires should not be worn past the bottom of the tire grooves.
Gear Struts/Wheelwell/Doors ..... CONDITION, NO LEAKS
Gear Uplock Hook ..... UNLOCKED
If the uplock hook is in the LOCKED position, cycle the freefall lever to reposition the uplock to the UNLOCKED position.
Ground Locking Pin ..... REMOVED
Static Discharger ..... CONDITION
Ensure the static discharger is present. Otherwise, refer to the CDL for dispatch with missing items.
Landing and Taxi Lights..... CONDITION
Hydraulic Compartment (right side)..... NO LEAKS
Oxygen Disc and Recharging Panel (right side) ..... CHECK
Check oxygen overpressure green disc in place.

FUSELAGE

Access Doors and Panels..... SECURED
Fueling Compartment Door (right side) ..... SECURED
Inspection Lights ..... CONDITION
Air Inlets and Outlets..... NO OBSTRUCTION
Red Beacon ..... CONDITION
Antennas..... CONDITION
Ram Air Inlet ..... NO OBSTRUCTION
Fluid Drain Holes ..... NO LEAKS

WINGS

Landing Lights..... CONDITION
Emergency Lights ..... CONDITION
Wing Leading Edge..... CONDITION
Access Doors and Panels..... SECURED
Direct Measuring Sticks ..... PUSHED IN
Air Inlets, Outlets and Vents ..... NO OBSTRUCTION

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Vortilons and Vortex Generators ..... NUMBER AND CONDITION
Navigation and Strobe Lights ..... CONDITION
Static Dischargers ..... NUMBER AND CONDITION
Refer to the CDL for dispatch with missing items.
Flight Control Surfaces and Fairings ..... CONDITION
Flaps must be retracted and spoilers closed.
Main Gear ..... CHECK
Wheels and Tires ..... CONDITION
Gear Uplock Hook ..... UNLOCKED
If the uplock hook is in the LOCKED position, cycle the freefall lever to reposition the uplock to the UNLOCKED position.
Gear Struts/Wheelwells ..... CONDITION, NO LEAKS
Ground Locking Pins ..... REMOVED
Brake Wear Indicators ..... CHECK
Wear indicators should be no less than flush with the housing.

TAIL CONE SECTION

Air Inlets and Outlets ..... NO OBSTRUCTION
Antennas ..... CONDITION
Access Doors and Panels ..... SECURED
Pylons ..... CONDITION
Engines ..... CHECK
Check engines for leaks and obstructions in the air inlets.
Thrust Reverser Doors ..... FLUSH WITH NACELLE
Horizontal Stabilizer ..... CONDITION
Logo Lights ..... CONDITION
Flight Control Surfaces ..... CONDITION
Static Dischargers ..... NUMBER AND CONDITION
Refer to the CDL for dispatch with missing items.

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APU	CONDITION
Pressurization Static Ports	NO OBSTRUCTION
Baggage Door	LATCHED/ LOCK PANEL CLOSED

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INTERNAL SAFETY INSPECTION

The Internal Safety Inspection must be carried out by the copilot prior to the first flight of the day, when the airplane is due to return to service after maintenance, or whenever the crew-airplane combination changes.

The internal safety inspection should be accomplished with electrical power supplied from APU or GPU. In the event that APU or GPU are not available, batteries may be used.

NOTE: Using batteries for an extended period will discharge them.

Maintenance Status ..... CHECK

Cockpit Emergency Equipment ..... CHECKED

Check for the availability, status and proper location of the following equipment:

- Escape ropes;
- Oxygen masks;
- Smoke goggles;
- Portable Breathing Equipment (PBE);
- Fire extinguishers;
- Crash Axe;
- Flashlights;
- Life vests.

Reinforced Cockpit Door Vent Louver (if applicable) ... OPEN

Circuit Braker Panels ..... CHECKED

Verify all circuit breakers IN at the overhead panel, behind the CPT seat and behind the F/O seat. If any CB is pulled verify the reason for it and if there is any operational implication advise the other pilot.

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Switches and knobs on the overhead panel must be set as follows:

Generators ..... IN
GPU ..... OUT
APU GEN ..... IN
BATT 1 & 2. ..... OFF
Essential Power ..... GUARDED
OUT
Bus Ties & Shed Buses ..... AUTO

Shed Buses must be set to OVRD to operate the recirculation fans when the electrical system is energized by the APU generator.

AC Power ..... IN
Back-up ..... IN
Avionics Master 1&2 ..... OUT
Emergency Lights ..... OFF
Fire Extinguishing Handle 1 ..... IN
Fuel Crossfeed ..... OFF
Pump Power 1&2 ..... OFF
ICU Panel ..... OUT
Exterior Lights ..... OFF
APU Fire Extinguishing ..... GUARDED
OUT
APU Master ..... OFF
APU Fuel Shutoff ..... GUARDED
OUT
Ignitions ..... AUTO
Start/Stop Selectors ..... STOP
Fire Extinguishing Handle 2 ..... IN
Ailerons & Rudders Shutoff ..... IN
Engine Pump Shutoff ..... GUARDED
OUT
Electric Hydraulic Pumps ..... OFF

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Windshield Heating ..... OFF
Sensors ..... IN
Ice Protection Buttons ..... IN
Ice Detection Override Knob ..... AUTO
Recirculation & Gasper ..... IN
Packs 1 & 2 ..... OUT
Engine & APU Bleed ..... OUT
Windshield Wipers (if installed) ..... OFF
Logo Light ..... OFF
Dome Light ..... AS REQUIRED
Pax Signs ..... OFF

Switches on the main panel must be set as follows:

ELT ..... ARMED
AHRS ..... SET
MFD Reversion ..... NORMAL
ADC, AHRS, SG Reversion ..... OUT
DAU 1&2 ..... OUT

Radar ..... OFF
Gear Lever ..... DOWN
Crew Oxygen ..... ON

Make sure that the Shutoff/Regulator Valve is in the ON position.

Passenger Oxygen ..... AUTO
Gust Lock ..... LOCKED

CAUTION: NEVER MOVE CONTROL SURFACES SUCH AS FLAPS AND SPOILERS WITHOUT FIRST MAKING SURE THAT THE AREA IS CLEAR.

Speed Brake ..... CLOSED

Emergency/Parking Brake ..... ON

If the airplane is to be pushed back for start and if start is to be performed with the APU, the crew may leave the parking brake released as long as the chocks are in place.

NOTE: To prevent hydraulic fluid transfer between systems: To apply the parking brake first press the brake pedals to full deflection, then pull the emergency/parking brake handle. To release the parking brake, first press the brake pedals to full deflection then release the emergency/parking brake handle.

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Flaps Selector Lever ..... UP

Make sure that the selected position is consistent with the position observed during external inspection. If not, be aware that, once the airplane is energized, if the handle is lifted from the detent, the flaps will move to the commanded position.

Free Fall Lever Compartment ..... CHECKED

The OVERRIDE switch must be in the NORMAL position and guarded.

The FREE FALL lever must be full down.

NOTE: If, during the external inspection, one of the gear uplock hooks is found mispositioned, the free fall lever may be pulled for uplock hook repositioning. This procedure must be carried out with gear pins in place.

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POWER UP

APU START RECOMMENDATIONS

For APU start and operation the following is recommended:

Starting cycle:

After First Attempt.....60 SECONDS OFF

After Second Attempt.....60 SECONDS OFF

After Third Attempt..... 30 MINUTES OFF

In case of an unsuccessful APU start or if BATT 1 OFF BUS followed by APU GEN OFF BUS messages are displayed on EICAS, the APU master switch must be set to OFF position and time intervals as stated above shall be observed before the next start attempt.

If during start ignition is not detected at about 30% engine speed, the starter generator is de-energized. When the engine decelerates to about 5% engine speed, the starter is automatically re-energized for another start attempt (Swing Start). Swing Start is limited to one time per start attempt.

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APU START WITH BATTERIES

Internal Safety Inspection ..... COMPLETED

Batteries 1 & 2..... AUTO

Immediately after the batteries are switched ON the aural message “AURAL UNIT OK” can be heard.

Avionics Master 1 or 2 ..... ON

∗ Batteries Voltage ..... CHECKED

Check battery voltage on MFD.

If battery voltage is below 19 V it must be replaced. If battery voltage is below 24 V report to the maintenance personnel or recharge the affected battery by using the APU generator. In case of recharging, it is recommended that battery 1 be turned OFF before APU start. After APU start wait 3 minutes then select battery 1 to AUTO.

The minimum time for battery recharging is 30 minutes.

For cold soak operation, refer to Operation in Icing Conditions section.

Once the batteries are on, the pilot must concentrate on starting up the APU shortly, so as to save the batteries. Avoid, for example, taking time to adjust the seat or to look at documents. Plan to do these things after starting the APU and its generator is on.

∗ Backup Battery (EMB-145 XR only) ..... CHECKED

Release the Backup Battery Button momentarily and check if ISIS remains operating normally.

Avionics Master 1 & 2 ..... OFF

Once the battery charge is checked, Avionics Master 1 & 2 must be switched OFF before starting the APU.

PUMP PWR ..... ON

Select one of the TANK 2 electric fuel pumps and switch the Pump Pwr Tank 2 to on. However, if TANK 1 has more fuel than TANK 2, use XFEED and select one of the TANK 1 pumps plus the Pump Pwr Tank 1 instead.

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∗ Fire Detection ..... CHECKED

Press and hold (for at least 2 seconds) the Fire Detection Test button while observing the following events:

EICAS messages:

Warning: APU FIRE, ENG 1 (2) FIRE, BAGG SMOKE (*)
Caution: APU FIREDET FAIL, E1 (2) FIREDET FAIL
(*) for class C compartment only.

Fire Extinguisher handles illuminated.

BAGG EXTG button illuminated (for airplanes with baggage hold extinguishing only).

Fire aural warning.

APU Master ..... ON/WAIT 3 SECONDS/ START/THEN ON

Turn the knob to ON, wait 3 seconds, and then momentarily to START. Monitor APU EGT and RPM increasing within limits. The APU generator will come on line after RPM exceeds 95%.

NOTE: For airplanes equipped with AHRS-900 or IRS, do not start the APU before 30 seconds after airplane energization to prevent disturbances in the AHRS/IRS initialization.

Avionics Master 1 & 2 ..... ON

Switch the avionics master to ON. Verify APU voltage and amperage on electrical page. Amperage may be greater than 400 A (APU GEN OVLD may appear on the EICAS) at first while the APU recharges the batteries. Do not bring any additional load on line until amperage is below 400 A. Allow few seconds for the APU GEN OVLD message to disappear before switching the avionics master to ON.

Turn the NAV lights ON, be it day time or night time. NAV lights ON show the ramp personnel that the airplane is powered up, and also make wingtips and tail end more visible to people driving vehicles in the proximity of the airplane.

The LOGO light may also be switched ON during night time.

Allow 3 minutes for the APU to warm up before adding pneumatic load.

NOTE: Following every APU start attempt, allow 3 minutes of APU warm-up before adding pneumatic load. This is particularly important after unsuccessful APU start attempts, so as to permit that excessive fuel accumulated during the previous start attempts is burned, preventing fuel odor inside the cabin/cockpit.

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APU Bleed..... OPEN

Air Conditioning..... AS REQUIRED

Should it be necessary to climatize the airplane:

- Both Packs ON;
- XBLEED to OPEN;
- Set both temperature controls to AUTO. If control of the Pack 2 by the cabin attendant is desired, select the corresponding knob to ATTD. Recirculation fans and gaspers will be ON;
- Shed Buses must be set to OVRD to operate the recirculation fans when the electrical system is energized by the APU generator.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

APU START WITH GPU

Internal Safety Inspection ..... COMPLETED

Batteries 1 & 2 ..... AUTO

Immediately after the batteries are switched ON the aural message “AURAL UNIT OK” can be heard.

Avionics Master 1 or 2 ..... ON

∗ Batteries Voltage ..... CHECKED

Check battery voltage on MFD.
If battery voltage is below 19 V it must be replaced. If battery voltage is below 24 V report to the maintenance personnel or recharge the affected battery by using the APU generator. In case of recharging, it is recommended that battery 1 be turned OFF before GPU disconnection. After GPU disconnection wait 3 minutes then select battery 1 to AUTO.

While GPU is ON, batteries will not be recharged.
The minimum time for battery recharging is 30 minutes.
For cold soak operation, refer to Operation In Icing Conditions section.

GPU Voltage ..... CHECKED

Check the ELEC page on the MFD if voltage is within 28.0 V (-2.0 V +1.0 V).

Avionics Master 1 & 2 ..... OFF

Once the GPU voltage is checked, Avionics Master bars 1 & 2 must be switched OFF.

GPU ..... ON

When the GPU switch is selected, the “GPU AVAIL” message on it goes off and its yellow stripe lights up.

PUMP PWR ..... ON

Switch on one of the TANK 2 electric fuel pumps. However, if TANK 1 has more fuel than TANK 2, use XFEED and switch one of the TANK 1 pumps instead.

∗ Fire Detection ..... CHECKED

Press and hold (for at least 2 seconds) the Fire Detection Test button while observing the following:

EICAS messages:
Warning: APU FIRE, ENG 1 (2) FIRE, BAGG SMOKE
Caution: APU FIREDET FAIL, E1 (2) FIREDET FAIL

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Fire Extinguisher handles illuminated.
BAGG EXTG button illuminated (applies to airplane with baggage hold extinguishing only).
Aural fire warning.

APU Master..... ON/WAIT 3 SECONDS/ START/THEN ON

Turn the knob to ON, wait 3 seconds, and then momentarily to START. Monitor APU EGT and RPM increasing within limits. The APU generator will come on line after RPM exceeds 95%.

GPU ..... OFF

Crew must deselect the GPU as soon as the APU is running and stable to prevent the ground crew from disconnecting it while still selected, which causes an unwanted transient.

Avionics Master 1 & 2 ..... ON

Switch the avionics master to ON. Verify APU voltage and amperage on electrical page. Amperage may be greater than 400 A (APU GEN OVLD may appears on the EICAS) at first while the APU recharge the batteries. Do not bring any additional load on line until amperage is below 400 A. Allow a few seconds for the APU GEN OVLD message to disappear before switching the avionics master to ON.

Turn the NAV lights ON, be it daytime or nighttime. NAV lights ON show the ramp personnel that the airplane is powered up, and also make wingtips and tail end more visible to people driving vehicles in the proximity of the airplane.

The LOGO light may also be switched ON during nighttime.

Allow 3 minutes of APU warm up before adding pneumatic load.

APU Bleed..... OPEN

Air Conditioning..... AS REQUIRED

Should it be necessary to cool down the cabin:

- Both Packs ON;
- XBLEED to OPEN;
- Set both temperature controls to AUTO. If control of the PACK 2 by the cabin attendant is desired, select the corresponding knob to ATTD. Recirculation and gaspers fans will be on;
- Shed Buses must be set to OVRD to operate the recirculation fans when the electrical system is energized by the APU generator.

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GPU POWER (NO APU)

Internal Safety Inspection ..... COMPLETED

Batteries 1 and 2 ..... AUTO

Immediately after the batteries are switched ON the aural message ”AURAL UNIT OK” can be heard.

Avionics Master 1 or 2 ..... ON

Batteries Voltage ..... CHECKED

If battery voltage is below 19 V it must be replaced. If battery voltage is below 24 V report to the maintenance personnel or recharge the affected battery by using the generators. In case of recharging, it is recommended that battery 1 be turned OFF before GPU disconnection. After GPU disconnection wait 3 minutes then select battery 1 to AUTO.

While GPU is ON, batteries will not be recharged.

For cold soak operation, refer to Operation In Icing Conditions section.

GPU Voltage..... CHECKED

Check in the ELEC page, on the MFD, if the voltage is within 28.0 V (-2.0 V +1.0 V).

GPU ..... ON

When GPU button is selected, the “GPU AVAIL” message on it goes off and its yellow stripe lights up.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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INTENTIONALLY BLANK

BEFORE START - FIRST FLIGHT

To begin the cockpit preparation the EXTERNAL SAFETY INSPECTION and the INTERNAL SAFETY INSPECTION must have been completed and the airplane must be powered up.

Airplane Manual & Documents ..... ON BOARD

Check the local regulations and company policy for the required on-board operational documents.

Typically the company has an approved Airplane Operating Manual with required operational information that must be on board. Additionally an approved MEL and a Route Manual may also be required, if not already part of the AOM.

The Company QRH must be on board.

Data such as runway analyses, driftdown analyses (if applicable), enroute diversion data, etc must also be on board.

Make sure that documents which are legally required to be on board are really on board, such as:

- Certificate of Airworthiness.
- Copy of the Insurance Policy.
- Airplane weighing document.
- The Cabin Crew, except for specific cases when the passenger documents must legally be handed to the Captain, handles documents such as General Declaration and passenger documentation.

Oxygen Masks CHECKED/100%

Both pilots must check their respective masks for supply of oxygen and for microphone functionality. The masks must be set to 100% oxygen.

This oxygen pressure must be enough for the intended flight.
Carry out the test as follows:

- Select the MASK position on the Audio Panel;
- Set the mask to 100%;
- Select SPKR on the Audio Panel and set the volume to mid-range;

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

- Select HOT MIC on the control wheel communication switch;
- Actuate the test button on the mask stowage location. Check that the blinker changes color; (*)
- The OXY ON flag must appear on the stowage box; (*)
- For EROS masks: While maintaining the RESET TEST lever (TEST/SHUTOFF sliding control) depressed, check that the blinker changes color momentarily, and then depress the PRESS-TO-TEST regulator for 1 second; or

For Puritan Bennett or B/E Aerospace masks: Set the regulator's control knob to EMERGENCY and momentarily actuate the test button on the mask stowage location;

- Check that the blinker changes color;
- The OXY ON flag must appear on the box; (*)
- The sound of oxygen flowing must be heard momentarily on the speaker, thereby assuring the microphone electrical integrity;
- Set the mask to 100%; (*)
- After finishing the test, select the BOOM position on the Audio Panel.

(*) Applicable only to Puritan Bennett or B/E Aerospace masks.

If there is an observer on the jump seat, check the observer oxygen mask as follows:

- Select the MASK position on the observer Audio Panel;
- Set the mask to 100%;
- Select SPKR on the Audio Panel and set the volume to mid-range;
- Select HOT MIC on the control wheel communication switch;
- For EROS masks: Depress the PRESS-TO-TEST regulator for 1 second; or

For Puritan Bennett or B/E Aerospace masks: Turn the regulator knob to the EMERGENCY position momentarily and then turn back the knob to 100% position;

- The sound of oxygen flowing must be heard momentarily on the speaker, thereby assuring the microphone electrical integrity;
- After finishing the test, select the BOOM position on the Audio Panel.

User: fhherna0f - Printed By myTechCare - Nov 21/24 - 00:36:37

CVR ..... CHECKED

Press the CVR TEST button and check the STATUS LED illuminated for about one second.

Batteries 1 & 2 ..... AUTO

Immediately after the batteries are switched ON the aural message ”AURAL UNIT OK” can be heard.

Electrical Panel ..... SET

Check if:

- All four generator buttons and the APU generator button are pressed;
- The ESSENTIAL POWER button is guarded and not pressed;
- The BUS TIES selector is set to AUTO;
- The SHED BUSES selector is set to OVRD in case of the galley ovens and recirculation fans are to be used and check also if the source of electrical power is the APU. If the source is a GPU, then set the selector to AUTO;
- The AC PWR, BACKUP and AVIONICS MASTER buttons are pressed.

Emergency Lights ..... ARMED

Switch the EMERG LT to ARM.

Photoluminescent Emergency Lights (if applicable) ..... CHARGED

For airplanes equipped with Photoluminescent Emergency Lights, make sure that the system was properly charged.

Push Button Lights (If installed) ..... CHECKED

Moving the switch to the TEST position will illuminate all the bars and button annunciators. The fire handles, APU fire extinguish button, BAGG EXTG button, electromechanical GUST LOCK indication lights, GPU AVAIL annunciator, digital pressurization control button and ATDT CALL button will not illuminate and will not be tested.

Overhead Panel Lights ..... AS REQUIRED

Engine 1 Fire Handle ..... PUSHED IN

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Fuel System ..... SET

Select the fuel pumps according to the alternating policy in use.

If the APU is running, feed it from the tank that has more fuel.

Reset the used fuel readout on the MFD.

PC Power System (if installed) ..... AS REQUIRED

If the PC Power supply is desired turn on the system releasing the PC Power button on IFE overhead panel.

Ventral Tank Transfer

Knob (EMB-145 XR only) ..... AUTO

Check if the knob is in the AUTO position.

* Fire Detection ..... CHECKED

Check the fire detection system if it has not been checked yet.

To do the test, press and hold for at least 2 seconds the Fire Detection Test button while observing the following:

EICAS messages:

Warning: APU FIRE, ENG 1 (2) FIRE, BAGG SMOKE(*)
Caution: APU FIREDET FAIL, E1 (2) FIREDET FAIL

Fire Extinguisher handles illuminated.

BAGG EXTG button illuminated(*).

Aural fire warning.

NOTE: - On the ground, if Fire Detection Test button is held for more than 10 seconds with the APU running, it will cause automatic APU shutdown.

- If it is necessary to repeat the test, wait at least 6 seconds to press the test button(*).
- If Fire Detection Test button is held for less than 2 seconds the BAGG EXTG button may remain illuminated. Should this happen, just repeat the test by pressing and holding the Fire Detection Test button for at least 2 seconds. After that the BAGG EXTG button should be not illuminated(*).

(*) Applicable to airplane with class C baggage compartment only

FIRE EXTINGUISHER Panel..... CHECK

- APU fire extinguishing Button OFF and no lights.
- BAGG fire extinguishing Button OFF and no lights.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

APU CONTROL Panel..... CHECK

APU MASTER Selector..... AS REQUIRED

APU FUEL SHUTOFF Button ..... OFF

- Verify APU FUEL SHUTOFF Button OFF, guarded and no striped bars illuminated.

Ignition ..... AUTO

Verify both switches set to AUTO.

Takeoff Data ..... STORED

As a general guideline, the lower thrust rating should always be used if the airplane's performance for the prevailing ambient conditions and the intended departure runway allows it.

Proceed as follows to enter the takeoff data:

- Select the T/O page on the MFD.
- Press the STORE button once and verify the white mark besides T/O MODE, which means that it is prompting for the selection of takeoff mode.
- Use the DEC/INC knob to select the takeoff mode. Press the STORE button one more time and the white mark will move to the REF TO TEMP line.
- Use the DEC/INC knob again to select the reference local temperature. Each movement of the knob will change the reference temperature by 1°C. Press the STORE button one more time and the white mark will move to the A-ICE mode selection line.
- Use the DEC/INC knob to select ANTI-ICE ON or OFF. Press the STORE a last time and the TAKEOFF DATA entry is complete.
- Also verify on the MFD T/O page that the level of lubricating oil in each engine is in the normal range.

Ref. Anti-Ice Policy: the following criteria must be observed when setting ref. Anti-ice to ON or to OFF:

Whenever temperature on ground is at or below 10°C and there is visible moisture in the air, it must be assumed that icing conditions are present. Under these circumstances the use of engine anti-ice (anti-ice override switch to ENG) is mandatory.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

The ERJ145/135 anti-ice system is such that if any ice is detected at a speed above 25 Kt the whole ice protection system goes ON.

If chances are that ice will be encountered during takeoff then REF A/ICE must be set to ON so that the FADEC allows a ITT margin for the anti-ice ON condition.

If REF A/ICE is set to ON then the takeoff performance-limited weight must be based on the anti-ice ON condition.

EXTERIOR LIGHTS Panel ..... AS REQUIRED

Engine 2 Fire Handle ..... PUSHED IN

FLIGHT CONTROLS Panel ..... CHECK

AILERON SHUTOFF SYS 1 and 2 Buttons ..... PUSHED IN

RUDDER SHUTOFF SYS 1 and 2 Buttons ..... PUSHED IN

Electric Hydraulic Pumps ..... CHECKED & OFF

Select the MFD HYD page and switch both electric hydraulic pumps to AUTO. Verify that the indicated pressures are within 2900 $\pm$ 200 psi. Check also the hydraulic fluid level of systems 1 and 2 are within normal range.

Switch both electric hydraulic pumps to ON and verify that the indicated pressures are within 2900 $\pm$ 200 psi.

NOTE: The electric hydraulic pumps should never be switched ON if the battery is the sole source of electrical power. If the batteries are the sole source of electrical power, wait until the APU or a GPU is available before switching ON the electric hydraulic pumps.

After both pumps have been checked, turn them OFF.

LOGO and DOME Lights ..... AS REQUIRED

Pax Signs ..... ON

Switch the FSTN BELTS and NO SMKG signs ON.

Ice Protection ..... SET

Make sure that the ENG, WING and STAB buttons are pressed. If some of them are not pressed, press them now. The SENSORS buttons must also be pressed. The WINDSHIELD buttons need to be pressed only if the windshield needs defogging.

The ICE DETECTION OVERRIDE knob must be in AUTO.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Air Conditioning ..... AS REQUIRED

If air conditioning is desired and if the APU has been running for more than 3 minutes (5 minutes is preferable) open the CROSSBLEED and select both PACKS to OPEN. The recirculation fans (RECIRC button) must be ON.

If the passengers are not to board the airplane through a jetway, then it is recommended that PACK 1 be switched OFF thus reducing the external noise at the main passenger door for the sake of passenger comfort. If PACK 2 only is capable of keeping a comfortable cabin temperature, PACK 1 can be left OFF until after both engines are running (after going through the After Start Checklist).

HGS Combiner (if installed)..... SET

Crew/Passenger Oxygen Pressure ..... CHECKED

Check on the MFD ECS page if the minimum pressure for flight crew is 1500 psi for three occupants or 1100 psi for two occupants.

For airplanes equipped with gaseous passenger oxygen system check on the MFD ECS page if the minimum pressure for passenger system is 1150 psi.

NOTE: The minimum oxygen pressure for dispatch was calculated at an ambient temperature of 21°C (70°F). For other temperatures, refer to Oxygen Pressure Correction Chart on section 2-16.

Glareshield Lights Control Panel..... AS REQUIRED

Weather Radar ..... TEST & STBY

Both pilots must select RADAR to SBY on their panels.

If there is just one radar panel, then the CPT must do it.

Display Control ..... SET

Both pilots must select the following information on their panels:

- PFD format (full compass format or arc format);
- PFD source (NAV or FMS);
- Bearing pointer source (VOR, ADF or FMS);
- Select DH on the PFD as appropriate.

Flight Number & Clocks..... SET

The crew must enter the flight number into the appropriate place in the clock at his side.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

AHRS ..... SET

AH-800 AHRS: both pilots must check if the respective AHRS is set to SLVD.

AH-900 AHRS: enter the present position through the FMS CDU.

Flight Guidance Controller ..... SET

Autopilot ..... CHECKED

The crew assigned for the flight must carry out the AUTOPILOT check as follows:

- Release the GUST LOCK, bring the control column to its midcourse position between full up and full down;
- Select the AP to his side and engage it, verifying the "AP" and "YD" indications on the PFD;
- Press the AP/PUSHER/TRIM button on the control wheel and verify the disengagement of the AP and the disappearance of the respective indications on the PFD;
- Set the gust lock again.

NOTE: When the wind is strong enough to force the horizontal stabilizer, an automatic pitch trim action may occur if the airplane is on the ground and the autopilot is engaged.

Gust Lock ..... LOCKED

DIGITAL AUDIO Panel ..... AS REQUIRED

Select the microphone and audio reception buttons as required and adjust the volume levels.

Reversionary Panels ..... NORMAL

Both pilots must check that their respective MFD Selector Knobs are set to NORM.

User: fhhernaof - Printed By myTechCare - Nov 21/24 - 00:36:37

Flight Instruments ..... SET & X-CHECKED

Both pilots must set their respective altimeters to the local QNH. They must also select an initial course as per the expected departure procedure. The CPT must also set the HDG bug according to the intended runway heading.

Once these actions are complete, the pilots must carry out an instrument crosscheck as follows:

- Both AIRSPEED TAPES not showing speed;
- EADI's level and flag-free;
- Both ALTIMETERS with their QNH set, and reading consistent with altitudes. If the crew already has the predeparture clearance, they can select the initial assigned altitude on the ASEL;
- Both VERTICAL SPEED INDICATORS showing zero;
- EHSI's with the courses selected according to the intended departure procedure, showing the same magnetic heading, flag-free and with the heading bug set to the intended runway heading.

NOTE: In case of heading split, check if there are ferrous structures or other magnetic interference sources close to the airplane, and/or move the airplane to a different location.

Standby Instruments..... SET

Uncage the STANDBY ATTITUDE indicator, if it is caged, and observe that the red flag is removed and the horizon is steady.

Compare its indication with the main attitude indicators. Set the QNH and compare its readout with one of the main altitude tapes.

MFD SYS Pages..... CHECK

RMU..... SET

The PF assigned for the flight must set the COMM and NAV frequencies as appropriate for the expected SID or departure procedure.

The use of the VHF COMM sets must follow the arrangement described below:

COMM 1: ATC

COMM 2: Company frequency, ATIS, VOLMET, etc.

COMM 3 (if available): Distress (121.5) and air-to-air broadcast.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Verify if the ATC/TCAS window is in SBY. Select the ABOVE function.

Test the TCAS by placing the yellow cursor box over the code. Press the RMU test button for 5 to 7 seconds until the test OK message on the RMU and "TCAS TEST, PASSED" aural annunciation is heard.

Enter the flight number or CALL SIGN on the appropriated window into the RMU.

Verify that BACK-UP TUNING is set to NORMAL and is copying RMU2.

Flight Control DISCONNECT Handles ..... CHECK

Speed Brake Lever ..... CLOSED

Thrust Levers ..... IDLE

Stall Protection System ..... CHECKED

The AHRS should be aligned.

CUTOUT 1 and 2 buttons must be guarded and not illuminated and QUICK DISCONNECT BUTTON must be released.

Carry out the Stall Protection System test as follows:

- Pull the control column all the way back and momentarily press the SPS TEST button (the TEST button must not be kept pressed beyond the shaker actuation). Both stick shakers and stick pusher will actuate, the caution and warning lights will illuminate and an aural warning will be heard.
- Lightly counteract the control column tendency to move forward.
- The test takes about 5 seconds and is valid if the amber light on the TEST button extinguishes.
- Press the caution and warning light buttons to turn them off.

Trims ..... CHECKED

Verify that the aileron, rudder, main and backup pitch trims are operating properly both ways up to the 3 seconds automatic stop; leave the aileron and rudder trims to the neutral and the pitch trim to the green band.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

BACK-UP TUNING (if installed) ..... SET

Set to NORMAL and copying RMU2.

COMM 3 (if installed) ..... SET

Press the transfer button in case of an error message on the radio display.

Pressurization ..... SET

Set the system to the destination airport elevation and verify that the DUMP and AUTOMAN switches are guarded and were not pushed (if they have been pushed the white mark on the buttons will be lit). The manual controller knob must be set to the green mark (DN position) to enable automatic pressurization control.

FMS ..... SET

The PF assigned for the flight must enter all the data that does not depend on the final ship papers. So the FMS initialization including the check if the DATABANK is still valid, check for correct date and time and check for possible messages related to the status of the FMS. Also if the flight plan needs to be entered, it can be done now.

NOTE: For UNIVERSAL FMS operations, in order to prevent CDU DATA BUS FAIL massage from occurring, a crossfill operation should be performed only after the airplane is energized by its generators (APU and/or engines), provided that airplanes buses are stable and already supplying power to the systems (GPU is disconnected).

AFTER THE FINAL SHIP PAPERS ARRIVE ON BOARD – SHORTLY BEFORE STARTUP:

FUEL QTY ..... CHECK

Confirm if onboard fuel quantity matches required fuel for the intended flight.

FMS ..... SET

The LSP must complete data entry into the FMS including TOTAL FUEL, CARGO DATA and PAX NUMBER.

Speed Bugs ..... SET

Set V_1, V_R, V_2 and V_{APP} on the MFD. Set V_{FS} on the PFD.
In case of Noise Abatement procedure set V_2+10 on the PFD.

User: fhherna0f - Printed By myTechCare - Nov 21/24 - 00:36:37

HF (if installed) ..... SET

Pitch Trim ..... SET/ZERO/ ZERO

Pitch Trim must be set as per the CG position stated in the weight and balance sheet.

Doors & Windows ..... CLOSED

Both pilots must verify that their respective cockpit window is closed and the RSP should select MFD T/O page to check all airplane doors closed indications.

Check the cockpit door securely closed.

Both pilots should select TCAS page on MFD for takeoff.

Takeoff Briefing ..... COMPLETED

The briefing should describe the departure procedures, taxi out routes, power reductions, weather, terrain/MSA, noise abatement procedures, low visibility procedures, inoperative airplane components, runway in use/condition, return alternate airports, NOTAMs and any required operational procedures that differ from the normal procedures. It is recommended to perform the takeoff briefing before engine start.

Fuel Pump Power ..... ON

Red Beacon ..... ON

Ground Equipment ..... AS REQUIRED

Emergency/Parking Brake ..... ON

Check that the PARKING BRAKE is ON and the corresponding ON light is lighted. If the EMRG BRK LO PRESS shows on the EICAS then switch on the electric hydraulic pump 2 momentarily to repressurize the accumulator.

Steering ..... AS REQUIRED

Safety Pins ..... ON BOARD

Verify that the safety pins are on board, behind the CPT seat.

Locking Pins (if applicable) ..... ON BOARD

Verify that the locking pins are on board, behind the CPT seat.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

BEFORE START - FIRST FLIGHT

To begin the cockpit preparation the EXTERNAL SAFETY INSPECTION and the INTERNAL SAFETY INSPECTION must have been completed and the airplane must be powered up.

Airplane Manual & Documents ..... ON BOARD

Check the local regulations and company policy for the required on-board operational documents.

Typically the company has an approved Airplane Operating Manual with required operational information that must be on board. Additionally an approved MEL and a Route Manual may also be required, if not already part of the AOM.

The Company QRH must be on board.

Data such as runway analyses, driftdown analyses (if applicable), enroute diversion data, etc must also be on board.

Make sure that documents which are legally required to be on board are really on board, such as:

- Certificate of Airworthiness.
- Copy of the Insurance Policy.
- Airplane weighing document.
- The Cabin Crew, except for specific cases when the passenger documents must legally be handed to the Captain, handles documents such as General Declaration and passenger documentation.

Oxygen Masks CHECKED/100%

Both pilots must check their respective masks for supply of oxygen and for microphone functionality. The masks must be set to 100% oxygen.

This oxygen pressure must be enough for the intended flight.

Carry out the test as follows:

- Select the MASK position on the Audio Panel;
- Set the mask to 100%;
- Select SPKR on the Audio Panel and set the volume to mid-range;

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

- Select HOT MIC on the control wheel communication switch;
- Actuate the test button on the mask stowage location. Check that the blinker changes color; (*)
- The OXY ON flag must appear on the stowage box; (*)
- For EROS masks: While maintaining the RESET TEST lever (TEST/SHUTOFF sliding control) depressed, check that the blinker changes color momentarily, and then depress the PRESS-TO-TEST regulator for 1 second; or

For Puritan Bennett or B/E Aerospace masks: Set the regulator's control knob to EMERGENCY and momentarily actuate the test button on the mask stowage location;

- Check that the blinker changes color;
- The OXY ON flag must appear on the box; (*)
- The sound of oxygen flowing must be heard momentarily on the speaker, thereby assuring the microphone electrical integrity;
- Set the mask to 100%; (*)
- After finishing the test, select the BOOM position on the Audio Panel.

(*) Applicable only to Puritan Bennett or B/E Aerospace masks.

If there is an observer on the jump seat, check the observer oxygen mask as follows:

- Select the MASK position on the observer Audio Panel;
- Set the mask to 100%;
- Select SPKR on the Audio Panel and set the volume to mid-range;
- Select HOT MIC on the control wheel communication switch;
- For EROS masks: Depress the PRESS-TO-TEST regulator for 1 second; or

For Puritan Bennett or B/E Aerospace masks: Turn the regulator knob to the EMERGENCY position momentarily and then turn back the knob to 100% position;

- The sound of oxygen flowing must be heard momentarily on the speaker, thereby assuring the microphone electrical integrity;
- After finishing the test, select the BOOM position on the Audio Panel.

User: fnhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

CVR ..... CHECKED

Press the CVR TEST button and check the STATUS LED illuminated for about one second.

Batteries 1 & 2 ..... AUTO

Immediately after the batteries are switched ON the aural message ”AURAL UNIT OK” can be heard.

Electrical Panel ..... SET

Check if:

- All four generator buttons and the APU generator button are pressed;
- The ESSENTIAL POWER button is guarded and not pressed;
- The BUS TIES selector is set to AUTO;
- The SHED BUSES selector is set to OVRD in case of the galley ovens and recirculation fans are to be used and check also if the source of electrical power is the APU. If the source is a GPU, then set the selector to AUTO;
- The AC PWR, BACKUP and AVIONICS MASTER buttons are pressed.

Emergency Lights ..... ARMED

Switch the EMERG LT to ARM.

Photoluminescent Emergency Lights (if applicable) ..... CHARGED

For airplanes equipped with Photoluminescent Emergency Lights, make sure that the system was properly charged.

Push Button Lights (If installed) ..... CHECKED

Moving the switch to the TEST position will illuminate all the bars and button annunciators. The fire handles, APU fire extinguish button, BAGG EXTG button, electromechanical GUST LOCK indication lights, GPU AVAIL annunciator, digital pressurization control button and ATDT CALL button will not illuminate and will not be tested.

Overhead Panel Lights ..... AS REQUIRED

Engine 1 Fire Handle ..... PUSHED IN

User: fhherna0f - Printed By myTechCare - Nov 21/24 - 00:36:37

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Fuel System ..... SET

Select the fuel pumps according to the alternating policy in use.

If the APU is running, feed it from the tank that has more fuel.

Reset the used fuel readout on the MFD.

PC Power System (if installed) ..... AS REQUIRED

If the PC Power supply is desired turn on the system releasing the PC Power button on IFE overhead panel.

Ventral Tank Transfer

Knob (EMB-145 XR only) ..... AUTO

Check if the knob is in the AUTO position.

* Fire Detection ..... CHECKED

Check the fire detection system if it has not been checked yet.

To do the test, press and hold for at least 2 seconds the Fire Detection Test button while observing the following:

EICAS messages:

Warning: APU FIRE, ENG 1 (2) FIRE, BAGG SMOKE(*)
Caution: APU FIREDET FAIL, E1 (2) FIREDET FAIL

Fire Extinguisher handles illuminated.

BAGG EXTG button illuminated(*).

Aural fire warning.

NOTE: - On the ground, if Fire Detection Test button is held for more than 10 seconds with the APU running, it will cause automatic APU shutdown.

- If it is necessary to repeat the test, wait at least 6 seconds to press the test button(*).
- If Fire Detection Test button is held for less than 2 seconds the BAGG EXTG button may remain illuminated. Should this happen, just repeat the test by pressing and holding the Fire Detection Test button for at least 2 seconds. After that the BAGG EXTG button should be not illuminated(*).

(*) Applicable to airplane with class C baggage compartment only.

FIRE EXTINGUISHER Panel ..... CHECK

- APU fire extinguishing Button OFF and no lights.
- BAGG fire extinguishing Button OFF and no lights.

APU CONTROL Panel..... CHECK

APU MASTER Selector..... AS REQUIRED

APU FUEL SHUTOFF Button ..... OFF

Verify APU FUEL SHUTOFF Button OFF, guarded and no striped bars illuminated.

Ignition ..... AUTO

Verify both switches set to AUTO.

Takeoff Data ..... STORED

As a general guideline, the lower thrust rating should always be used if the airplane's performance for the prevailing ambient conditions and the intended departure runway allows it.

Proceed as follows to enter the takeoff data:

- Select the T/O page on the MFD.
- Press the STORE button once and verify the white mark besides T/O MODE, which means that it is prompting for the selection of takeoff mode.
- Use the DEC/INC knob to select the takeoff mode. Press the STORE button one more time and the white mark will move to the REF TO TEMP line.
- Use the DEC/INC knob again to select the reference local temperature. Each movement of the knob will change the reference temperature by 1°C. Press the STORE button one more time and the white mark will move to the A-ICE mode selection line.
- Use the DEC/INC knob to select ANTI-ICE ON or OFF. Press the STORE a last time and the TAKEOFF DATA entry is complete.
- Also verify on the MFD T/O page that the level of lubricating oil in each engine is in the normal range.

Ref. Anti-Ice Policy: the following criteria must be observed when setting ref. Anti-ice to ON or to OFF:
Whenever temperature on ground is at or below 10°C and there is visible moisture in the air, it must be assumed that icing conditions are present. Under these circumstances the use of engine anti-ice (anti-ice override switch to ENG) is mandatory.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

The ERJ145/135 anti-ice system is such that if any ice is detected at a speed above 25 Kt the whole ice protection system goes ON.

If chances are that ice will be encountered during takeoff then REF A/ICE must be set to ON so that the FADEC allows a ITT margin for the anti-ice ON condition.

If REF A/ICE is set to ON then the takeoff performance-limited weight must be based on the anti-ice ON condition.

EXTERIOR LIGHTS Panel ..... AS REQUIRED

Engine 2 Fire Handle ..... PUSHED IN

FLIGHT CONTROLS Panel ..... CHECK

AILERON SHUTOFF SYS 1 and 2 Buttons ..... ON

RUDDER SHUTOFF SYS 1 and 2 Buttons ..... ON

Electric Hydraulic Pumps ..... CHECKED & OFF

Select the MFD HYD page and switch both electric hydraulic pumps to AUTO. Verify that the indicated pressures are within 2900 $\pm$ 200 psi. Check also the hydraulic fluid level of systems 1 and 2 are within normal range.

Switch both electric hydraulic pumps to ON and verify that the indicated pressures are within 2900 $\pm$ 200 psi.

NOTE: The electric hydraulic pumps should never be switched ON if the battery is the sole source of electrical power. If the batteries are the sole source of electrical power, wait until the APU or a GPU is available before switching ON the electric hydraulic pumps.

After both pumps have been checked, turn them OFF.

LOGO and DOME Lights ..... AS REQUIRED

Pax Signs ..... ON

Switch the FSTN BELTS and NO SMKG signs ON.

Ice Protection ..... SET

Make sure that the ENG, WING and STAB buttons are pressed. If some of them are not pressed, press them now. The SENSORS buttons must also be pressed. The WINDSHIELD buttons need to be pressed only if the windshield needs defogging.

The ICE DETECTION OVERRIDE knob must be in AUTO.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Air Conditioning ..... AS REQUIRED

If air conditioning is desired and if the APU has been running for more than 3 minutes (5 minutes is preferable) open the CROSSBLEED and select both PACKS to OPEN. The recirculation fans (RECIRC button) must be ON.

If the passengers are not to board the airplane through a jetway, then it is recommended that PACK 1 be switched OFF thus reducing the external noise at the main passenger door for the sake of passenger comfort. If PACK 2 only is capable of keeping a comfortable cabin temperature, PACK 1 can be left OFF until after both engines are running (after going through the After Start Checklist).

HGS Combiner (if installed) ..... SET

Lower the combiner to its operating position and check if the simbology is displayed. Following, the simbology may be stowed or may be cleared if not desired during any remaining pre-flight or taxi-out.

Crew/Passenger Oxygen Pressure ..... CHECKED

Check on the MFD ECS page if the minimum pressure for flight crew is 1500 psi for three occupants or 1100 psi for two occupants.

For airplanes equipped with gaseous passenger oxygen system check on the MFD ECS page if the minimum pressure for passenger system is 1150 psi.

NOTE: The minimum oxygen pressure for dispatch was calculated at an ambient temperature of 21°C (70°F). For other temperatures, refer to Oxygen Pressure Correction Chart on section 2-16.

Glareshield Lights Control Panel ..... AS REQUIRED

Weather Radar ..... STANDBY

Both pilots must select RADAR to SBY on their panels.
If there is just one radar panel, then the CPT must do it.

Display Control ..... SET

Both pilots must select the following information on their panels:

- PFD format (full compass format or arc format);
- PFD source (NAV or FMS);
- Bearing pointer source (VOR, ADF or FMS);
- Select DH on the PFD as appropriate.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Flight Number & Clocks ..... SET

The crew must enter the flight number into the appropriate place in the clock at his side.

AHRS (if installed)..... SET

AH-800 AHRS: both pilots must check if the respective AHRS is set to SLVD.

AH-900 AHRS: enter the present position through the FMS CDU.

IRS (if installed)..... NAV

The initial alignment must be performed by setting the MSU switch to NAV. Make sure that the airplane is not moved or bumped during the alignment process. Alignment time varies with latitude. It is necessary to enter the airplane present position through the FMS CDU to complete the initial alignment.

NOTE: The IRS knob should never be moved to ATT on ground. If for any reason it is set to ATT, restart the alignment process from scratch by setting the knob to OFF then back to NAV.

Flight Guidance Controller ..... SET

Autopilot ..... CHECKED

The crew assigned for the flight must carry out the AUTOPILOT check as follows:

- Release the GUST LOCK, bring the control column to its midcourse position between full up and full down;
- Select the AP to his side and engage it, verifying the "AP" and "YD" indications on the PFD;
- Press the AP/PUSHER/TRIM button on the control wheel and verify the disengagement of the AP and the disappearance of the respective indications on the PFD;
- Set the gust lock again.

NOTE: When the wind is strong enough to force the horizontal stabilizer, an automatic pitch trim action may occur if the airplane is on the ground and the autopilot is engaged.

Gust Lock ..... LOCKED

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

DIGITAL AUDIO Panel ..... AS REQUIRED

Select the microphone and audio reception buttons as required and adjust the volume levels.

Reversionary Panels..... NORMAL

Both pilots must check that their respective MFD Selector Knobs are set to NORM.

Flight Instruments ..... SET & X-CHECKED

Both pilots must set their respective altimeters to the local QNH. They must also select an initial course as per the expected departure procedure. The CPT must also set the HDG bug according to the intended runway heading.

Once these actions are complete, the pilots must carry out an instrument crosscheck as follows:

- Both AIRSPEED TAPES not showing speed;
- EADI's level and flag-free;
- Both ALTIMETERS with their QNH set, and reading consistent with altitudes. If the crew already has the predeparture clearance, they can select the initial assigned altitude on the ASEL;
- Both VERTICAL SPEED INDICATORS showing zero;
- EHSI's with the courses selected according to the intended departure procedure, showing the same magnetic heading, flag-free and with the heading bug set to the intended runway heading.

NOTE: In case of heading split, check if there are ferrous structures or other magnetic interference sources close to the airplane, and/or move the airplane to a different location.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Standby Instruments ..... SET

Conventional Standby Instruments:

Uncage the STANDBY ATTITUDE indicator, if it is caged, and observe that the red flag is removed and the horizon is steady. Compare its indication with the main attitude indicators. Set the QNH and compare its readout with one of the main altitude tapes.

Integrated Standby Instrument System:

Ensure airplane is not moved until ISIS is initialized. Initialization occurs within 90 seconds after airplane power-up.

Compare its indication with the main attitude indicators. Set the QNH and compare its readout with the main altitude tapes. Check no ALT or SPD flags displayed.

MFD SYS Pages ..... CHECK

RMU ..... SET

The PF assigned for the flight must set the COMM and NAV frequencies as appropriate for the expected SID or departure procedure.

The use of the VHF COMM sets must follow the arrangement described below:

COMM 1: ATC

COMM 2: Company frequency, ATIS, VOLMET, etc.

COMM 3 (if available): Distress (121.5) and air-to-air broadcast.

Verify if the ATC/TCAS window is in SBY. Select the ABOVE function.

Test the TCAS by placing the yellow cursor box over the code. Press the RMU test button for 5 to 7 seconds until the test OK message on the RMU and “TCAS TEST, PASSED” aural annunciation is heard.

Enter the flight number or CALL SIGN on the appropriated window into the RMU.

Verify that BACK-UP TUNING is set to NORMAL and is copying RMU2.

Flight Control DISCONNECT Handles ..... CHECK

Speed Brake Lever ..... CLOSED

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Thrust Levers ..... IDLE

Stall Protection System..... CHECKED

The AHRS/IRS should be aligned.

CUTOUT 1 and 2 buttons must be guarded and not illuminated and QUICK DISCONNECT BUTTON must be released.

Carry out the Stall Protection System test as follows:

- Pull the control column all the way back and momentarily press the SPS TEST button (the TEST button must not be kept pressed beyond the shaker actuation). Both stick shakers and stick pusher will actuate, the caution and warning lights will illuminate and an aural warning will be heard.
- Lightly counteract the control column tendency to move forward.
- The test takes about 5 seconds and is valid if the amber light on the TEST button extinguishes.
- Press the caution and warning light buttons to turn them off.

Trims ..... CHECKED

Verify that the aileron, rudder, main and backup pitch trims are operating properly both ways up to the 3 seconds automatic stop; leave the aileron and rudder trims to the neutral and the pitch trim to the green band.

BACK-UP TUNING (if installed) ..... SET

Set to NORMAL and copying RMU2.

COMM 3 (if installed)..... SET

Press the transfer button in case of an error message on the radio display.

Pressurization ..... SET

Set the system to the destination airport elevation and verify that the DUMP and AUTOMAN switches are guarded and were not pushed (if they have been pushed the white mark on the buttons will be lit). The manual controller knob must be set to the green mark (DN position) to enable automatic pressurization control.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

FMS..... SET

The PF assigned for the flight must enter all the data that does not depend on the final ship papers. So the FMS initialization including the check if the DATABANK is still valid, check for correct date and time and check for possible messages related to the status of the FMS. Also if the flight plan needs to be entered, it can be done now.

NOTE: For UNIVERSAL FMS operations, in order to prevent CDU DATA BUS FAIL massage from occurring, a crossfill operation should be performed only after the airplane is energized by its generators (APU and/or engines), provided that airplanes buses are stable and already supplying power to the systems (GPU is disconnected).

HGS Control Panel (if installed)..... SET

Verification of the proper operation of all HCP displays can be accomplished by performing na HCP Display Test.
Enter runway length and TDZE for possible return for landing.
Enter glideslope angle for the the expected runway.
Select or verify the primary (PRI) mode on the HCP.

AFTER THE FINAL SHIP PAPERS ARRIVE ON BOARD – SHORTLY BEFORE STARTUP:

FUEL QTY..... CHECK

Confirm if onboard fuel quantity matches required fuel for the intended flight.

FMS..... SET

The LSP must complete data entry into the FMS including TOTAL FUEL, CARGO DATA and PAX NUMBER.

Speed Bugs..... SET

Set V_1, V_R, V_2 and V_{APP} on the MFD. Set V_{FS} on the PFD.
In case of Noise Abatement procedure set V_2+10 on the PFD.

HF (if installed)..... SET

Pitch Trim..... CKD/SET

Pitch Trim must be set as per the CG position stated in the weight and balance sheet.

User: fhherna0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Doors & Windows ..... CLOSED

Both pilots must verify that their respective cockpit window is closed and the RSP should select MFD T/O page to check all airplane doors closed indications.

Check the cockpit door securely closed.

Both pilots should select TCAS page on MFD for takeoff.

Takeoff Briefing..... COMPLETED

The briefing should describe the departure procedures, taxi out routes, power reductions, weather, terrain/MSA, noise abatement procedures, low visibility procedures, inoperative airplane components, runway in use/condition, return alternate airports, NOTAMs and any required operational procedures that differ from the normal procedures. It is recommended to perform the takeoff briefing before engine start.

Fuel Pump Power ..... ON

Red Beacon ..... ON

Ground Equipment..... AS REQUIRED

Emergency/Parking Brake..... ON

Check that the PARKING BRAKE is ON and the corresponding ON light is lighted. If the EMRG BRK LO PRESS shows on the EICAS then switch on the electric hydraulic pump 2 momentarily to repressurize the accumulator.

Steering ..... AS REQUIRED

FMS ..... COMPLETED

The PF assigned for the flight must complete the data entry into the FMS including PAX number and cargo data.

In case of dual FMS installation, the flight plan must be copied by the PF from his FMS to the other so as to ensure consistency among flight plans.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Safety Pins ..... ON BOARD

Verify that the safety pins are on board, behind the CPT seat.

Locking Pins (if applicable) ..... ON BOARD

Verify that the locking pins are on board, behind the CPT seat.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

BEFORE START - THROUGH FLIGHT

Fuel System and Quantity ..... CHECKED
lb/kg

The CPT must alternate the fuel pumps, reset the used fuel reading and check the fuel on board is not less than the required fuel for the next flight. The copilot must also reset the used fuel reading on his MFD.

PC Power System (if installed) ..... AS REQUIRED

If the PC Power supply is desired turn on the system releasing the PC Power button on IFE overhead panel.

Takeoff Data ..... STORED

As a general guideline, the lower thrust rating should always be used if the airplane's performance for the prevailing ambient conditions and the intended departure runway allow it.

Proceed as follows to enter the takeoff data:

- Select the T/O page on the MFD.
- Press the STORE button once and verify the white mark besides T/O MODE, which means that it is prompting for the selection of takeoff mode.
- Use the DEC/INC knob to select the takeoff mode. Press the STORE button one more time and the white mark will move to the REF TO TEMP line.
- Use the DEC/INC knob again to select the reference local temperature. Each movement of the knob will change the reference temperature by one degree Celsius. Press the STORE button one more time and the white mark will move to the A-ICE mode selection line.
- Use the DEC/INC knob to select ANTI-ICE ON or OFF. Press the STORE for the last time and the TAKEOFF DATA entry is complete.

Also verify on the MFD T/O page that the level of lubricating oil in each engine is in the normal range.

Pax Signs..... ON

Once all disembarking passengers have left the airplane, the FSTN BELTS sign must be switched ON again. The NO SMKG sign should be already ON. If not, it must be switched ON at this time.

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HGS Combiner (if applicable) ..... SET

Lower the combiner to its operating position and check to verify that symbology is displayed. Following the combiner check, it may be stowed or the symbology may be cleared if not desired during any remaining pre-flight or taxi-out.

Oxygen Pressure ..... CHECK

Both pilots must check their respective masks for supply of oxygen and for microphone functionality. The masks must be set to 100% oxygen.

Check on the MFD ECS page if the minimum pressure for flight crew is 1500 psi for three occupants or 1100 psi for two occupants.

For airplanes equipped with gaseous passenger oxygen system check on the MFD ECS page if the minimum pressure for passenger system is 1150 psi.

This oxygen pressure must be enough for the intended flight.

Carry out the test as described in the Before Start-First Flight procedures.

Flight Number and Clocks..... SET

The CPT sets the number of the next flight onto his clock if it is different from the previous flight number.

The CPT must also change the flight number on the RMU too, if necessary.

IRS (if applicable)..... NAV

Perform a quick alignment during intermediate stops. Set the knob to ALIGN and back to NAV without delay.

NOTE: The IRS knob should never be moved to ATT on ground. If for any reason it is set to ATT, restart the alignment process from scratch by setting the knob to OFF then back to NAV.

Flight Instruments ..... X-CHECKED

Both pilots must set their respective altimeters to the local QNH. They must also select an initial course as per the expected departure procedure. The CPT must also set the HDG bug according to the intended runway heading.

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Once these actions are completed, the pilots must carry out an instrument crosscheck as follows:

- Both AIRSPEED TAPES not showing speed;
- EADI's level and flag-free;
- Both ALTIMETERS with their QNH set, and reading consistent altitudes;
- Both VERTICAL SPEED INDICATORS showing zero;
- EHSI's with the courses selected according to the intended departure procedure, showing the same magnetic heading, flag-free and with the heading bug set to the intended runway heading;
- If the crew already has obtained predeparture clearance, they can select the initial assigned altitude on the ASEL; if the clearance is not available yet, the requested altitude minus 100 ft or yet the most probable altitude can be set;
- The 100 ft decrement is a reminder that the selected altitude has not been authorized by ATC yet.

Standby Instruments..... SET

Set the QNH or QFE on the standby altimeter.

RMU..... SET

The PF assigned for the flight must select the applicable COMM and NAV frequencies for the intended departure and select ABOVE and a proper range on the TCAS. Also, the PF should change the Flight Number. If necessary.

Stall Protection System..... CHECKED

The AHRS/IRS should be aligned.

CUTOUT 1 and 2 buttons must be guarded and not illuminated and QUICK DISCONNECT BUTTON must be released.

Carry out the Stall Protection System test as follows:

- Pull the control column all the way back and momentarily press the SPS TEST button (the TEST button must not be kept pressed beyond the shaker actuation). Both the stick shaker and the stick pusher will actuate and an aural warning will be heard.
- Lightly counteract the control column tendency to move forward.
- The test takes about 5 seconds and is valid if the amber light on the TEST button extinguishes.

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HGS Control Panel (if applicable)..... SET

Enter runway length and TDZE for possible return for landing.

Enter glideslope angle for the expected runway.

Select or verify the primary (PRI) mode on the HCP.

Pressurization ..... SET

Select the elevation of the destination airport.

FMS..... SET

The PF assigned for the flight must enter all the data that does not depend on the final ship papers. So the FMS initialization including the check if the DATABANK is still valid, check for correct date and time and check for possible messages related to the status of the FMS. If the flight plan needs to be entered, it can be done now.

NOTE: For UNIVERSAL FMS operations, in order to prevent CDU DATA BUS FAIL massage from occurring, a crossfill operation should be performed only after the airplane is energized by its generators (APU and/or engines), provided that airplanes buses are stable and already supplying power to the systems (GPU is disconnected).

AFTER THE FINAL SHIP PAPERS ARRIVE ON BOARD – SHORTLY BEFORE STARTUP:

FUEL QTY..... CHECK

FMS..... COMPLETED

The PF assigned for the flight must complete the data entry into the FMS including PAX number and cargo data.

In case of dual FMS installation, the flight plan must be copied by the PF from his FMS to the other so as to ensure consistency among flight plans.

Speed Bugs..... SET

Once all the dispatch papers are on board, set V_1, V_R and V_2 on the MFD as per the runway analysis. Set the V_{AP} bug to $V_{REF45°}$ plus 5 knots (or plus wind correction, whichever is greater) so if an air return is to be carried out, the final approach speed is already set.

The wind correction added to the $_{VAP}$ is limited to 15 Kt.

The V_{FS} (Final Segment Speed) shows at the upper left corner on the PFD and is set through the SPD button.

HF (if installed)..... SET

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Pitch Trim..... SET/ZERO/ ZERO

Pitch Trim must be set as per the CG position stated in the weight and balance sheet.

Doors & Windows ..... CLOSED

Both pilots must verify that their respective cockpit window is closed and the RSP should select MFD T/O page to check all airplane doors closed indications.

Check the cockpit door securely closed.

Both pilots should select TCAS page on MFD for takeoff.

Takeoff Briefing..... COMPLETED

- The takeoff briefing should be performed by the PF and the left seat pilot must state the Reject Takeoff procedures.
- The briefing should describe the departure procedures, taxi out routes, power reductions, weather, terrain/MSA, noise abatement procedures, low visibility procedures, inoperative airplane components, runway in use/condition, return alternate airports, NOTAMs and any required operational procedures that differ from the normal procedures. It is recommended to perform the takeoff briefing before engine start.

Fuel Pump Power ..... ON

Red Beacon ..... ON

Parking Brake ..... ON

The CPT must verify on the MFD that the brake temperature is within the green range. If so, then he can apply the parking brake; otherwise, the parking brake must be left released until the brakes cool down as appropriate. If the brake temperature is in the yellow range, the next flight cannot commence since the accelerate-stop performance would fall short of the published performance.

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Steering..... AS REQUIRED

Push-back required: DISENGAGE pressing the trigger on the yoke and observe STEERING INOP message on EICAS.

No push-back required or after push-back: ENGAGE pressing STEERING HANDWELL and observe STEERING INOP message disappear on EICAS.

NOTE: Steering handle actuation with nose wheels beyond their operational limits may cause damage to the nose wheel steering system.

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ENGINE START

Either engine 1 or engine 2 may be started first. However, the following considerations are important before the engine start:

- Starting engine 1 during towing operations: to avoid damage to the nose landing gear while towing, disengage the steering. The steering is disengaged through the steering disengage button on the control wheel. For airplanes Post-Mod. SB 145-32-0057 the steering is disengaged alternatively on ground. Refer to AOM sections 1-12-10 and 2-12-15 for details.
- Single engine taxi: the gust lock lever was designed to allow extra travel for one of the thrust levers. The gust lock extra travel is only adjustable for airplanes Post-Mod. SB 145-27-0115 or Post-Mod. SB 145-27-0126 or with an equivalent modification factory incorporated. In this case, the pilot may choose the thrust lever to have extra travel.
- Logistic regarding passengers boarding and ground personal clearance, according to local authority allowances.
- For engine start using APU or LPU, refer to AOM section 1-2-81.

Start/Stop Selector..... START, THEN RUN

Turn the start selector to RUN for 2 seconds, then turn the switch to the START position momentarily (signals the initiate start sequence to the FADEC) and then to RUN, and start the stopwatch.

Increase in N2..... CHECKED

Verify increase in N2 RPM within 10 seconds of start selection.

Make sure N2 accelerates normally.

Ignition is activated when N2 is at approximately 14% N2. Fuel is injected when N2 is at approximately 31.5% (28.5% for airplanes equipped with FADEC B7.4 and on) or 12 seconds after ignition is activated.

IGN A (B) annunciation..... CHECKED

Observe the annunciation IGN A (B) at about 14% N2.

With ignition in AUTO, only the FADEC in control activates the ignition system. FADEC in control is alternated on every subsequent ground start. Only one ignition channel is activated on grounds starts. Ignition channels are also alternated every subsequent start.

If ignition is set to OFF, FADEC neither activates ignition nor actuates the fuel valve to open, thus allowing dry motoring. However, a dry motoring procedure must not be performed if one of the FADECs is declared incapable.

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FF/ITT ..... CHECKED OFF

Observe the fuel flow and ITT indications raise at about 31.5% N2 (28.5% for airplanes equipped with FADEC B7.4 and on).
For airplanes equipped with FADEC older than B8.0, there is no automatic shut-down by the FADEC for an overtemperature on start. FADEC B8.0 and on has an automatic shut-down as an backup protection. Independently of the FADEC version, the pilot must keep his hands on START/RUN/STOP switch and manualy abort the engine start if necessary.

IGN A (B) annunciation ..... CHECKED OFF

Verify the annunciation IGN A (B) go OFF at about 57% N2.
The start cycle ends at approximately 57% N2, which can be observed when IGNITION A or B annunciation on EICAS disappears. After start is completed, engine stabilizes at about 64% N2 (70% N2 for airplanes equipped with FADEC 9.4.1 and on) and 24% N1.

Engine parameters..... CHECKED

Verify that the engine stabilizes at about 64% N2 (70% N2 for airplanes equipped with FADEC 9.4.1 and on) and 24% N1. Verify ITT, fuel flow and oil pressure for normal indications.

CAUTION: ABORT THE ENGINE START BY SELECTING THE START/STOP SELECTOR TO STOP IF AN ABNORMAL ENGINE START IS DETECTED.

NOTE: - Light-ups at 28% N2 will be achieved with systems meeting minimum performance requirements. If light-ups are occurring below 28%, the airplane should be scheduled for maintenance to avoid disruptions to passenger service.

- If light-ups are occurring later than 5 seconds after the first fuel flow indication, the airplane should be scheduled for maintenance to avoid disruptions to passenger service.
- If the light-up occurs between 5 and 10 seconds after the first fuel flow indication, smoke and a momentary flash of combustion may be produced.
- Routine operations may continue subsequent to any light-up achieved within 10 seconds after the first fuel flow indication.

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Repeat the procedure for the other engine.

If any starting limit is exceeded prior to aborting a start, do not attempt further starts and report to the maintenance personnel.

If a hung or no start occurs, accomplish the Dry Motoring Procedure before attempting another start.

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AFTER START

Ground Equipment..... REMOVED

Do not start taxiing before receiving confirmation from the ground crew that the airplane is free to taxi. Then acknowledge that and switch OFF the cockpit dome lights.

It is recommended that the taxi light be ON during taxi even during daytime.

NOTE: The steering handle engagement actuation with the Nose wheels beyond their operational limits may cause damage to the Nose Wheel Steering System.

Electrical System ..... SET

If the SHED BUSES are set to OVRD, switch them to AUTO.

APU..... AS REQUIRED

Set the APU ON or OFF according to the electrical and pressurization systems. The APU usage shall be defined for a specific operation in order to minimize the overall costs.

FADEC..... RESET/ALTN

This swapping of the FADECs is important because it ensures that both the controlling and the standby FADECs are properly set.

Electric Hydraulic Pumps..... AUTO

Set the electric hydraulic pumps to AUTO after start.

Windshield Heating..... AS REQUIRED

Turn Windshield Heating ON if icing conditions or windshield fogging is encountered or anticipated.

For airplanes equipped with PPG windshield, the windshield heating system may be selected ON during all flight phases.

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AIR COND/PNEUMATIC Panel ..... SET

CONDITION	ENGINE MODE	ENGINE BLEED	APU BLEED	CROSSBLEED
No icing	ALT T/O	Open	Closed	Auto
	T/O (1)	Closed	Open	Open
	E T/O	Closed	Open	Open
Icing	ALT T/O	Open	Closed	Auto
	T/O	Open	Closed	Auto
	E T/O	Open	Closed	Auto

Takeoff Data ..... CHECKED

Check the ATTCS annunciation on EICAS.

Transponder ..... AS REQUIRED

Select the transponder mode in accordance with local requirements. The use of TA/RA or TA only modes on ground may trigger TCAS POP UP on MFD.

FLAPS ..... SET__

Adjust FLAPS to a setting consistent with the intended takeoff configuration and performance.

Flight Controls ..... CHECK

Release the gust lock and check AILERON and ELEVATOR free travel. Once this check is complete, the gust lock should be once again applied.

Each time electromechanical gust lock lever is set to unlocked (FREE) position elevator movement must be checked. This check must be performed at least 10 seconds after positioning the gust lock lever to the unlocked (FREE) position by moving the control column from the full up stop to the full down stop and back to the full up stop position.

Check the RUDDER by pressing the steering disengage button on the control wheel and moving the pedals from full right to full left.

Taxi Lights ..... ON

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Steering ..... CHECK

Verify the STEER INOP message displayed on the EICAS.

Press and hold for 5 seconds the steering handwheel maintaining it in the neutral position. Verify that the STEER INOP message is removed and, after handwheel is released, the message is not displayed again.

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BEFORE TAKEOFF

NOTE: - Ensure that a “cold” engine operates at least 4 minutes before increasing N2 above 83%. An engine is considered “cold” if it has not run for the previous 90 minutes.

- Ensure that a “warm” engine operates at least 2 minutes before increasing N2 above 83%. An engine is considered “warm” if it has run for the previous 90 minutes.
- Should the pilot observes any noticeable change in the weather conditions or total time between setting of the T/O data and takeoff roll is expected to be longer than 20 minutes, it is recommended that the temperature stored in the T/O data setting be updated shortly before takeoff.
- To increase N2 above 83% the engine oil temperature must be at 40°C minimum. If the oil temperature is below 40°C after 4 minutes, the engine should be run an additional 4 minutes before advancing the Thrust Levers for takeoff.

Takeoff Briefing..... COMPLETED

It is recommended that the briefing be performed before engine start if there is time for that and if there is enough information about the cleared departure procedure.

If briefing is performed before engine start and there are clearance amendments afterwards or if there are any new facts that may cause significant changes in the departure procedure, the briefing must be amended.

NOTE: It is highly recommended that the briefing be performed with the active participation of both pilots. Techniques such as reading back or posing questions to each other enhance this participation. Briefings consisting of mechanical repetition of a memorized speech without having the mind set on the subject are useless.

Cabin Crew..... ADVISE

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Ice Protection Test ..... AS REQUIRED

The ice protection test must be carried out once a day (not necessarily at the first flight of the day) when icing conditions are forecast.

The test may be carried out completely on the ground, or in 2 separate phases (first phase on the ground and second phase in flight), depending on weather conditions and crew discretion. For ice protection test information, refer to AOM Supplementary Procedures, Environmental, section 1-02-79.

Crossfeed ..... OFF

PC Power System (if installed) ..... OFF

The PC Power System must be turned off until the airplane reaches 10000 ft.

Lights ..... ON

Brakes Temperature ..... CHECKED

Verify on the MFD HYD page that the brakes temperature are within the green range. Takeoff cannot be attempted with brake temperatures outside the green range.

EICAS ..... CHECK

Check:

- No EICAS messages displayed.
- Thrust rate mode.

Transponder ..... TA/RA

Takeoff Configuration ..... CHECK

Right Seat Pilot presses the T/O CONFIG Button and “TAKEOFF OK” synthetic message shall be heard.

Flight Director ..... SET

Verify that the AUTOPILOT is selected to his side then press the FD button and select GO AROUND by pressing the respective button at the thrust lever head. Check that the flight director bar on T/O mode became visible on the PFD.

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Flaps ..... ___° SET

Move the flap to the setting consistent with the intended takeoff configuration and performance. The flap position must be indicated on the EICAS.

The flap must be checked for deflection consistent with the takeoff performance being considered.

Thrust Rating ..... CHECKED

Flight Controls..... CHECKED

The flight controls must be checked close to the holding point if a prolonged taxi in cold soak conditions occur or in any wheather that may possibly cause flight control problems due to freezing or due to accumulation of snow or slush.

Release the gust lock and check AILERON and ELEVATOR free travel. Once this check is complete, the gust lock should be once again applied.

Each time electromechanical gust lock lever is set to unlocked (FREE) position elevator movement must be checked. This check must be performed at least 10 seconds after positioning the gust lock lever to the unlocked (FREE) position by moving the control column from the full up stop to the full down stop and back to the full up stop position.

With the airplane taxiing on a straight line or standing still, check the RUDDER by pressing the steering disengage button on the control wheel and moving the pedals from full right to full left, and pressing the steering handle to reconnect the steering.

Gust Lock..... UNLOCKED

If Electromechanical Gust Lock is installed, wait 10 seconds to perform ELEVATOR check.

Elevator..... CHECK

NOTE: For airplanes Post-Mod. SB 145-27-0125 or with an equivalent modification factory incorporated, the Gust Lock Caution Lights remain blinking until unlocking cycle is completed. This cycle is completed with the gust lock lever at unlocked position (full forward).

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Cabin.....READY

This item is checked after the cabin attendant reported that the cabin is ready for departure.

NOTE: - If the ENGINE has not been running in the previous 90 minutes (“Cold” Engine) ensure at least 4 minutes to warm-up before apply takeoff power.

- If the ENGINE has been running in the previous 90 minutes (“Warm” Engine) ensure at least 2 minutes to warm-up before apply takeoff power.
- To increase N2 above 83% the engine oil temperature must be at least 40°C.

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CLEARED INTO POSITION

External Lights ..... ON

The following lights must be turned on by the CPT prior to entering the runway: LDG 1, NOSE, LDG 2, TAXI (if not ON yet) and STROBE.

It is advisable to have strobe lights ON whenever entering or crossing an active runway.

EICAS Messages..... CHECKED

Make sure that there are no CAUTION or WARNING messages on the EICAS. If there is any ADVISORY message, evaluate the associated condition and its effects on the takeoff.

NOTE: The ADVISORY message CHECK XXX PERF is displayed to inform pilots about the engine model installed on the airplane, on ground and with parking brakes ON, so that the correct performance numbers for takeoff, landing, and flight planning can be used.

Transponder ..... TA/RA

Verify that the TCAS is set to ABOVE and that a proper range has been selected. He must also check that the transponder code is the correct one and is set to TA/RA.

Gust Lock..... UNLOCKED

Elevator..... CHECKED

The elevator movement must be checked after the Gust Lock Lever is in the unlocked (FREE) position. For airplanes equipped with electromechanical gust lock system the elevator movement must be checked at least 10 seconds after positioning the Gust Lock Lever to the unlocked (FREE) position by moving the control column from the full up stop to the full down stop and back to the full up stop position.

Takeoff Configuration ..... CHECKED

The Takeoff Configuration Test button must be pressed once runway line up is authorized. The “TAKEOFF OK” aural message should be heard. If any other announcement is heard, the airplane is out of the normal configuration, and must be properly configured prior to takeoff.

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TAKEOFF

(APPLICABLE TO ALL ENGINES EXCEPT AE3007A1P AND AE3007A1E)

Thrust Levers ..... THRUST SET

If an Alternate Takeoff Mode has been selected, check green ATTCS indication presented on EICAS.

NOTE: - If the runway is considered to be limiting, a static takeoff must be accomplished. In this case, release brakes after engine has reached the target N1.

- For rolling takeoffs, performance data is valid from the point where takeoff thrust is achieved.
- During takeoff run, pedals should be used to steer the airplane.

Engine Parameters ..... MONITOR

NOTE: High vibration indicates a malfunction which may worsen and increase vibration severity. Therefore, continuous engine operation with vibration in the amber range is not recommended. According to engine vibration limits, the pilot may elect not to reduce TLA for vibration below 2.5 IPS time limited to 5 minutes. If vibration returns to the green range within 5 minutes, the flight may continue but vibration causes should be investigated before the next flight. According to Rolls-Royce AE3007A Series Operation Manual, vibration in any flight phase in the amber range up to 1.5 IPS for less than 30 seconds does not require maintenance action.

At V_R, rotate the airplane to 14° (flaps 9°), 13° (flaps 18°) or 12° (flaps 22°) or follow the Flight Director guidance.

With positive rate of climb:

Landing Gear ..... UP

Command gear up on request, after confirming that the rate of climb is positive. Confirm the three white UP indications on the EICAS.

Do not apply brakes after becoming airborne. The main wheels will stop automatically.

Minimum Airspeed ..... V_2

If maneuvering is required, maintain a minimum airspeed of V_2 + 10 KIAS with a maximum bank of 25°.

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At level off height altitude:
For takeoff with flaps 9°:
At V_2 + 15 KIAS or higher.....FLAPS UP
For takeoff with flaps 18°:
At V_2 + 10 KIAS or higher.....FLAPS 9°
At V_2 + 30 KIAS or higher.....FLAPS UP
For takeoff with flaps 22°:
At V_2 + 5 KIAS or higher.....FLAPS 9°
At V_2 + 25 KIAS or higher.....FLAPS UP

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TAKEOFF
(APPLICABLE TO AE3007A1P ENGINES)

Thrust Levers ..... THRUST SET

If an Alternate Takeoff Mode has been selected, check green ATTCS indication presented on EICAS.

NOTE: - If the runway is considered to be limiting, a static takeoff must be accomplished. In this case, release brakes after engine has reached the target N1.

- For rolling takeoffs, performance data is valid from the point where takeoff thrust is achieved.
- During takeoff run, pedals should be used to steer the airplane.

Engine Parameters ..... MONITOR

NOTE: High vibration indicates a malfunction which may worsen and increase vibration severity. Therefore, continuous engine operation with vibration in the amber range is not recommended. According to engine vibration limits, the pilot may elect not to reduce TLA for vibration below 2.5 IPS time limited to 5 minutes. If vibration returns to the green range within 5 minutes, the flight may continue but vibration causes should be investigated before the next flight. According to Rolls-Royce AE3007A Series Operation Manual, vibration in any flight phase in the amber range up to 1.5 IPS for less than 30 seconds does not require maintenance action.

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At level off height altitude:

For takeoff with flaps 9°:

At V_2 + 15 KIAS or higher.....FLAPS UP

For takeoff with flaps 18° or 22°:

At V_2 + 10 KIAS or higher.....FLAPS 9°

At V_2 + 30 KIAS or higher.....FLAPS UP

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AFTER TAKEOFF

NOTE: Keep the airplane trimmed to avoid excessive loads on the Horizontal Stabilizer Actuator (HSA). The airplane should be trimmed before 160 KIAS. Failure to accomplish the above procedure may lead to an inoperative trim condition not associated with any EICAS message.

Landing Gear ..... UP

PNF commands landing gear up after PF has requested and confirms the three white UP indications on the EICAS.

FLAPS 0

PNF retracts FLAPS at acceleration altitude according Normal takeoff for Flaps 9, 18 or 22° schedule.

Thrust Rating ..... CLIMB

Select CLB mode on the THRUST RATING panel and confirm on the EICAS the CLB indication.

Internal and External Lights ..... AS REQUIRED

Windshield Heating ..... AS REQUIRED

Turn Windshield Heating ON if icing conditions or windshield fogging is encountered or anticipated.

For airplanes equipped with PPG windshield, the windshield heating system may be selected ON during all flight phases.

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Air Conditioning..... SET

Once CLB thrust is set the air conditioning should be set as follows:

- If the takeoff was performed on APU BLEED then both engine BLEEDS must be selected to OPEN, the CROSS BLEED must be set to AUTO and the APU bleed must be CLOSED.
- If the takeoff was performed on ENGINE BLEED, depending on the takeoff mode and on the temperature an ECS OFF signal may be generated. In this case, both PACKS must be reset, preferably one at a time, one shortly after the other for the sake of passenger comfort.

Altimeters ..... SET & XCHECKED

Upon passing the transition altitude, the altimeters are set to QNE by the respective pilots if it is an operation in ICAO airspace.

Pressurization ..... CHECKED

Once the air conditioning system is set, verify that the pressurization is functioning properly. Verify the cabin altitude, the differential pressure and the cabin rate of climb on the EICAS.

APU..... AS REQUIRED

Shut down the APU IMMEDIATELY after the engine bleed valves are open, that is, without any cool down period.

ABOVE 10000 FT

External Lights ..... OFF

Upon passing 10000 ft switch the external lights OFF except strobe and red beacon. The logo light must also be switched OFF.

Fasten Belts ..... AS REQUIRED

Switch the FSTN BELTS OFF if conditions permit.

PC Power System (if installed) ..... AS REQUIRED

If PC Power supply is desired release the PC Power button on IFE overhead panel to turn on the system for passengers use.

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DESCENT

Windshield Heating ..... ON

The system must be switched ON to prevent fog and ice formation on the windshield inner layer.

Approach Briefing ..... COMPLETED

The crew must review the descent, approach and landing procedures.

HGS Combiner (if installed) ..... SET

If the combiner has been installed, position the combiner in the operating position.

HGS Control Panel (if installed) ..... SET

Enter on HCP, the touchdown zone elevation for the landing runway.

Enter on the HCP the glideslope angle for the landing runway.

Select the desired mode.

Speed Bugs ..... SET

Check on the FMS the expected landing weight and set V_{REF}, V_{APP}, V_{APP} CLB, V_{FS} on the MFD:

$V_{APP} = V_{REF}$ + wind correction.

Wind correction = ½ steady headwind component + gust increment above steady wind.

For Flaps 45° landing, the minimum wind correction is 5 KIAS and the maximum is 15 KIAS.

For Flaps 22° landing, the minimum wind correction is 5 KIAS and the maximum is 20 KIAS.

For $V_{APP\ CLB}$, set the $V_{APP\ CLB}$ or the V_{APP}, the greatest.

For V_{FS}, set V_{FS} or the V_{APP}, the greatest.

EXAMPLE:

- V_{REF} = 118 kt
- Reported wind = 16 kt, gusting to 25 kt
- The wind correction would be ½ (16) + (25 - 16) = 17 kt

However the maximum wind correction is 15 kt (Flaps 45°), thus:

- V_{APP} = 118 kt + 15 kt = 133 kt

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Pressurization ..... CHECKED

Verify that the digital controller was set to the destination airport elevation.

BELOW 10000 FT

External Lights ..... ON

The following lights must be turned ON upon crossing 10000 ft:

- LDG1, NOSE AND LDG2.

During night time, the LOGO light must also be turned ON.

Fasten Belts ..... ON

Switch the FASTEN BELTS light upon crossing 10000 ft, if it is not ON yet.

PC Power System (if Installed) ..... OFF

Below 10000 ft the PC Power System must be turned off by pressing the PC Power button on IFE overhead panel.

Curtains..... STOWED

Any curtain used during flight must be stowed for landing.

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APPROACH

XFEED ..... OFF

PASS SIGNS Panel ..... SET

AIR COND/PNEUMATIC Panel ..... SET

Altimeters ..... SET & XCHECKED

When the altimeters are set to QNH (passing the Transition Level) the Approach Checklist should be called for, if it is a flight in ICAO airspace. If the flight is in other than ICAO airspace, checklist must be called for at an altitude established as operational standard.

Verify that both altimeters and the standby altimeter are set to QNH.

Approach Aids ..... SET & XCHECKED

NOTE: The VAPP mode should be selected only on final approach segment, below 2500 ft AGL. Therefore, the outbound segment should be flown using any other mode.

Both pilots must verify that the frequencies and courses that were selected are correct for the intended approach. Ensure that both PFD's are displaying appropriate information.

They must also verify that the radio altimeter alert (DH) and the FMS are properly selected for the type of approach in mind.

CAUTION: RADIO ALTIMETER-BASED DECISION HEIGHTS ARE NOT RECOMMENDED ON CAT I APPROACHES. THE DECISION ON A CAT I APPROACH HAS TO BE BASED ON THE ALTIMETER RATHER THAN ON THE RADIO ALTIMETER. THE DH ALERT IN THESE CASES IS A REFERENCE ONLY THAT MUST BE USED WITH CARE AND ITS VALIDITY DEPENDS ON THE PILOTS' KNOWLEDGE OF THE TERRAIN BEFORE THE RUNWAY. ALTIMETER-BASED DECISIONS ARE NOT ALLOWED ON CAT II APPROACHES. THE DECISION ON THESE APPROACHES HAS TO BE BASED ON THE RADIO ALTIMETER.

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The tables below shows the flap maneuvering speeds during a visual approach or during an instrument approach:

ALL ENGINES EXCEPT EMB-145XR MODEL

		FLAP MANEUVERING SPEED (KIAS)			
		BELOW MSLW*		ABOVE MSLW*	
FLAPS	GEAR	NO ICING CONDITIONS	WITH ICING CONDITIONS	NO ICING CONDITIONS	WITH ICING CONDITIONS
0°	Up	180	200	180	200
9°	Up/Dn	160			
18°/22°	Up/Dn	140	150		
45°	Dn	140			

*Maximum Structural Landing Weight as specified on Limitations Section.

ONLY APPLICABLE TO EMB-145XR MODEL

		FLAP MANEUVERING SPEED (KIAS)			
		BELOW MSLW*		ABOVE MSLW*	
FLAPS	GEAR	NO ICING CONDITIONS	WITH ICING CONDITIONS	NO ICING CONDITIONS	WITH ICING CONDITIONS
0°	Up	180	200	180	200
9°	Up/Dn	160			170
18°/22°	Up/Dn	150	160		
45°	Dn	140	150		

*Maximum Structural Landing Weight as specified on Limitations Section.

Thrust Rating..... T/O

If fuel consumption is a consideration, consult the In-flight performance software for maximum endurance speeds.

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NOTE: - The maximum flap 45° extended speed (V_{FE}) of 145 KIAS must not be exceeded in any condition. However, if momentary deviations happen to speeds up to 160 KIAS during transition to or flight with flaps 45°, no maintenance action is required. This information does not constitute authorization to operate above V_{FE}.

For the EMB-145 XR model, any exceedance of the flap 45° extended speed (V_{FE}) – 160 KIAS – requires maintenance action.

- The maximum flap 22° and 18° extended speed (V_{FE}) of 200 KIAS must not be exceeded in any condition. However, if momentary deviations happen to speeds up to 210 KIAS during transition to or flight with flaps 22° or 18°, no maintenance action is required. This information does not constitute authorization to operate above V_{FE}.
- The maximum flap 9° extended speed (V_{FE}) of 250 KIAS must not be exceeded in any condition. However, if momentary deviations happen to speeds up to 260 KIAS during transition to or flight with flaps 9°, no maintenance action is required. This information does not constitute authorization to operate above V_{FE}.

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MISSED APPROACH

Go Around Button ..... PRESS

Press the Go Around buttons at the thrust levers and check if Flight Director goes to pitch 10° nose up. Rotate or verify that autopilot rotates the airplane following the Flight Director.

Thrust Levers ..... MAX

Advance the thrust levers to MAX position and verify the engines parameter.

Flaps ..... 9°

Select the flaps control to 9° position.

With positive rate of climb:

Landing Gear ..... UP

Select the landing gear lever to the up position.

Minimum Airspeed ..... APPROACH CLIMB SPEED

Maintain the pitch as commanded by the Flight Director or pitch 10° if Go Around is being performed on raw data to maintain the airplane airspeed above the minimum airspeed (approach climb speed selected on the MFD).

Once the acceleration height is reached check that the speed is consistent with the flap retraction speed, reduces the thrust levers to Thrust Set position. Select flap controls to zero position and select Climb Mode at the Thrust Rating panel.

NOTE: - For coupled Go-Around the altitude loss may be 75 ft.

- During the GO-AROUND procedure, the DON'T SINK aural warning may sound. In this case monitor the sink rate and follow the GO-AROUND guidance.

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BEFORE LANDING

Landing Gear ..... DOWN

Command gear down and check whether the speed is within limits for landing gear extension. Also check the three green lights before this item is confirmed.

Speed Brake ..... CLOSE

Flaps ..... ___°SET

Check that the flap position is the intended one for landing.

Landing Lights ..... AS REQUIRED

Auto Pilot & Yaw Damper ..... OFF

CAUTION: YAW DAMPER ON DURING LANDING MAKES THE DIRECTIONAL CONTROLLABILITY OF THE AIRPLANE ON THE RUNWAY MORE DIFFICULT ESPECIALLY WITH GUSTS AND CROSS WINDS.

SPD Button (Flight Guidance Controller)..... SET
APPROACH
CLIMB SPEED

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AFTER LANDING

Thrust Levers ..... AS REQUIRED

If taxi is not required, thrust levers should be set to idle.

Brakes ..... AS REQUIRED

Windshield Heating ..... AS REQUIRED

Turn windshield heating OFF if it is not required to defog or de-ice the windshield.

For airplanes equipped with PPG windshield, the windshield heating system may be selected ON during all flight phases.

Air Conditioning and Pneumatic System ..... AS REQUIRED

Pressurization ..... CHECK

External Lights ..... SET

Turn ON the taxi light, that must remain ON throughout the taxi regardless of the time of the day. The strobe lights must be turned OFF as soon as the airplane leaves the runway.

Radar ..... STBY

Verify that both radar selectors are set to Standby.

Flaps ..... 0°

The flaps must be retracted to a zero-degree position.

NOTE: Flap retraction from 22° to 0° following landing on a contaminated runway or after operation in icing condition should be delayed until flap gaps and actuators have been checked to be free of contamination and ice.

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Pitch Trim ..... SET

Reset the PITCH TRIM back in the green range (approx. 7.0 UP).

APU ..... AS REQUIRED

If the intention is to start the APU, do it now. Do not use the APU BLEED until the airplane is parked and with blocks on (wait at least 3 minutes for use APU bleed). This will maximize the APU life.

NOTE: To prevent spurious overcurrents in the electrical system, engines must not be shut down concurrently with the starting of the APU. A minimum one-minute interval between those two procedures is recommended.

Transponder ..... AS REQUIRED

Set the Transponder to Standby or in accordance with local regulations.

Gust Lock ..... LOCKED

The GUST LOCK must be applied immediately after the airplane leaves the runway.

NOTE: In case of an overcurrent protection is actuated, and the EICAS message DC BUS 2 OFF (PFD 2 and MFD 1 blank and MFD 2 displaying a red X) is displayed after a commanded engine 2 shutdown during taxi, the following actions must be carried out:

- Stop the airplane.
- Restart the engine 2.
- Taxi the airplane normally to the appropriate area.
- To shut the airplane down and reset the overcurrent protection, refer to Shutdown Procedures.

CAUTION: DURING TAXI, THE ENGINE 2 MUST NOT BE SHUT DOWN JUST BEFORE OR DURING A TURN, AS THIS MAY CAUSE STEERING COMMAND LOSS (STEERING IS SUPPLIED BY DC BUS 2).

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SHUTDOWN

Thrust Levers ..... IDLE

Emergency/Parking Brake ..... ON

Typically when approaching the parking position and turning towards the marshal, turn OFF the taxi light. This is especially important during nighttime.

Pull the Emergency/Parking Brake and twist it to the set position after airplane has stopped. Make sure that the airplane is static before pulling the Emergency/Parking Brake.

The crew should verify the brake temperatures. If the brakes are hot, release the Emergency/Parking Brake as soon as the chocks are ON.

NOTE: To avoid hydraulic fluid transference from system 1 to system 2 first apply brakes using the pedals and after pull the emergency/parking brake handle. To release the emergency/parking brake, do the same procedure.

GPU/APU ..... AS REQUIRED

If the APU is not running yet, then start it up before the engines are shut down. If the APU (or the APU generator) is unserviceable and there is a GPU available, select the GPU before shutting down the engine. Check the GPU voltage on the MFD ELEC page before selecting it.

Shed Buses ..... AS REQUIRED

If the electrical system is being powered by the APU after the shut down of both engines and galley power is necessary, switch the shed buses to OVRD.

If the electrical system is being powered by a GPU after shutdown, the shed buses can be left in AUTO.

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Start/Stop Selectors ..... STOP

Once the Emergency/Parking Brake is applied, shut down the engines by selecting the engine start knobs to STOP.

NOTE: - Associated engine BLEED must be CLOSED before selecting the engine START/STOP Selectors to STOP;

- The engines will not shut down with START/STOP Selectors unless Thrust Levers are first moved to IDLE. If STOP is selected before Thrust Lever is retarded to IDLE, momentarily cycle START/STOP Selector to RUN and back to STOP;

- It is recommended to keep the engine running at idle during 1 minute to permit engine thermal stabilization prior to shutdown. Time of operation at or near idle, such as taxiing, is included in this 1-minute period.

- To prevent spurious overcurrents in the electrical system, engines must not be shut down concurrently with the starting of the APU. A minimum one-minute interval between those two procedures is recommended.

- If the GPU is required and it was not connected prior to engine shutdown, wait until N2 reaches 0% to connect the GPU. This is necessary to prevent transients in the electrical system.

NOTE: If the overcurrent protection is actuated, the airplane will enter in electrical emergency when both engines are shut down (both PFDs and MFDs deenergized, but EICAS display energized). In this case, the following steps must be accomplished:

- Batteries 1 and 2.....OFF
- Bus Ties .....OFF
- Properly trained personnel must reset the electrical system through ELEC SW switch on the Maintenance Panel behind the pilot's seat.
- If the failure persists, the related fault isolation task (FIM TASK 24-60-00-810-820-A) should be accomplished.

Red Beacon ..... OFF

The red beacon should be switched OFF after the engines are shut down. The use of the Red Beacon should be associated with engine(s) running or airplane in movement.

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Fasten Belts.....OFF

The FSTN BELTS lights should be switched OFF by crew as soon as the airplane is static and the engines are shut down. This will be a signal to cabin crew to initiate the procedures for deplanning of the passengers.

PUMP PWR..... AS REQUIRED

If the APU is running, keep the right fuel pump ON (or the left pump ON and CROSSFEED open).

If the APU is not running, turn both fuel pumps OFF.

Elec. Hydraulic Pumps.....OFF

Once the airplane is parked and the parking brake is applied, the copilot must switch both electric hydraulic pumps to OFF.

Ice Protection System.....OFF

Air Conditioning .....SET

If passengers are to be disembarked through means other than a jetway, the crew must switch APU BLEED to ON, CROSSBLEED to OPEN, and switch PACK 1 to OFF, thus reducing the external noise in the vicinity of the main passenger door, for better passenger comfort.

If better cooling is required after disembarkation is finished, PACK 1 can be switched ON again.

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LEAVING THE AIRPLANE

Avionics Master 1 & 2 .....OFF

Select the AVIONICS MASTER 1 & 2 OFF prior to switching GPU or APU OFF. If the airplane is equipped with UNIVERSAL FMS installation, switch the FMS's OFF prior to switching OFF AVIONICS MASTER 1 & 2.

Emergency Lights .....OFF

The emergency lights must be switched from ARM to OFF before the batteries are switched OFF. Otherwise the emergency lights will illuminate and drain their batteries.

External & Internal Lights.....OFF

Make sure that all internal and external lights are switched OFF (with the exception of the cockpit dome light at night) before switching OFF GPU or APU.

Passenger Signs Panel .....OFF

Set EMERG LT, STERILE, NO SMKG (NO ELEC DEVICES in some configurations) and FSTN BELTS to OFF.

Weather Radar .....OFF

Switch the radar from STBY to OFF.

Standby Attitude (if applicable).....CAGED

Cage the standby horizon. Make sure it is caged by checking whether its red flag is visible.

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GPU/APU ..... OFF

Shut APU down by pressing the STOP button on its panel. Verify the shutdown on the EICAS. Wait until APU rotation drops to 5% before switching APU MASTER OFF.

NOTE: Do not close the air conditioning packs before shutting down the APU. Shutting down the APU while bleed air is coming out of it helps extending APU life.

If a GPU is the source of electrical power, switch it OFF through the GPU button on the Electrical System panel.

Never leave the airplane unattended and energized. A member of the maintenance team, familiar with the airplane, should always be left in charge before they leave.

Air Conditioning ..... OFF

Set the PACK and BLEED buttons on the Air Conditioning/Pneumatic panel to CLOSED, if they are not in this position already. The XBLEED valve should be left in AUTO. The RECIRC and GASPER buttons should be left pressed (this is their normal state).

PUMP PWR ..... OFF

Fuel pumps are needed only as long as the APU is in use. Once the APU is shut down the fuel pumps are not needed any more. So if the airplane is being powered by the GPU or solely by the batteries the pumps are not needed.

Main and Backup Batteries ..... OFF

Switch both batteries OFF.

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LEAVING THE AIRPLANE

IRS (If installed) .....OFF

The manual switching of the IRS ensures proper finalization of the IRS software. Wait a minimum of ten seconds before removing the input power.

Avionics Master 1 & 2 .....OFF

Select the AVIONICS MASTER 1 & 2 OFF prior to switching GPU or APU OFF. If the airplane is equipped with UNIVERSAL FMS installation, switch the FMS's OFF prior to switching OFF AVIONICS MASTER 1 & 2.

Emergency Lights .....OFF

The emergency lights must be switched from ARM to OFF before the batteries are switched OFF. Otherwise the emergency lights will illuminate and drain their batteries.

External & Internal Lights.....OFF

Make sure that all internal and external lights are switched OFF (with the exception of the cockpit dome light at night) before switching OFF GPU or APU.

Passenger Signs Panel .....OFF

Set EMERG LT, STERILE, NO SMKG (NO ELEC DEVICES in some configurations) and FSTN BELTS to OFF.

HGS Combiner (If installed).....STOWED

Stow the combiner with the cover.

Weather Radar .....OFF

Switch the radar from STBY to OFF.

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Standby Attitude (if applicable) ..... CAGED

Cage the standby horizon. Make sure it is caged by checking whether its red flag is visible.

GPU/APU ..... OFF

Shut APU down by pressing the STOP button on its panel. Verify the shutdown on the EICAS. Wait until APU rotation drops to 5% before switching APU MASTER OFF.

NOTE: Do not close the air conditioning packs before shutting down the APU. Shutting down the APU while bleed air is coming out of it helps extending APU life.

If a GPU is the source of electrical power, switch it OFF through the GPU button on the Electrical System panel.

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Air Conditioning..... OFF

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PUMP PWR ..... OFF

Fuel pumps are needed only as long as the APU is in use. Once the APU is shut down the fuel pumps are not needed any more. So if the airplane is being powered by the GPU or solely by the batteries the pumps are not needed.

Main and Backup Batteries ..... OFF

Switch both batteries OFF.

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CROSSFEED OPERATION

NOTE: Crossfeed must be OFF during takeoff and landing.

If fuel imbalance is verified:
- Attitude ..... WINGS LEVELED
- If left wing presents lower level:
  - Crossfeed Selector LOW1
- If right wing presents lower level:
  - Crossfeed Selector LOW2
- Avoid rapid thrust levers movement.
- Monitor fuel imbalance.
- When the desired balance is achieved:
  - Crossfeed Selector ..... OFF

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OPERATION IN ICING CONDITIONS

This Section contains amplified procedures to Operation in Icing Conditions, Cold Weather Operation and Cold Soak Operation that supplement those procedures published in the AFM. In case of disagree, the AFM shall prevail.

EXTERNAL SAFETY INSPECTION

Operating regulations clearly state that no takeoff is allowed when snow, ice or frost is adhering to the airplane.

The responsibility for ensuring a clean airplane rests with the flight crew. The primary method for the flight crew to ensure a clean airplane is through close visual and physical inspection of the critical surfaces prior to takeoff. Visually check the wing, control surfaces, engines and fuselage prior to takeoff. In addition, as no frozen contamination is allowed on the wing upper surface, carry out a physical (hands-on) inspection to ensure that there is no ice accretion. Do not touch the surfaces with bare hands, as the skin may stick to a freezing surface. Even at intermediate stops, an external walk around is necessary due to the possibility of ice forming after landing from either cold soaking frost, conventional frost or precipitation freezing on the airplane.

During the pre-flight walk-around, ensure that the pitot tubes, static ports, TAT probe, AOA vanes, all inlets, outlets and vents are clear of ice and unobstructed.

A 3 mm (1/8 in) frost layer is permitted on the underwing surfaces. Frost is not permitted on the lower or upper surface of the horizontal stabilizer or the upper surface of the wing.

If the airplane has become cold soaked as a result of flight at very cold temperatures, fuel might be at a subfreezing temperature. This can cause ice accretion if the airplane is subjected to high humidity, fog, drizzle or rain even when the outside air temperature is substantially above freezing.

At the completion of the walk-around, if ice, snow or frost is discovered, de-icing, and possibly anti-icing will be required. The check for ice accumulation should be done in a well-lit area.

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All Protective Covers..... REMOVE

Remove covers from engine air inlet/outlet, APU air outlet, pitot tubes, TAT probes and wheels.

Fuselage, Wing, Tail and Control Surfaces ..... FREE OF FROST, ICE OR SNOW

Check that the fuselage, wing upper and lower surfaces, tail and control surfaces are free of frost, ice or snow. Inspect control surfaces, gaps and hinges for signs of residual fluid or gel.

A thin layer of hoarfrost is permitted on the fuselage provided the layer is thin enough to distinguish surface features underneath, such as painting and markings. Frost is not permitted on the lower/upper surface of the horizontal stabilizer or the upper surface of the wing.

Pitot Tubes, TAT, Static Ports and AOA Vanes ..... CLEAR OF ICE

Engine/APU Air Inlet ..... CLEAR OF ICE OR SNOW

Check that the engine inlet and the APU air inlet is clear of ice or snow. Fluid applied close to the APU inlet area may be ingested and cause a flameout and result in APU internal parts damage. Preferably, all soft snow should be mechanically removed by blowing cold air across the airplane surface, using brooms or soft hand scrappers.

Landing Gear ..... CLEAR OF ICE, UNOBSTRUCTED

Check that doors, gear locks and mechanisms are unobstructed and clear of ice and snow. Check that no leakage exists.

Air Conditioning Inlets and Outlets ..... CLEAR OF ICE

Fuel Tank Vents..... CLEAR OF ICE OR SNOW

Batteries..... INSTALLED

Certain temperatures require batteries removal to prevent cold soaking. Verify that batteries have been re-installed.

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INTERNAL SAFETY INSPECTION

Batteries..... CHECKED

If battery voltage is below 24 V and battery temperature is colder than -15°C (5°F), replace the battery, as it may not recharge under very low temperatures.

APU..... START

Observe fuel and oil limitations before APU starting. Minimum fuel temperature is -40°C (-40°F). Minimum MIL-L-23699 oil temperature is -43°C (-45°F). Minimum MIL-L-7808 oil temperature is -54°C (-65°F).

Minimum battery temperature to start the APU is -20°C (-4°F). Minimum temperature to start APU using external electrical power is -54°C (-65°F).

If APU cannot be started, apply heat from a ground cart directly into the APU compartment. Do not allow the hot air from the ground heating cart to exceed 93°C (200°F), as it may damage the components inside the compartment.

Observe RPM and EGT during starting. If the APU flames out, make sure that ice or snow deposits are cleared before attempting a second start.

After the APU has been started, RPM and EGT fluctuation may be an indication of fluid ingestion into the APU. Record any discrepancy in the logbook.

Air Conditioning ..... SET

Turn both air conditioning packs on, bleeding air from the APU (or from a ground conditioned air cart, with packs off) to warm up the interior of the airplane. The warm-up should be accomplished with all doors closed, if possible.

Turn recirculation fans on.

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CONTINUED FROM PREVIOUS PAGE

In very cold days, Embraer recommends a gradual warming of the cabin, as follows:

- Set air conditioning control to manual mode;
- Put the cockpit temperature selection knob in the 9 o'clock position;
- Wait approximately 3 minutes;
- Change control to automatic mode;
- Wait another 2 minutes before controlling temperature as required.

CAUTION:

- MANTAIN CABIN AT THE FIELD ELEVATION. DO NOT PRESSURIZE THE AIRPLANE.
- WITH PACKS OPERATING AND DOORS CLOSED, DO NOT LEAVE THE AIRPLANE UNATTENDED.

Main Panel ..... CHECK

Check proper operation of all instruments and systems. Liquid Cristal Display may not be readable at temperature below -20°C.

Electric Hydraulic Pumps ..... ON

Check hydraulic pressure. If pressure does not rise to normal values, warm up the hydraulic reservoir compartment with hot air and keep the electric hydraulic pumps running for 15 minutes.
Do not allow the hot air from the ground cart to exceed 93°C (200°F), as it may damage the components inside the compartment.

Flight Controls ..... CHECK

Check control wheel, control column and rudder pedals for freedom of movement and full travel. Control forces can be increased at low temperatures.
Operate all trim systems, including back up pitch trim system, checking for freedom of movement and full travel. If any flight control is suspected of restricted movement or jamming, report to maintenance personnel.

Flaps ..... CHECK

Extend and retract the flaps. Make sure the flaps are free from snow or ice before moving them. Leave flaps UP if application of anti-icing/deicing fluids is expected.

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ENGINE START

SPS/ICE SPEEDS message will remain displayed after icing encounter. Before next takeoff the message must be removed by testing the Stall Protection System.

Do not start the engine until it has been checked that all ice deposits have been removed from the air inlet.

Fuel and oil temperature limits are the same as those prescribed for APU start.

Proceed with normal engine start.

In cold weather conditions, the usage of dual ignition (ignition switch rotated to the ON position) is highly recommended for the first engine start of the day or if the engine has not been run in the previous 90 minutes. This procedure may reduce the time from fuel introduction to light-up.

As a reference, this procedure can be used for temperatures below 5°C, or at operator's discretion.

After a successful start the Ignition Switch must be switched to the AUTO position.

If the engine does not start, ground heating may be necessary to warm the nacelle, Air Turbine Starter (ATS) and Starting Control Valve (SCV).

Do not allow the hot air from the ground cart to exceed 93°C (200°F), as it may damage the components inside the nacelle.

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AFTER START

Ice Detection Override Knob ..... ENG

The Ice Detection Override Knob must be at ENG during all ground operations (in icing conditions) except during ice protection system test. Wing and stabilizer anti-icing must be kept off.

Crossbleed ..... AUTO

CAUTION:
- BOTH ENGINE BLEEDS MUST BE OPEN, IN ORDER TO ASSURE BLEED AIR FLOW THROUGH THE LEADING EDGES. APU BLEED MUST NOT BE USED.
- DELAYING THE USE OF THE ENGINE ANTI-ICING SYSTEM UNTIL ICE BUILD-UP IS VISIBLE FROM THE COCKPIT MAY RESULT IN ICE INGESTION AND POSSIBLE ENGINE DAMAGE OR FLAME-OUT.

NOTE:
- When thrust is set to below 83% N2, the ENG 1-2 A/ICE FAIL message may appear due to the low pressure available for anti-icing. Moving thrust levers forward will cause the message to disappear.
- On airplanes Pre-Mod. SB 145-30-0028, when Ice Detector Override Knob is at ENG on the ground, TAT heating is on. TAT and SAT reading may increase and cause an invalid indication (amber dashes) to appear. If TAT invalid indication causes the AHRS reversion to Basic Mode, continue the mission. The TAT invalid indication and AHRS reversion will remain until the airplane attains sufficient speed to bring the TAT sensors within the normal range of operation.
- AHRS BASIC MODE is inhibited on the ground for airplanes modified to EICAS version 16.5.
- On airplanes Post-Mod. SB 145-30-0028 or S/N 145.180 and on, TAT heating is on when Thrust Levers are set above 65° position or when the airplane is airborne.

Engine Instruments ..... MONITOR

Continue to monitor engine instruments, mainly oil pressure and temperature. Apply associated abnormal procedure if any failure arises.

Main Panel ..... CHECK

Check proper operation of all instruments and systems.

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AIRPLANE ANTI-ICING/DEICING FLUID APPLICATION WITH ENGINES/APU RUNNING

WARNING: APU OPERATION IS NOT RECOMMENDED DURING THE AIRPLANE DEICING/ANTI-ICING PROCEDURE. IF THE APU IS KEPT IN OPERATION DURING THE DEICING/ANTI-ICING PROCEDURE, DAMAGE CAN OCCUR TO IT. IF APU OPERATION IS ABSOLUTELY NECESSARY, MAKE SURE THAT THE APU BLEED AIR VALVE IS CLOSED, PACKS ARE SET TO OFF, AND THE DEICING/ANTI-ICING FLUID IS NOT APPLIED DIRECTLY TO OR NEAR THE APU AIR INLET.

Parking Brake ..... ON
Thrust Levers ..... IDLE
Gust Lock ..... ENGAGE
Doors ..... CLSD
Flaps ..... 0°

Pitch Trim ..... AS REQUIRED

To avoid APU fluid ingestion, it is recommended that pitch trim should be set from 0° to FULL NOSE DOWN, hence fluid cascades downwards and aft, keeping the stabilizer leading edge free from the fluid drip that could be ingested by the APU.

However, operators are reminded to frequently inspect surfaces for residue, as prescribed in the SNL 145-30-0006. This is applicable mainly to fluid Types II, III and IV which may leave residue on the aerodynamic quiet areas.

Engine Bleed ..... CLOSED
APU Bleed ..... CLOSED
Air Conditioning Packs ..... OFF

Packs should be off to avoid contamination of cabin air with fumes generated from ingestion of fluids in engine/APU.

Ice Detection Override Knob ..... ENG

CONTINUES ON NEXT PAGE

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CONTINUED FROM PREVIOUS PAGE

After Deicing/Anti-icing Procedure is complete:

Wait 1 minute.
ENG Bleeds ..... OPEN
Wait 3 more minutes.
Packs ..... OPEN
APU Bleed..... REMAIN CLOSED DURING T/O AND INITIAL CLIMB

Wait at least one minute to open engine bleed, and three minutes to turn air conditioning packs on, thereby avoiding contaminating the airframe air conditioning system with deicing/anti-icing fluid gases.

The deicing/anti-icing fluid shall drop out after initial climb then allowing the APU bleed valve opening.

Ice Detection Override Knob..... ENG

The Ice Detection Override Knob must be at ENG during all ground operations in icing conditions.

Pitch Trim ..... SET

Pitch Trim must be set as per CG position stated in the Weight and Balance sheet.

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TAXI

The maximum recommended wind speeds for airplane towing, pivoting, turning and taxi are:

- Dry Runways ..... 50 kt
- Wet Runways ..... 45 kt
- Snow Covered Runways ..... 30 kt
- Ice Covered Runways ..... 10 kt

Power backs are not allowed. Use minimum thrust to avoid blowing snow or slush on personnel or airplanes nearby.

During taxi, “cold set” (the condition where the tire retains the flat shape it had while parked) may induce vibration in the airplane. Vibration should disappear as the tires recover their elasticity during taxi. Do not initiate your takeoff run before the cold set disappears.

Maintain a greater than normal distance behind other airplanes while taxiing in snow-covered runways, to avoid contamination by snow blown by jet blasts.

Do not apply reverse thrust during taxi, unless it is strictly necessary.

Flaps ..... AS REQUIRED

When taxiing through slush or standing water, flaps should be retracted to avoid snow and slush contamination from the main gear wheels.

CAUTION:
- IF FLAPS WERE LEFT UP DURING TAXI, COMPLETE AFTER START CHECKLIST BEFORE TAKEOFF.
- TAXI AT REDUCED SPEED IN ICE-COVERED RUNWAYS TO AVOID SKIDDING THE AIRPLANE.

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BEFORE TAKEOFF

Ice Protection Test:

NOTE: - The ice protection test must be carried out once a day (not necessarily at the first flight of the day) when icing conditions are forecast.

- The test may be carried out completely on the ground, or in 2 separate phases (first phase on the ground and second phase in flight), depending on weather conditions and crew discretion. For takeoffs when icing conditions exist or are anticipated for takeoff or climb, the tests in paragraph A must be performed.

On ground, if engine vibration increases, advance thrust levers, one at a time, to obtain at least 60% N1 for 5 seconds and then return to the former setting.

A - When actual icing conditions exist or are anticipated for takeoff and climb, proceed:

Thrust Levers 83% N2
Ice Detection Override Knob ..... ALL
Anti-Icing Buttons (engine, wing and stabilizer) ..... PRESSED
Ice Detection Test Knob ..... 1, THEN 2

Test knob must be held at least 10 seconds in each test position but no more than 15 seconds.

For each side separately, check that OPEN inscriptions in the buttons are illuminated and that, ICE DET 1 (or 2) FAIL and BLD 1 (or 2) LOW TEMP caution messages and ICE CONDITION advisory message are displayed on EICAS. The CROSS BLD OPEN advisory message may also be displayed.

NOTE: - Wait for the messages go out of view after each release of the Test knob.

- For the EMB-145 XR model, when the Ice Detection Test Knob is selected to 1, the CLR ICE 1, CLR ICE 2, CLR/I INOP 1 and CLR/I INOP 2 caution messages are displayed on the EICAS and the lights CLR ICE 1 and CLR ICE 2 illuminate; when the Ice Detection Test Knob is selected to 2, none of those caution messages are displayed on the EICAS.

Thrust Levers ..... IDLE
Ice Detection Override Knob ..... ENG

CAUTION: ICE DETECTION OVERRIDE KNOB MUST NOT BE SET TO "ALL" ON GROUND, EXCEPT DURING TEST.

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NOTE: In case of first attempt of Ice Protection Test method A is unsuccessful, thrust levers should be set to IDLE and a second attempt can be performed, following the same procedures.

B - For flight when no actual icing conditions exist or are anticipated for takeoff and climb, proceed:

Before engines start, perform the on ground test:

Air Conditioning Packs ..... OPEN
APU Bleed ..... CLOSE
Engine Bleed ..... CLOSE
Anti-Icing Buttons (engine, wing and stabilizer) ..... PRESSED
Ice Detection Override Knob ..... AUTO
Ice Detection Test Knob ..... 1, THEN 2

Test knob must be held at least 10 seconds in each test position.

For each side separately, check that ICE DET 1 (or 2) FAIL and BLD 1 (or 2) LOW TEMP caution messages and ICE CONDITION advisory message are displayed on EICAS. The CROSS BLD OPEN advisory message and/or the PACK 1 (2) VLV FAIL caution message may also be displayed.

NOTE: For the EMB-145 XR model, when the Ice Detection Test Knob is selected to 1, the CLR ICE 1, CLR ICE 2, CLR/I INOP 1 and CLR/I INOP 2 caution messages are displayed on the EICAS and the lights CLR ICE 1 and CLR ICE 2 illuminate; when the Ice Detection Test Knob is selected to 2, none of those caution messages are displayed on the EICAS.

During climb, perform the inflight test:

Engine Bleeds ..... OPEN
Thrust Lever ..... THRUST SET
Altitude ..... FROM 2000 ft TO 23000 ft
TAT ..... LESS THAN 10°C
Ice Detection Override Knob ..... ALL FOR 20 SECONDS

Check that OPEN inscriptions in the buttons are illuminated and NO ICE-A/ICE ON caution message is displayed on EICAS. The CROSS BLD OPEN advisory message may also be displayed.

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Ice Detection Override Knob ..... AUTO (AFTER 20 SECONDS)

NOTE: - The ice protection test must be fully accomplished before entering icing conditions and before reaching 23000 ft.

- In case the first attempt of the inflight test is unsuccessful, a second attempt can be performed following the same procedures.

NOTE: Do not reset/alternate a FADEC after the Anti-Ice System test.

After completion of the test, set the Ice Detection Override Knob to ENG. Check that engine REF A/ICE on MFD takeoff page is set to ON.

Ignition..... ON

Turn ignition on when standing water, ice, or snow is present on the takeoff runway.

Takeoff Briefing..... COMPLETE

Confirm $V_1/V_R/V_2$ and V_{FS} speeds for the associated runway or takeoff condition.

Flight Controls..... CHECK

Check freedom of movement and full travel of all flight controls (including trims).

Flaps ..... TAKEOFF SETTING

Set flaps to takeoff setting (if flaps were left up after starting).

Takeoff Configuration..... CHECK

Ice Accumulation..... CHECK

Continuously monitor ice accumulation, by checking windshield and, if installed, windshield wiper. High winds and jet blast may cause anti-icing fluid to flow off and many other factors contribute to reduce fluid effectiveness.

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TAKEOFF

Takeoff in a normal manner. Check thrust rating mode. T/O-1 mode gives the maximum weight and thrust for the associated runway.

Do not apply static takeoff technique on an icy or slippery runway, as the airplane may begin to slide when thrust lever is advanced with brakes applied. In this case, release brakes and advance thrust levers simultaneously.

However, appropriate assessment of the takeoff distance is required as performance data available in the AFM for slippery runways is predicted on the use of static takeoff technique only. For rolling takeoffs, performance data is valid from the point where takeoff thrust is achieved.

Check N1 indication consistent with takeoff thrust setting tables (check AFM performance tables which have dedicated thrust setting tables for takeoff in icing conditions). Check N1 pointer reaching N1 target.

Apply light forward pressure on control column to increase nose wheel steering effectiveness.

Check engine stable operation during takeoff run. Rotate the airplane at VR smoothly to takeoff attitude. After lift-off, smooth flight control inputs should be applied if any tendency in pitch and roll are felt. Use of flight director takeoff sub-mode is recommended (on those certifications which allow the use of flight director during takeoff).

Flight controls forces may be heavier than normal, without causing any difficult in controllability.

Increased V2 procedures (if available in the approved AFM) may be used if runway length is not a limiting factor.

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AFTER TAKEOFF

Ice Protection Test (if applicable) ..... COMPLETE

Ice Detection Override Knob..... AUTO

Monitor weather conditions for an encounter with ice for the remainder of the flight. Closely monitor the static air temperature indication so that when moisture is present, a look at the windshield and, if installed, the windshield wiper will indicate if ice is accumulating. Notwithstanding installation of the ice detector, the crew remains responsible for monitoring icing conditions and for manual activation of the ice protection system whenever necessary.

Ignition..... AS REQUIRED

CLIMB/CRUISE

If engine vibration increases, advance thrust levers, one at a time, to obtain 60% N1 minimum for 5 seconds, and then return to the former setting.

If ITT increases beyond limits, reduce Thrust Levers as required to maintain ITT within limits.

When flying in icing conditions or after flying in icing conditions, ice accretion on unprotected areas may cause vibration at high speeds. If vibration and/or buffeting occurs, a change in the current airspeed will eliminate these effects. At high speeds reduce the airspeed as required, limited to a minimum of 200 KIAS. Observe normal (including operation in icing conditions) procedures contained in the approved AFM.

No special technique is required to fly with the autopilot on or off. Climb using FLC mode provides enough speed margin to stall. SPD and VS modes may also be used, provided that the airspeed is not allowed to decrease below 200 KIAS (when flying IAS) or 0.56 M (when flying Mach). During autopilot operation, monitor pitch attitude and speed continuously.

If BLD 1 (2) LOW TEMP message appears, advance Thrust Lever until the message disappears and check bleed temperature pointer (MFD ECS and Pneumatic page) in the green range.

During cruise, observe minimum fuel tank temperature (-40°C). If fuel temperature is reaching the limit, apply the FUEL LOW TEMPERATURE procedure in the AFM.

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HOLDING

Landing Gear ..... UP
Flaps ..... UP
Minimum Airspeed ..... 200 KIAS

CAUTION: MAINTAIN A MINIMUM AIRSPEED OF 200 KIAS SINCE EVEN SMALL ACCUMULATIONS OF ICE ON THE WING LEADING EDGE MAY CHANGE THE STALL CHARACTERISTICS OR THE STALL PROTECTION SYSTEM WARNING MARGIN.

DESCENT

Observe normal (including operation in icing conditions) procedures contained in the approved AFM.

When using the autopilot, monitor pitch attitude and speed continuously.

If approaching the terminal area in icing conditions, an increased rate of descent may be necessary. In this case, a combination of flaps set at 9° and speed brakes open may be used.

NOTE: Engine and Wing Ice Protection Systems operation is automatic and based on the primary ice detection system. However, the crew remains responsible for monitoring icing conditions and for manual activation of the ice protection system if icing conditions are present and the ice detection system is not activating the ice protection system.

APPROACH AND LANDING

Observe normal (including operation in icing conditions) approach/landing procedures contained in the approved AFM.

When landing below -40°C (-40°F), ensure that rate of descent before touchdown is less than 300 ft/min. After landing, report to the maintenance personnel.

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NOTE: During approach and landing with engines and anti-icing system on, the FADEC logic automatically reduces the Flight Idle thrust when landing gear is lowered. On airplanes equipped with an EICAS version earlier than the 16.5, the WG 1(2) A/ICE FAIL, WG A/ICE ASYMMETRY and/or STAB A/ICE FAIL messages may be presented due to low bleed pressure available. If these messages appear, the OPEN inscription on the buttons may still be illuminated. To avoid those messages from appearing, it is recommended to maintain a minimum of 55% N1 during descent and landing phases when landing gear is down. Reducing N1 below 55% is recommended only when needed for landing.

LANDING ON WET OR SLIPPERY RUNWAYS

Wet runways can cause airplane hydroplaning, the technical term used to express slipperiness. The factors that influence the occurrence of this phenomenon are high speed, standing water and poor runway macrotexture. When hydroplaning occurs, it causes a substantial loss of tire friction and wheel spin-up may not occur.

Icy runways can be very slippery at all speeds depending on temperature.

Stopping the airplane with the least landing run must be emphasized when landing on wet or slippery runways.

- Anticipate the approach procedures and speeds: a well-planned and executed approach, flare and touchdown minimize the landing distance.
- Immediately after touchdown, check the ground spoiler automatic deployment when thrust levers are reduced to IDLE.
- Lower nose wheel immediately to the runway. It will decrease lift and will increase main gear loading.
- Apply thrust reversers judiciously to observe how the airplane responds before full reverse is used. Normal procedure is to move the thrust levers out of reverse when ground speed is reduced to 50 kt. In an emergency, reverse thrust may be used to bring the airplane to a full stop.
- Do not use asymmetric reverse thrust on slippery and icy runways.
- Apply brakes with moderate-to-firm pressure, smoothly and symmetrically, and let the anti-skid do its job.

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– If no braking action is felt, hydroplanning is probably occurring. Do not apply Emergency/Parking Brake, as it will cut anti-skid protection and may cause the spoilers to close. Maintain runway centerline and keep braking until airplane is decelerated.

TAXI-IN AND PARKING

Ice Detection Override Knob ..... ENG

NOTE: Make sure the flaps are free from snow, ice or slush.

Flaps ..... UP

CAUTION: TAXI AT REDUCED SPEED IN ICE-COVERED RUNWAYS TO AVOID SKIDDING THE AIRPLANE.

THROUGH-FLIGHTS

Doors and Windows..... CLOSED

Whenever possible, to maintain the cabin warm, keep the passenger, baggage and service doors closed at intermediate stops.

APU..... ON

APU should be on to provide bleed air to maintain cabin warm.

Air Conditioning Packs..... ON
Recirculation Fans ..... ON

Walk around the airplane and check the following items:

Wing, Tail and Control Surfaces..... FREE OF FROST, ICE OR SNOW
Pitot Tubes, TAT, Static Ports and AOA Vanes..... CLEAR OF ICE
Engine/APU Air Inlet..... CLEAR OF ICE OR SNOW
Landing Gear ..... CLEAR OF ICE, UNOBSTRUCTED
Air Conditioning Inlets and Outlets ..... CLEAR OF ICE
Fuel Tank Vents..... CLEAR OF ICE OR SNOW

Ask for deice/anti-ice fluid application, if necessary.

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LEAVING THE AIRPLANE - SECURING FOR COLD SOAK OR AN EXTENDED PERIOD

The procedures below should be performed in the event of extended airplane exposure at low temperatures. In the event that the airplane is off the maintenance base, the crew should ensure that all actions have been accomplished.

Wheel Chocks ..... IN PLACE

Emergency/Parking Brakes ..... AS REQUIRED

For an icy ramp, leave Emergency/Parking Brakes applied. Otherwise, Emergency/Parking Brakes must not be applied to avoid freezing of the brakes.

Pitch Trim ..... FULL NOSE DOWN

As high precipitation may occur during overnights, it is recommended that pitch trim be left at full nose down position.

Gust Lock ..... LOCKED

Protective Covers ..... INSTALLED

Install protective covers at engines and APU inlets/outlets, pitot, TAT probes, and wheels.

Water and Waste System ..... DRAINED

Drain water and waste from all water tanks, if cold soak temperature is expected to be below 0°C (32°F).

Batteries ..... REMOVED

As the batteries may not fully recharge under very low temperatures, batteries should be removed whenever the temperature forecast during the overnight is below -15°C (5°F).

Doors and Windows ..... CLOSED

All doors and windows must be closed to prevent snow and humidity from entering into the airplane.

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GENERAL REMARKS WHEN FLYING IN ICING CONDITIONS

- Continuously monitor engine parameters, airplane pitch attitude and airspeed.
- Closely monitor the SAT indication and presence of moisture. If environmental ice conditions exist, even intermittent, check the windshield, windshield wiper (if installed), and wing surface for ice accumulation. To visualize ice formation, if necessary, use a flashlight on the windshield and the wing inspection light on the wing. If any ice formation is detected or suspected, select the anti-ice protection system override knob to ALL. When flying in detected or suspected ice conditions, use ice speeds as reference.
- Be careful for any mistrimmed condition that may be masked by the autopilot - keep the airplane trimmed at all times. Consider turning the autopilot off if you suspect you are flying in severe icing conditions.
- Monitor anti-ice systems for proper operation. Apply the associated AFM abnormal procedure in case of system failure. If the failure persists, exit and avoid icing conditions. Make the air traffic controller know you are requesting a change due to icing conditions and keep him informed about it.
- Strictly follow AFM Operation In Icing Condition normal procedures.
- Avoid landing in an airport where icing conditions exist or are anticipated if anti-ice system, brakes, thrust reverse, ground spoilers, nosewheel steering or flight controls have failed.
- Do not hesitate to leave icing conditions when icing cannot be handled, even with anti-ice system operating properly.

NOTE: Engine and Wing Ice Protection Systems operation is automatic and based on the primary ice detection system. However, the crew remains responsible for monitoring icing conditions and for manual activation of the ice protection system if icing conditions are present and the ice detection system is not activating the ice protection system.

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FREEZING RAIN AND FREEZING DRIZZLE

Atmospheric conditions involving freezing rain or freezing drizzle associated to supercooled large droplets (SLD), may present a condition that is beyond those for which the airplane was certified. Both freezing rain and freezing drizzle can exist down to ground level and cause ice to form quite rapidly on all surfaces even during short exposures and on areas not normally known to be subjected to ice accretion. This means that the airplane is not designed to fly under freezing rain/drizzle (SLD) conditions.

If the crew notices abnormal ice formation on areas not usually affected by this phenomenon, or ice formation on the previously treated upper surface of the wings, they must consider to be flying under severe icing conditions. In this case, the anti-ice system is failing to reduce or control ice formation. The crew must then exit freezing rain/drizzle conditions as soon as possible since continuous flight under such conditions is, indeed, quite hazardous.

FLAP OPERATION UNDER ICING CONDITIONS

Ice accretion on an airplane depends mainly on the cloud type encountered, the cloud liquid water content and droplet size, and weather conditions. Icing should be expected when flying in visible precipitation, such as rain or cloud droplets, with a temperature between +2°C and -10°C (between 35.6°F and 14°F).

Regardless of the airplane type, the wing, horizontal stabilizer, and engine inlets are typically critical airplane parts for ice accretion and are protected with anti-icing or de-icing systems. The wing flaps are not equipped with a anti-icing or de-icing system and, therefore, if they remain extended for a long period of time in icing conditions, ice may build up on the flaps leading edge. This ice may cause difficulties in retracting the flaps.

For a certain flight time in different weather conditions, the ice accretion intensity may vary, being either trace, light, moderate, or severe. Because of the varying conditions, it is not possible to state a reliable time figure that would cover all situations.

Therefore, as a general policy, the use of flaps in icing conditions should be avoided or minimized whenever possible.

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TURBULENT AIR PENETRATION

Flight through severe turbulence must be avoided, if possible.
If not possible, reduce altitude to increase buffet margin.
The recommended procedures for turbulent air penetration are:

1. AIRSPEED

At or Below 10000 ft ..... 200 KIAS
Above 10000 ft ..... 250 KIAS/ 0.63 M, WHICHEVER IS LOWER

Severe turbulence will cause large and often rapid variations in indicated airspeed. Do not chase the airspeed.

2. ATTITUDE

Maintain wings level and proper pitch attitude. Use attitude indicator as the primary instrument. In extreme drafts, large attitude changes may occur. Do not use sudden large control inputs.

3. PITCH TRIM

Maintain control of the airplane with the elevators. After establishing the trim setting for penetration speed, do not change pitch trim.

4. ALTITUDE

Large altitude variations are possible in severe turbulence. Sacrifice altitude in order to maintain the desired attitude. Do not chase altitude.

5. THRUST SETTING

Make an initial thrust setting for the target airspeed. Change thrust setting only in case of extreme airspeed variation.
In case of inadvertent negative-g condition, reduce thrust levers.

NOTE: Do not extend flaps except for approach and landing.

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VOLCANIC ASH

Flight in areas of known volcanic activity must be avoided. This is particularly important during hours of darkness or daytime instrument meteorological conditions when volcanic dust may not be visible. When a flight is planned into an area with a known potential for volcanic activity, it is recommended that all NOTAMs and air traffic control directives be reviewed for current status of volcanic activity. If volcanic activity is reported, the planned flight should remain well clear of the area and, if possible, stay on the upwind side of the volcanic dust.

The airplane's weather radar is not capable of detecting volcanic ash/dust clouds and is therefore not reliable under these circumstances. The presence of volcanic ash/dust may be indicated by:

- Smoke of dust appearing inside the airplane;
- An acrid odor similar to electrical smoke or burnt dust or sulfur;
- Engine malfunctions such as power loss, engine stalls, increasing ITT, fluctuating engine RPM, etc;
- At night, Saint Elmo's fire/static discharges may be observed around the windshield or windows;
- Orange glow from engine inlets.

Flight into volcanic ash/dust clouds can result in the degradation of airplane and engine performance. The adverse effects cause by volcanic ash/dust encounters may be:

- Rapid erosion and damage to the internal engine components;
- Ash/dust buil-up and blockage of the guide vanes and cooling holes, which may cause surge, loss of thrust and/or high ITT;
- Ash/dust blockage of the pitot system, resulting in unreliable airspeed indications;
- The abrasive properties of volcanic material may cause serious damage to the engines, wing and tail leading edge surfaces, windshields, landing lights, etc;
- Windshield and windows may become opaque, reducing the visibility.

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ON GROUND OPERATIONS

The following recommendations apply to starting and operating engines on airports where volcanic ash has fallen and ground contamination is present:

- When the airplane is parked install engine covers or reposition the airplane to limit blowing ash accumulation from wind and jet blasts from other airplane.
- During preflight, check that the engine inlet and exhaust areas have been cleared of volcanic ash;
- Check that all volcanic ash has been cleaned away from the area within 25 ft of the engine inlets;
- Use APU for engine starting only, not for air conditioning;
- Prior to starting, dry motor the engine for one minute in order to blow out any ash that may have entered the engine bypass duct area;
- Use minimum required thrust for breakaway and taxi; Avoid single engine taxi;
- Keep bleed valves closed during taxi. Use the cleanest taxiways whenever possible;
- Be aware of loose ash being blown by the exhaust wake of other airplane. Maintain adequate ground separation and allow for dust to set on the runway before starting the takeoff roll;
- Use a rolling takeoff technique. Avoid setting high thrust at low airspeeds;
- After landing at an airport contaminated with volcanic ash, minimize the use of reverse thrust to prevent any recirculation ingestion;
- Avoid static engine operation above idle;
- Use APU for engine starting only, not for air conditioning.

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IN FLIGHT OPERATIONS

Flight operations in volcanic ash are extremely hazardous and must be avoided. However, volcanic ash/dust clouds may sometimes extend for hundreds of miles, reaching altitudes above 60000 ft and an encounter may be unavoidable.

In case of an inadvertent encounter, proceed as follows:

Volcanic Ash Area..... EXIT/AVOID

Consider performing a 180º turn. Due to the dimensions of the Ash clouds a 180º turn could be the fastest way to exit an Ash cloud.

Oxygen Masks (if necessary)..... Don, 100%

If a significant amount of volcanic ash fills the cockpit or if there is a strong smell of sulphur, don an oxygen mask and select 100%.

APU ..... START
Ignitions..... ON
Thrust Lever (if altitude permits) ..... IDLE
Anti-Icing Buttons (engine, wing and stabilizer)..... PRESSED
Ice Detection Override Knob..... ALL

This action will increase bleed air extraction from the engines and further improve the engine stall margin.

ITT..... MONITOR

If the ITT is still increasing even with the thrust levers in idle:

Affected Engine..... Shutdown

If it becomes necessary to shutdown an engine to prevent exceeding ITT limits, restart the engine once it has cooled down. If the engine fails to start, repeated attempts should be made immediately.

NOTE: A successful start may not be possible until the airplane is clear of the volcanic ash/dust, and the airspeed and altitude is within the airstart envelope. Take note that engines can be very slow to accelerate to idle at high altitudes and this could be interpreted as a failure to start or as an engine malfuntion.

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After exiting the area of volcanic ash/dust cloud and the engine(s) restarted, restore systems to normal operation. Inform ATC of the encounter.

Airspeed..... MONITOR

Monitor airspeed for any abnormal indication. If necessary perform the Unreliable Airspeed procedure.

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LIGHTNING STRIKE

Even though the airplane is adequately protected against lightning strikes effects, operating procedures should be established in an attempt to avoid such phenomenon.

Avoid penetration of thunderstorms. In-flight lightning avoidance is closely associated with thunderstorm avoidance. Maintain visual contact with thunderstorms during the daytime and lightning at night.

Check the radar for precipitation, review all available types of weather information, examine other pilot reports and follow ATC instructions. Even with a good weather report received and understood, pay close attention to those storms that develop rapidly along the route in a given area and that cannot be predicted. While enroute, constantly update the previous weather briefing through radio contact and airborne equipment for actual storm avoidance.

Remember that radar detects only liquid droplets, not the cloud itself. Only rain suspended in the cloud will produce a radar echo, which may lead to occasional encounters with hail and lightning.

Circumnavigate the detected thundercloud or area, if possible by more than 25 miles when traffic conditions permit. Flying over the top of the thunderclouds is preferable.

Be aware that lightning can strike an airplane miles away from the extreme side of a developed thunderstorm. Reports of airplane receiving strikes in clear air at 25 or more miles from the nearest storm are common.

The following paragraphs summarize the conditions in which strikes are most common:

- Meteorological conditions: incident reports show that an airplane must be within or beneath a cloud to receive a strike, or in or near regions of precipitation. Incident reports show that in over 80% of the strikes, the airplane was within a cloud and experiencing some precipitation and turbulence. But other strikes may occur in a cloud where there is no precipitation nearby, in clear air reasonably distant from a thundercloud, during snowstorms and in clouds over erupting volcanoes. Flight through or in the vicinity of cold front, warm front, stationary front, unstable air or squall line are indicators of imminent lightning strikes. Incident reports also show that lightning strikes occur most commonly under light or heavy turbulence conditions.
- Flight regime: Takeoff, climb, level flight, descent or approach.

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- Altitude: strikes are more intercepted between 5000 and 15000 ft, but may occur at virtually all flight altitudes. Lightning strike incidents at lower altitudes are far more frequent since at higher altitudes airplanes can divert around thunderclouds with greater ease.
- Outside air temperature: most strike incidents have occurred when the airplane is flying in temperatures near or at freezing level. Strikes may also occur at temperatures as high as 25°C, or as low as -45°C.

Metal airplanes produce a phenomenon called Faraday Cage effect, which distributes electrical charges along the airframe in such a manner that occupants and internal components will not receive the high current that causes injury and damage. There seems to be no record of any case of crew incapacitation due to lightning, although flash blindness can occur for a few seconds.

Direct effects which result from lightning current attachment to and flow through the airplane may be:

- Pit marks are often seen along the fuselage or holes in the trailing edge of wing and tail tips.
- Melting of rivets.
- Puncturing of nonmetallic structures.
- Puncturing and de-lamination of composites.
- Slight deformation of metal skins and structure.
- Welding or roughening of moveable hinges and bearings.
- Damage to other parts that may conduct lightning current other than the airframe, such as bonding or diverted straps and pitot tubes.

Effects caused by the flash-induced electromagnetic field and the increase of the voltage due to the current at the airplane structure are defined as indirect effects and may be:

- Interruption of instruments and navigation equipment.
- Damage to electronic and electrical equipment.
- Popping of circuit breakers.
- Loss of electrical power.
- Engine flame-out.

In case of lightning strike, report the incident to the maintenance personnel, by filling out the LIGHTNING STRIKE REPORT (Abnormal Procedures - Section 1-03-70 - Miscellaneous).

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IN FLIGHT OPERATIONS

IF LIGHTNING STRIKE IS SUSPECTED TO OCCUR

An imminent lightning strike event may be indicated to flight crews by the buildup of static discharge which causes interference on ADF indicators or noise in communication receivers. Another indication is St. Elmo's Fire, which is visible at night as small electrical discharges running across the windshields and sparking on the wings.

Consider wearing sunglasses to protect your eyes from the flash or have one pilot keep eyes downward.

All Cockpit Lights ..... ON/FULL BRIGHTNESS

IF THE AIRPLANE HAS BEEN HIT BY LIGHTNING

If situation is under control after a lightning strike, apply the following procedure to ascertain whether the flight may be proceed.

Circuit Breakers ..... CHECK

Compass/Heading System ..... CHECK

Check magnetic compass and heading system for normal indication.

Engine Indication ..... CHECK

Check engine for normal indication and apply associated procedure if any failure arises after strike attachment.

In case of engine shutdown, the flight crew shall analyze the circumstances of the event and consider an engine airstart.

Pressurization ..... CHECK

Check pressurization system for normal indication.

If loss of pressurization is presented, structural damage may be considered. In this case, the associated procedure must be accomplished.

Flight Controls ..... CHECK

Check all flight controls for freedom of movement. Verify that flaps and speed brakes are working properly (refer to flaps and speed brakes operating limits).

Fuel System ..... CHECK

Check fuel system for normal operation. Monitor fuel remaining and fuel consumption to ascertain that no fuel leak exists.

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All Other Airplane Systems..... CHECK

Check all airplane instrument following a panel scan sequence to ascertain that flight safety prevails.

The display colors may be changed, however the display information remains valid.

Apply the associated emergency/abnormal procedure if any failure arises after a lightning strike. Consider discontinuing the flight and land at the nearest suitable airport if any unsafe condition is revealed after checking system operation and general airplane condition.

ON GROUND OPERATIONS

ON THE GROUND

Approaching and landing an airplane during a thunderstorm is strongly not recommended. The human body may provide the grounding that is otherwise lacking. If you are in the cockpit, do not attempt to communicate with ground through a wire handset, and stay inside the airplane until the storm has passed.

IF THE AIRPLANE HAS BEEN HIT BY LIGHTNING

External safety inspection

Check for holes, punctures, discoloration and de-lamination throughout the whole airframe.

Verify for loose, melted or missing rivets.

Check that all static dischargers are in place or in accordance with the CDL.

Verify the integrity of the lights installed on tail, wing, fuselage and landing gear.

Verify all antennas, ice detectors, pitot tubes, angle-of-attack vanes, TAT probes and static ports for condition.

Report to maintenance personnel any detected damage or failure. Perform SECTION 05-50-01 (AMM) for detailed procedures to carry out a general inspection after a lightning strikes the airplane. Make sure that these procedures are carried out before flying the airplane again.

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PRESSURIZATION IN MANUAL MODE

This section contains additional information to assist pressurization operation in manual mode. If necessary, consult AOM Section 2-14-15 - Pressurization System. Procedures are intented to supplement the procedures published in the QRH.

Procedures herein are valid for dispatch with the pressurization system automatic mode inoperative (MEL item 21-30-00) or in case of loss of automatic mode in flight. For rapid loss of pressurization, refer to the RAPID CABIN DEPRESSURIZATION procedure in the QRH.

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GENERAL

It has been observed that cabin altitude indication may vary under manual mode operation. Therefore, it is recommended to wait until cabin altitude indication stabilizes, when the manual controller should be operated as required to control cabin altitude.

In manual mode, crew selection of the cabin rate and proper monitoring of cabin differential pressure is required to maintain appropriate cabin pressurization. With relation to the 12 o'clock position, clockwise rotation of the controller will induce a positive cabin rate of climb, and a counter-clockwise rotation will induce a negative cabin rate of climb.

The manual controller gain is very sensitive and the response time to the command may take few seconds. Avoid fast and large displacement of the controller.

After making cabin rate changes, wait a few seconds for the system to stabilize and then verify if the result is the desired one.

If necessary repeat the procedure until the desired result is achieved.

RECEIVING/BEFORE DOOR CLOSING

Pressurization Manual Controller..... FULL UP
Pressurization Mode Selector Button ..... MANUAL

Check that MAN inscription illuminates inside the button.

Pack ..... ONLY ONE PACK ON

This setting allows one outflow valve to be fully open and reduces cabin airflow, thus avoiding uncomfortable pressure changes when the doors are closed or during engine starts.

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TAXI OUT/BEFORE TAKEOFF

Pressurization Manual Controller ..... FULL UP

This setting will make the cabin altitude remain stable during taxi, independent of any variation in bleed.

Just before take-off:

Manual Controller ..... 11 O'CLOCK POSITION

This position will guarantee an acceptable pressurization during climb out.

AFTER TAKEOFF/CLIMB

Just after the initial climb:

Pressurization Manual Controller ..... BETWEEN 11 AND 12 O'CLOCK

Keeping the manual controller within the white mark allows a null or slightly positive rate for the cabin altitude.

Passing 10000 ft pressure altitude:

Manual Controller ..... TURN CLOCKWISE

Identify the resulting cabin rate. Usually a 400 to 500 ft/min will be sufficient for this situation.

Above 10000 ft:

QRH Table ..... CHECK

Search for the LOSS OF PRESSURIZATION INDICATION procedure in the QRH and use the table contained therein. Maintain the cabin altitude consistent with the airplane altitude specified on the table by close monitoring differential pressure and intermittent setting of the manual controller.

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CRUISE

Once cruise level is established, or a step in the climb is desired:

QRH Table ..... CHECK

Manual Controller..... NULL RATE

Allow the cabin to climb (or descend) to the value specified on the QRH table, then set null rate. Cabin altitude and ΔP must be consistent with the table. Keeping the manual controller close to the 12 o'clock position to keep a null rate is a good position for the rest of the cruise. However, minor adjustments might be required.

DESCENT

Just after initiating descent:

Manual Controller..... SLOWLY TURN COUNTER CLOCKWISE

Initially, set -400 ft/min rate, which corresponds to a position between 12 and 11 o'clock in the manual controller.

During descent:

Set a cabin rate that will meet the required landing altitude upon landing. Allow the cabin to descend slowly towards the desired landing altitude so that upon landing ΔP reads zero.

During holding at any flight altitude:

Manual Controller..... SET AROUND 12 O'CLOCK POSITION

Keep the manual controller close to the 12 o'clock position to keep a null rate. However, minor adjustments might be required.

TAXI-IN

On the ground:

Differential Pressure ..... ZERO

Once ΔP reads zero:

Manual Controller..... FULL UP

In this position, the outflow valve will be kept fully open, which will equalize outside and inside cabin pressure. After that, cockpit side windows and airplane doors can be opened.

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BIRD OR HAIL STRIKE

This procedure contains the information to perform an external inspection of the airplane structure after a suspected bird or hail strike.

This inspection consists of a General Visual Inspection (GVI) similar to the External Inspection, plus the attention points described in the procedure. The operator must assure that the Flight Crew understands these points and is capable of performing the Bird or Hail Strike Inspection.

The information contained herein do not constitute an operational approval. If Local Regulatory Authority approval is required, it should be obtained by the Operator.

BIRD OR HAIL STRIKE INSPECTION PROCEDURE

NO-GO FINDINGS

During the inspection, the occurrence of the following items requires maintenance intervention:

- Stains of blood and other bird remains that can not be cleaned from the airplane surfaces,
- Evidence of the ingress of bird remains into the engine, openings or intakes regardless if they can be cleaned,
- Any obvious damages such as:
  - Buckling, wrinkles, cracks, dents, nicks, and damaged paint finish,
  - Bent, twisted or loosened parts,
  - Loose or pulled fasteners,
  - Missing or pulled apart structures,
  - Hydraulic line leakage, and
  - General misalignment of the structure and assemblies.
- Any technical malfunction that could be related to a Bird or Hail strike occurrence.

NOTE: If bad smell through the bleeding system or abnormal engine parameters are noticed anytime after the suspected bird or hail strike, maintenance intervention is required.

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PREPARING FOR THE INSPECTION

External Lights ..... AS REQUIRED
Emergency/Parking Brake ..... ON
Visual/Access Blockers ..... REMOVE

Remove any objects that may block access to the airplane and its parts such as ground support equipment and ice and snow accumulation.

Flap ..... 45°
Flashlight ..... AS REQUIRED

BIRD OR HAIL STRIKE INSPECTION

WARNING: WHILE CONDUCTING THE INSPECTION, BE AWARE OF MOVING VEHICLES IN THE AIRPLANE SURROUNDINGS.

During the inspection, wipe any detected bird remains from the airplane surfaces with detergent.

WARNING: TO AVOID BIOLOGICAL HAZARDS, LOCAL REGULATIONS MUST BE FOLLOWED IN DEALING AND DISCARDING ANIMAL REMAINS.

Perform the inspection as follows:

Nose Section/Fwd Fuselage ..... CHECK

Verify radome, windshields, direct vision window, fuselage skin, probes, sensors, and detectors.

Antennas ..... CHECK

Verify upper and lower fuselage.

Landing Gear (NLG and MLG) ..... CHECK

Verify doors, components, assembly, and compartments.

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Wings ..... CHECK

Verify wing leading edges, flap surfaces, flap track fairings, winglet/wingtip, spoilers, ailerons, wing-to-fuselage fairings, and wing lower skin.

Horizontal/Vertical Stabilizers ..... CHECK

Verify leading edges, surface and attachments, including rudder and elevators.

Engines ..... CHECK

Verify pylon fairings, engine nacelle, reverser doors, exhaust nozzle, air intake module (inlet cowl, lipskin, inner and outer barrels), spinner and fan module (leading and trailing edges).

If any item listed as a NO-GO FINDING is detected during the inspection, no operation is allowed and maintenance intervention is required. Otherwise, if no item is detected, the airplane can return to service.

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FMZ 2000 FLIGHT MANAGEMENT SYSTEM

The information contained herein supplements the information of the basic AOM Normal Procedures.

HOLDING

If a Holding Pattern entering is necessary:

FMS ..... AS REQUIRED

The pilot must check the entry type and turn direction of holding pattern before entering it. For entry types other than the direct one, the pilot must activate the procedure holding pattern as soon as the approach procedure is retrieved from the Navigation Data Base.

NOTE: The FMS normal operating procedures are contained in the Honeywell Flight Management System (FMS) Pilot's Operating Manual, Honeywell Publication Number A28-1146-122-00, August 1997 edition (or later revision of the manual) for the software version NZ4.8 and in the Honeywell Publication Number A28-1146-133-00, February 1999 edition (or later revision of the manual) for the software version NZ5.2.

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FMS SOURCE SELECTION

Flight Plan ..... SELECT OR CREATE

FMS Source ..... SELECT

The FMS can be selected as the navigation source through the FMS Selector Button located on the Display Control Panel.

FMS Label..... CHECK

The FMS label appears on the associated PFD and MFD.

On PFD:

For airplanes Pre-Mod. SB 145-22-0001 or Post-Mod. SB 145-31-0009 or equipped with an equivalent modification factory-incorporated, if the FMS is the navigation source for only one side the color will be magenta, otherwise it will be amber.

For airplanes Post-Mod. SB 145-22-0001 or equipped with an equivalent modification factory incorporated, the FMS label will be always magenta.

On MFD the label will be always magenta.

For FMS coupling to the Autopilot/Flight Director:

NAV Mode (Flight Guidance Controller) ..... SELECT

The FMS will be coupled to the Autopilot/Flight Director when is selected and valid at the on side EHSI and crew selects the NAV mode on the associated Flight Guidance Controller. Once coupled the autopilot will follow the preselected flight plan on the FMS.

APPROACH

CAUTION: FOR AIRPLANES UNDER FAA AND JAA CERTIFICATION, ONLY PERMITTED WITH SOFTWARE NZ4.8 MOD C OR NZ5.2 MOD B OR LATER SOFTWARE VERSION INSTALLED.

The FMS GPS, NDB, RNAV, VOR, VOR/DME and VFR approaches may be linked into the flight plan and laterally coupled to the autopilot/Flight Director.

ILS approaches can be retrieved from the navigation data base and linked to the flight plan, but cannot be armed or activated as FMS approaches. The FMS can be used to provide navigation up to the final approach course at the point that the PFD must be changed to display raw ILS data.

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TRANSITION FROM FMS TO AUTOPILOT ILS APPROACH

ILS Frequency ..... SELECT AS REQUIRED
Radio Altitude ..... SELECT AS REQUIRED
HDG Mode (Flight Guidance Controller) ..... SELECT
Before selection, set the desired interception course on heading bug.

Navigation Source ..... SELECT
Select the NAV source on the Display Control Panel (LOC course selected on the PFD).

Autopilot/Flight Director ..... AS REQUIRED
When cleared for Approach:
APR Mode (Flight Guidance Controller)..... SELECT

ARC DME APPROACH USING FMS

Pilot Not-Flying ..... CHECK DME
During Arc DME approach using FMS the pilot not-flying must check DME Raw Data.

MISSED APPROACH

CAUTION: ONLY PERMITTED FOR AIRPLANES WITH SOFTWARE NZ4.8 MOD C OR NZ5.2 MOD B OR LATER SOFTWARE VERSION INSTALLED.

Go-Around Button..... PRESS
Thrust Levers..... MAX
Verify that airplane rotates to 10° nose up wings level (Pitch Mode) and changes to Speed Hold Mode after 20 seconds.

Flaps ..... 9°
With positive rate of climb:
Landing Gear..... UP
Airspeed..... APPROACH CLIMB SPEED OR ABOVE

NOTE: During the GO-AROUND procedure, the DON'T SINK aural warning may sound. In this case monitor the sink rate and follow the GO-AROUND guidance.

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NAV Mode (Flight Guidance Controller) ..... SELECT

Reselecting the NAV mode the airplane will regain the lateral guidance from the FMS to fly the missed approach legs to the missed holding point and to enter holding, as required.

FMZ 2010 FLIGHT MANAGEMENT SYSTEM

The information contained herein supplements the information of the basic AOM Normal Procedures.

BEFORE START

FMS..... AS REQUIRED

HOLDING

If a Holding Pattern entering is necessary:

FMS ..... AS REQUIRED

The pilot must check the entry type and turn direction of holding pattern before entering it. For entry types other than the direct one, the pilot must activate the procedure holding pattern as soon as the approach procedure is retrieved from the navigation database.

FMS SOURCE SELECTION

Flight Plan ..... SELECT OR CREATE

FMS Source ..... SELECT

The FMS can be selected as the navigation source through the FMS Selector Button located on the Display Control Panel.

FMS Label..... CHECK

The FMS label appears on the associated PFD and MFD.
On PFD and MFD the FMS label will be always magenta.

For FMS coupling to the Autopilot/Flight Director:

NAV Mode (Flight Guidance Controller) ..... SELECT

The FMS will be coupled to the Autopilot/Flight Director when is selected and valid at the on side EHSI and crew selects the NAV mode on the associated Flight Guidance Controller. Once coupled the autopilot will follow the preselected flight plan on the FMS.

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APPROACH

The FMS GPS, NDB, RNAV, VOR, VOR/DME, and VFR approaches may be linked into the flight plan and laterally coupled to the Autopilot/Flight Director.

ILS approaches can be retrieved from the navigation database and linked to the flight plan, but cannot be armed or activated as FMS approaches. The FMS can be used to provide navigation up to the final approach course at the point that the PFD must be changed to display raw ILS data.

TRANSITION FROM FMS TO AUTOPILOT ILS APPROACH

ILS Frequency ..... SELECT AS REQUIRED

Radio Altitude ..... SELECT AS REQUIRED

HDG Mode (Flight Guidance Controller) ..... SELECT

Before selection, set the desired interception course on heading bug.

Navigation Source ..... SELECT

Select the NAV source on the Display Control Panel (LOC course selected on the PFD).

Autopilot/Flight Director ..... AS REQUIRED

When cleared for Approach:

APR Mode (flight guidance controller)..... SELECT

ARC DME APPROACH USING FMS

Pilot Not-Flying ..... CHECK DME

During Arc DME approach using FMS the pilot not-flying must check DME Raw Data.

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LPV APPROACH (AIRPLANES POST-MOD. SB145-34-0125)

Prior to the IAF:

Approach Procedure ..... LOAD

Prior to the FAF:

VNV Button ..... PRESS
APR Button ..... PRESS
LPV Armed ..... VERIFY

After the FAF:

LPV Active ..... VERIFY

NOTE: LPV indications will be not displayed if the navigation source is copied (FMS 2 is selected on PFD 1 or FMS 1 is selected on PFD 2 as the navigation source).

LNAV/VNAV APPROACH (AIRPLANES POST-MOD. SB145-34-0125)

Prior to the IAF:

Approach Procedure ..... LOAD

Prior to the FAF:

VNV Button ..... PRESS
APR Button ..... PRESS
VGP Armed ..... VERIFY

After the FAF:

VGP Active ..... VERIFY

MISSED APPROACH

Go-Around Button ..... PRESS
Thrust Levers ..... MAX

Verify that airplane rotates to 10° nose up wings level (Pitch Mode) and changes to Speed Hold Mode after 20 seconds.

Flaps ..... 9°

With positive rate of climb:

Landing Gear ..... UP
Airspeed ..... APPROACH CLIMB SPEED OR ABOVE

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NOTE: During the GO-AROUND Procedure DON'T SINK aural warning may sound. In this case monitor the sink rate and follow the GO-AROUND guidance.

For airplanes Pre-Mod. SB145-34-0125

NAV Mode (Flight Guidance Controller)..... SELECT

Reselecting the NAV mode the airplane will regain the lateral guidance from the FMS to fly the missed approach legs to the missed holding point and to enter holding, as required.

For airplanes Post-Mod. SB145-34-0125

LNAV Mode (flight guidance controller)..... CHECK IF ARMED

When flying an ILS or non-RNAV approach, by reselecting the FMS source the airplane will regain the lateral guidance from the FMS to fly the missed approach legs to the missed holding point and to enter holding, as required.

BEFORE LANDING (AIRPLANES POST-MOD. SB145-34-0125)

PFD Speed ..... SET $V_{APP\ CL}$

Set Approach Climb Speed via Speed Intervention function on FMS.

LATERAL DEVIATION SCALE

When the FMS is selected as the navigation source the cross track deviation scale and pointer, if valid, will be displayed. The lateral deviation scale is defined by the FMS according to the values displayed on the RNP SETTINGS page. The PROGRESS 1/3 page displays the active RNP value, which is the two dots deviation on the lateral scale. For airplanes Post-Mod. SB145-34-0125 such information is also displayed on the PFD.

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VERTICAL DEVIATION SCALE

When the FMS is selected as the navigation source the vertical track deviation scale and pointer, if valid, will be displayed. The vertical deviation values are the following:

DEVIATION	ENROUTE (ft)	TERMINAL (ft)	APPROACH (ft)
0	0	0	0
1 dot	250	250	75
2 dots	500	500	150

For airplanes Post-Mod. SB145-34-0125 the vertical deviation full-scale value readout is displayed below the scale on the PFD.

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RVSM OPERATION

The RVSM operation reduces the EMB-145 minimum vertical separation from 2000 ft to 1000 ft between FL 290 and FL 370.

Airworthiness approval alone does not authorize flight into airspace for which an RVSM operational approval is required by an ICAO Regional Navigation Agreement.

LIMITATIONS

MINIMUM EQUIPMENT REQUIRED

During RVSM operation it is necessary that the following equipment and instruments be in proper operating condition:

- 2 Primary Altitude Measurement Systems;
- 1 Autopilot with Altitude Hold Mode operative;
- 1 Altitude Alerter;
- 1 Transponder.

NOTE: - An operating transponder may not be required for entry into all designated RVSM airspace. The operator should determine the requirement for an operational transponder in each RVSM area where operations are intended. The operator should also determine the transponder requirements for transition areas next to RVSM airspace.

- Should any of the required equipment fail prior to the airplane entering RVSM airspace, the pilot should request a new clearance to avoid entering this airspace.

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EMERGENCY AND ABNORMAL PROCEDURES

The procedures presented in the basic AOM Emergency/Abnormal Procedures remain unchanged, except as amended herein.

- In case of emergency or abnormal situation or contingencies (equipment failures, weather, etc.) which affect the ability to maintain the cleared flight level, notify ATC and co-ordinate an action plan that is appropriate to the airspace concerned;
- Notify ATC when encountering greater than moderate turbulence;
- If unable to notify ATC and obtain an ATC clearance prior to deviating from the cleared flight level, follow any established contingency procedures and obtain ATC clearance as soon as possible.

NORMAL PROCEDURES

The procedures presented in the basic AOM Normal Procedures remain unchanged, except as amended herein.

EXTERNAL SAFETY INSPECTION - NOSE SECTION

Sensors, Pitot Tubes and Static Ports ..... CONDITION, NO OBSTRUCTION

Particular attention should be paid to the condition of static sources and to the marked area on the fuselage skin near each primary static source.

BEFORE TAKEOFF

Altimeters ..... SET TO THE AIRFIELD QNH

Altitude Indications ..... CHECK

NOTE: - An alternative procedure using QFE may also be used.
- The maximum difference between altimeters indication should not exceed 23 m (75 ft).

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It has been observed that, during normal operation when flying with the autopilot using ADC 1 as source of information and transponder 2 is selected for transmitting altitude information to ATC or vice versa, the altitude difference between the two ADC's, however small it is, is seen by ATC as discrepancy between the assigned altitude and the actual altitude, adding to the altitude overall error. For this reason, when the autopilot uses ADC 1 as source of information, transponder 1 should be used to report altitude because during normal operation it is connected to ADC 1. The same logic applies when using ADC 2 as source of information, that is, transponder 2 should be used.

CRUISE

Be sure that all required equipment are in proper operating condition.

Ensure that the airplane is flown at the cleared flight level and that ATC clearances are fully understood and followed. Do not depart from cleared flight level without a positive clearance from ATC except for a contingency or emergency situation.

While changing flight levels, do not overshoot or undershoot the cleared flight level by more than 45 m (150 ft).

The autopilot should be operative and engaged during level cruise, except for circumstances such as the need to re-trim the airplane or when it must be disengaged due to turbulence.

AFTER LANDING

In case of failure or malfunction, the following information should be recorded when appropriate:

a) Primary and standby altimeter readings;
b) Altitude selector setting;
c) Subscale setting on altimeter;
d) Flight Director used with the Autopilot to control the airplane and any differences when the other Flight Director was coupled;
e) Use of air data computer selector for fault diagnosis procedure;
f) The transponder selected to provide altitude information to ATC and any difference noted when an alternative transponder was selected.

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ENHANCED/GROUND PROXIMITY WARNING

Aural Warning: WHOOP-WHOOP PULL UP or PULL UP (for EGPWS), SINK RATE, TERRAIN TERRAIN or TERRAIN TERRAIN PULL UP (for EGPWS), CAUTION TERRAIN (for EGPWS), OBSTACLE OBSTACLE PULL UP (for EGPWS), CAUTION OBSTACLE (for EGPWS), DON`T SINK DON`T SINK, TOO LOW TERRAIN, TOO LOW GEAR, TOO LOW FLAPS, GLIDE SLOPE and BANK ANGLE voice messages may be generated, but are not associated with GPWS/EGPWS EICAS message.

When an EGPWS/GPWS alert occurs, use the flight controls and thrust as necessary to correct the airplane attitude, flight path and configuration according to the voice message presented to provide terrain clearance.

CAUTION: FOR EGPWS, THE TERRAIN DISPLAY IS INTENDED TO BE USED AS A SITUATIONAL TOOL ONLY AND MAY NOT PROVIDE THE ACCURACY AND/OR FIDELITY ON WHICH TO SOLELY BASE TERRAIN AVOIDANCE MANEUVERING DECISIONS.

WINDSHEAR PREVENTION/RECOVERY

Aural Warning: WINDSHEAR voice message is generated if WDSHEAR red indication is presented (GPWS warning may also be activated).

Thrust Levers	MAX
Go-around Buttons	PRESS

Rotate the airplane smoothly to minimize altitude loss. Flight guidance on EADI must be followed.

NOTE: Pitch attitude may be well above normal angles.

Maintain airplane configuration. Do not change gear and flap position until terrain clearance is assured and above 1500 ft AGL or after WDSHEAR label is removed from PFD.

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TRAFFIC AND COLLISION AVOIDANCE

Aural Warning: According to the Traffic Advisory (TA) and Resolution Advisory (RA) associated.

The pilot must not initiate evasive maneuvers using information from the traffic display or the voice message only, without visually sighting the traffic. The traffic display and advisories are intended for assistance in visually locating the traffic.

Compliance with TCAS resolution advisory is required unless the pilot considers it unsafe to do so. Maneuvers which are in the opposite direction of the RA are extremely hazardous, especially RAs involving altitude crossing, and are prohibited unless it is visually determined to be the only means to assure safe separation.

TRANSPONDER

In compliance with FAA Airworthiness Directive 2006-19-04, during all flight phases, after completion of any 4096 ATC Code change (also referred to as Mode A Code), check the status of the transponder. If the transponder indicates that it is in standby mode, re-select the desired mode (i.e., the transponder should be in the active mode).

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RNP APPROACH

INTRODUCTION

The material contain herein is a guidance to perform RNP APCH operations.

According to AC 90-105, airplanes conducting GPS approaches under AC 90-94 meet the airworthiness requirements of RNP Approach Operations.

NOTE: Compliance with the above regulations does not constitute operational approvals.

In addition to the guidance of this section, the operator must continue to ensure they comply with the general operating requirements; checking Notices to Airmen (NOTAMs), availability of Navigational Aids (NAVAIDs) for overlay approaches, airworthiness of airplane systems, and aircrew qualification. Pilots should assess their capability to navigate (potentially to an alternate destination) in case of GPS outages or predicted unavailability. In these situations, pilots should rely on other equipment, delay departure, or discontinue IFR operations.

Any required alternate airport should have an approved instrument approach procedure other than GPS which is anticipated to be operational at the estimated time of arrival.

NAVIGATION DATA VALIDATION

The navigation database must be obtained by a supplier complying with AC 20-153 or equivalent and is expected to be current for the duration of the flight.

NOTE: If the AIRAC cycle will change during the flight, the locations of the waypoints used to define procedures must be verified with current navigational charts.

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GENERAL GUIDANCE

While performing RNP APCH operations, pilots are required to use the Flight Director and/or Autopilot in lateral navigation mode.

RNP APCH operations require flight crew monitoring of lateral track deviations on the PFD to ensure the airplane remains within the bounds defined by the procedure. The lateral scale and CDI are automatically changed according the current phase of flight as presented in the following table:

DEVIATION	ENROUTE (nm)	TERMINAL (nm)	APPROACH (nm)
0	0	0	0
1 dot	2.5	0.5	0.15
2 dots	5.0	1.0	0.30

NOTE: In the PFD display, the phases of flight are identified as follows:
- Terminal phase is presented as TERM.
- Approach phase is presented as APP.
- Enroute is recognized in case neither of these two denominations is presented.

All pilots are expected to maintain centerlines, as depicted by onboard lateral deviation indicators and/or flight guidance. For normal operations, cross-track error/deviation (the difference between the RNAV system computed path and the airplane position relative to the path) should be limited to half the navigation accuracy associated with the procedure (i.e., 0.15 nm for RNP APCH operations).

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PRIOR TO FLIGHT

Airplane Minimum Configuration ..... CHECK

Check the airplane configuration complies with the applicable list below:

For RNP APCH Operation:

- 1 FMS.
- 1 GPS.
- 1 DME (*).
- 1 VOR/LOC (*).
- 1 ADF(*).
- 4 Display units.
- 1 Flight Director.
- 1 CDU.

(*) Since the Flight crew should ensure sufficient means are available to navigate and land at the destination or at an alternate aerodrome in the case of loss of RNP APCH airborne, this equipment may be required to comply with this condition. This equipment may also be required to comply with the missed approach procedure if it is based on conventional navaids.

NAV Database ..... VERIFY CURRENCY

Verify that the Navigation Data Base (NDB) is current for the duration of the flight.

Predictive RAIM ..... CONFIRM AVAILABLE

The performance capability may be checked from an offline station, or with the airplane own capability. If using the airplane capability, insert the appropriate GPS NOTAMs to allow for an accurate predictive RAIM.

NOTAM NAVAIDS ..... DESELECT

Deselect manually the appropriate NAVAIDs in accordance with NOTAMs.

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APPROACH BRIEFING

Procedure ..... CONFIRM

The flight crew must retrieve the approach procedure by procedure name from the FMS and confirm that the correct approach and missed approach procedures have been selected by comparing the FMS waypoints and distances with the aeronautical charts.

Display Control Panel ..... SET

Select the FMS as the source for the PFD and Bearing Pointer.

NOTE: - The manual entry or creation of new waypoints, by manual entry of latitude and longitude or position/bearing/distance values is not permitted.

- Slight differences between the navigation information portrayed in the chart and CDI (magenta) may occur. Differences of 3° or less are considered acceptable.

LNAV Mode ..... AS REQUIRED

GPS is in use by the FMS ..... CONFIRM

NOTE: If the ETA is more than 15 minutes from the pre-flight ETA, a new RAIM availability check should be performed.

APPROACH

Track deviation ..... MONITOR

The deviation can be monitored through the lateral scales and CDI on PFD. Lateral deviation should not exceed 0.15 nm except briefly during and immediately after turns. If the deviation exceeds this limit perform a missed approach.

At the IAF:

Altimeters..... SET

2 NM before the FAF:

APP Annunciation..... CHECK

The annunciation indicates that the FMS is in the flight approach phase and the lateral deviation scaling has been set to approach scale factor.

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ABNORMAL PROCEDURES

In case of loss of GPS based navigation capability, alternate non-GPS procedures at the destination airport must be available.

LOSS OF SIGNAL IN SPACE

During a RNP APCH operation, if at any time GPS signal is lost the APP annunciation is removed, the DGR (or DR) PFD annunciation is displayed, and the deviations remain displayed and valid.

In any case, if not visual, perfom a missed approach using alternate sources (VOR, NDB or visual references).

DEGRADED NAVIGATION

The navigation will be degraded whenever the FMS cannot guarantee that the accuracy of the system meets the requirements for the current phase of flight (DGRAD annunciator) or if the sensors being used for navigation are not approved for the current phase of flight.

Select the non-affected FMS. For single FMS installations, if not visual, perform missed approach.

For airplanes equipped with FMZ 2010 FMS, in case one FMS (single FMS) or both FMS (dual FMS) are affected, use the procedures from the following table.

OPERATION	REQUIRED ACTION
Non-RNP Terminal or Enroute	Crosscheck FMS data with raw data from VOR, DME, and NDB. De-select error causing sensor, if detectable. Otherwise, contact ATC and revert to an alternative means of navigation (VOR, DME, or NDB).
RNAV/RNP	Contact ATC, advise of any loss of the RNAV/RNP capability or inability to continue RNAV/RNP.

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FMS FAILURE

Select the cross side FMS. For single FMS installation, if not visual, perform missed approach.

FLIGHT DIRECTOR FAILURE

If flight director is lost, if not visual, perform missed approach.

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PERFORMANCE BASED NAVIGATION (PBN)

INTRODUCTION

The material contain herein is a guidance to perform PBN operation. It does not consider AC-90-105 or AMC-20-27 which deal with RNP APCH operation. For RNP APCH operation, refer to 1-02-80 RNP Approach.
In addition to the guidance of this section, the operator must continue to ensure compliance with the general operating requirements; checking Notices to Airmen (NOTAMS), availability of Navigational Aids (NAVAID), airworthiness of airplane systems, and flight crew qualification.

NAVIGATION DATA VALIDATION

The navigation database must be obtained by a supplier complying with AC 20-153 or equivalent and is expected to be current for the duration of the flight.

NOTE: If the AIRAC cycle will change during the flight, the locations of the waypoints used to define procedures must be verified with current navigational charts.

GENERAL GUIDANCE

While performing PBN operations, pilots are encouraged to use the Flight Director and/or Autopilot in lateral navigation mode.

The following table presents the EMBRAER ERJ-145 capabilities in terms of the navigation specifications related to PBN. The information provided is based on AFM statements and, when there is no AFM statement, on analysis of the respective guidance material.

It is important to note that some guidance material that are listed on the table may either refer to other documentation for purposes of alternative compliance or may have been superseded by subsequent guidance material.

The ERJ-145 capabilities listed in this publication do not imply operational approval. Appropriate approval from the appropriate local authorities must be granted for each intended operation(s).

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The airplane is compliant with AC 90-100A (RNAV 1 and RNAV 2) and with TGL-10 (P-RNAV and B-RNAV).

RNAV SPECIFICATIONS			
Operation	**Sensors that may be used**	**Guidance FAA**	**Guidance EASA**
RNAV 10 (RNP 10) (1)	2 GNSS (2) 2 IRS+2 GPS 2 IRS (3)	Order 8400.12A	Order 8400.12A
RNAV 5	GNSS DME/DME VOR/DME	AC 90-96A (5a)	AMC 20-4 (5b)
RNAV 2	All permitted sensors (4) GNSS (2) DME/DME DME/DME/IRU (4)	AC 90-100A (6)	-
RNAV 1	All permitted sensors (4) GNSS (2) DME/DME DME/DME/IRU (4)	AC 90-100A (6)	TGL 10 (P-RNAV)

For P-RNAV operations, VOR/DME may be used as a sensor for positioning.

(1) Dual FMS is required.

(2) Off Line RAIM prediction is required.

(3) This operation is permitted up to 6.2 hours after the system is placed in the navigation mode.

(4) Only applicable for airplane with dual IRS installation (FMS HNL).

NOTE: For airplanes equipped with two AHRS and one additional IRS dedicated to HGS, only navigation based on GPS is allowable.

(5a) According to AC 90-96A, the airplane should be considered eligible for B-RNAV/RNAV 5 operations if the AFM shows the appropriate instrument flight rules (IFR) navigation system installation has received airworthiness approval in accordance with the current edition of AC 20-130. According to AFM, the EMB-145 RNAV system installation is compliant with AC 20-130A.

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(5b) AMC 20-4 defines that installations in accordance with AC 20-130() is an acceptable means of compliance for Basic RNAV systems, with no further substantiation. According to AFM, the EMB-145 RNAV system installation is compliant with AC 20-130A.

(6) NO AFM STATMENT - The AC 90-100A compliance table lists that the EMB-145 complies with AC-90-100A, therefore it is capable of RNAV 1 operation. Approval using DME/DME/IRU may be obtained only by those airplanes equipped with dual IRS. The airplanes with AHRS may obtain such approval using GPS.

LIMITATIONS

- For RNAV operations in terminal airspace, obstacle clearance protection, up to the Final Approach FIX (FAF), will assume that airplane comply with the required RNAV accuracy requirements;
- Obstacle clearance altitude is based upon the infrastructure giving the poorest precision;
- The minimum flight crew are 2 Pilots;
- The system must display essential information in the Pilot's primary field of view such as:
  - Lateral deviation;
  - TO/FROM waypoints;
  - Failure flag (failure of RNAV system);
- Where DME/DME/IRS is used, the flight crew must ensure initialization on the runway either by means of a manual runway threshold or intersection update, as applicable. This is to preclude any inappropriate or inadvertent position shift after takeoff;
- Where GNSS is used, the signal must be acquired before the takeoff roll commences and GNSS position may be used instead of runway update;
- Where reliance is placed on the use of radar to assist contingency procedures, its performance has been shown to be adequate for that purpose, and the requirement for a radar service is identified in the AIP;
- RNAV operations must use FMS to control all lateral navigation functions. For FMS limitations, refer to Section 1-01-60 (Limitations, System: FMS) of AOM;

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- The airplane RNAV system must display the following information to the flight crew:
  - The active (TO) waypoint and distance/bearing to this point;
  - Ground speed or time to the active (TO) waypoint;
  - For P-RNAV, automatic tuning of VOR and DME used for position updating together with the capability to inhibit individual NAVAIDs;
  - RNAV system failures; alternate means of displaying navigation information, that is sufficient to perform cross-checks.

NORMAL PROCEDURES

PRE-FLIGHT PLANNING

NOTAM NAVAIDS ..... VERIFY

Verify the availability of the intended RNAV procedure. Verify also if any NAVAID identified in the AIP and on the relevant charts as critical for a specific RNAV procedure is not available.

Airplane Minimum Configuration ..... CHECK

Check if the airplane configuration complies with the applicable list below:

For all but RNAV 10 operations:

– 1 GPS (*) ;
– 1 VOR (*);
– 1 DME (*);
– 1 IRS (*);
– 1 FMS;
– 1 CDU;
– 4 Display units;
– 1 Flight Director.

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For RNAV 10 operations:

– 2 GPS (*);
– 2 IRS (*);
– 2 FMS;
– 2 CDU;
– 4 Display units;
– 1 Flight Director.

(*) Verify required positioning sensors for the intended operation, acording to RNAV Specifications table.

Navigation Infrastructure ..... CHECK AVAILABILITY

Check minimum equipment required acording to local regulation.

Navigation Database..... CHECK

The navigation database must be appropriate for the region of the intended operation and must include the NAVAIDS, waypoints, and coded terminal airspace procedures for the departure, arrival and alternate airfields. In this case, affected procedures must be prohibited by an operator's notice to the flight crew.

RNAV System (if required)..... CONFIRM AVAILABILITY

When dual RNAV system is required on the AIP.

RAIM (if applicable)..... CONFIRM AVAILABILITY

– Confirmation is necessary if a stand-alone GPS is to be used for RNAV 1 and RNAV 2 operations.
– Confirmation is necessary if dual GPS is to be used for RNP 10 operations.

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DEPARTURE (RNAV 1/P-RNAV/RNAV 2)

NAV Database (both pilots) ..... VERIFY CURRENCY

Airplane Position Entry ..... CHECK

Desired Path (PNF) ..... VERIFY

Airplane Position relative to the Path..... CHECK

Flight Plan ..... CHECK

Compare the navigation charts with the MAP display and the MCDU.

NOTE: - A procedure shall not be used if doubt exists as to the validity of the procedure in the navigation database;
- The creation of new waypoints by manual entry into the RNAV system by the flight crew is not permitted;
- Route modifications in the terminal area may take form of radar headings or direct to clearances.

Airplane Minimum Configuration ..... VERIFY AVAILABILITY

Also, where applicable, verify if the correct airport and runway data have been loaded.

Flight Progress..... MONITOR

During the procedure and where feasible, monitor navigation reasonableness by cross-check with conventional NAVAIDs using the primary displays with the MCDU.

NOTE: When automatic update for departure is not available, the procedure should be flown by conventional navigation means. A transition to the RNAV structure should be made at the point where the airplane has entered DME/DME coverage and has had sufficient time to achieve an adequate input. If a procedure is designed to be started conventionally, then the latest point of transition to the RNAV structure will be marked on the charts. If a Pilot elects to start a RNAV procedure using conventional methods, there may not be any indication on the charts of the transition point to the RNAV structure.

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CONTINENTAL ENROUTE (B-RNAV/RNAV 5/RNAV 1/RNAV 2)

Cleard Flight Plan ..... CHECK

Flight crew should cross-check the cleared flight plan by comparing charts or other applicable resources with the navigation system textual display and the airplane map display, if applicable. If required, the exclusion of specific NAVAIDs should be confirmed.

Flight Progress ..... MONITOR

During the flight, and where feasible, monitore navigational reasonableness by cross-check with conventional NAVAIDs using the primary displays in conjunction with the RNAV control and display unit (CDU).

REMOTE ENROUTE (RNAV 10)

Dual FMS and GPS ..... CHECK AVAILABILITY

At least two FMS and two GPS must be operational at the oceanic entry point. If this is not the case, then the pilot should consider an alternate route which does not require that particular equipment or regard to make a diversion for repairs.

Before entering oceanic airspace:

Airplane Position ..... CHECK

The position of the airplane must be checked as accurately as possible by using external NAVAIDs. This may require DME/DME and/or VOR checks to determine navigation system errors through displayed and actual positions.

NOTE: Operator in-flight operating drills must include mandatory cross-checking procedures to identify navigation errors in sufficient time to prevent airplane from inadvertent deviation from ATC-cleared routes.

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ARRIVAL (RNAV 1/P-RNAV AND RNAV 2)

RNAV arrival operation may only be performed down to the FAF, and shall not be used on Final Approach, i.e. from FAF to RWY or during Missed Approach.

Active Flight Plan ..... CHECK

Prior to the arrival phase, verify that the correct terminal procedure has been loaded. Then, compare the charts with the MAP display and the MCDU. This includes confirmation of the waypoint sequence, reasonableness of track angles and distances, any altitude or speed constraints, and, where possible, which waypoints are fly-by and which are fly-over.

NOTE: If required by procedure, a check will need to be made to confirm that updating will exclude a particular NAVAID. A procedure shall not be used in case of doubt regarding the procedure in the navigation database.

Flight Progress..... MONITOR

During the procedure and where feasible, monitor navigation reasonableness by cross-checks with the conventional NAVAIDs using the primary displays with the MCDU.

NOTE: - When the contingency plan is to revert to a conventional arrival procedure the flight crew must make the necessary preparation.

- For VOR/DME RNAV procedure (P-RNAV only), the reference VOR/DME used for the construction of the procedure must be displayed and checked by the flight crew. Incase there is no GNSS updating, a check for navigation reasonableness is required during the descent phase before reaching the Initial Approach FIX (IAF). For GNSS-based RNAV systems, the absence of an integrity alarm is considered sufficient. If the check fails, a conventional procedure must be flown.

- Route modifications in the terminal area may take the form of radar headings or “direct to” clearances and the flight crew must be capable of reacting in a timely manner. This may include the insertion of tactical waypoints loaded from the database. Manual entry or modification by the flight crew of a loaded procedure, using temporary waypoints or fixes not provided in the database is not permitted.

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Altitude/Speed Constraints ..... CHECK

Flight crew must be aware of any published altitude or speed constraints in the procedure.

CONTINGENCY PROCEDURES

ATC ..... NOTIFY

Notify any problem with the RNAV system that results in the loss of required navigation capability, together with the proposed course of action.

COMMUNICATION FAILURE

Continue with the RNAV procedure in accordance with the published lost communication procedure.

RNAV CABABILITY LOSS

Navigate using an alternative means of navigation. The alternate means does not need to be based on RNAV system.

NAVIGATION SENSORS FAILURE

Discontinue the RNAV procedure following the approved missed approach procedure or if feasible revert to a conventional or IRS procedure and inform ATC.

MULTIPLE SYSTEM FAILURES

If multiple system failures occur such as those affecting GNSS, Flight Director, and any other used for RNAV procedure, perform a missed approach and inform ATC.

If the Autopilot fails, continue the approach using manually, and in case the flight path cannot be followed, perform a missed approach procedure and inform ATC.

If the DGRAD annunciation is displayed:

Select the non-affected FMS. For single FMS installations, use the procedures from the following tables:

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Operation	Required Action
Non-RNP Terminal or En-route (including B-RNAV)	Crosscheck FMS data with raw data from VOR, DME and NDB. De-select sensor causing error, if detectable.
P-RNAV	Contact ATC, advise inability to continue P-RNAV.
Non-RNP (excluding GPS required) Approach	Use alternate sourse (VOR, NDB or visual references) if available. If not, declare Missed Approach.
Non-RNP Remote	Crosscheck FMS data with raw data from GPS or IRS. De-select error causing sensor, if detectable.

FMS 1(2) FAILURE

Select the cross-side FMS.

In case both FMS are unavailable, use the procedures from the following table:

Operation	Required Action
Non-RNP Terminal or En-route	Use alternate sourse (VOR, NDB, DME).
B-RNAV, P-RNAV	Contact ATC, advise inability to continue B-RNAV or P-RNAV operations.
Non-RNP (excluding GPS required) Approach	Use alternate sourse, if available (VOR, NDB or visual references) if available. If not, declare Missed Approach.
Remote Operations	Contact ATC and declare loss of long range navigation capability.

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INCIDENT REPORTING

Significant incidents associated with the operation of the airplane which affect or could affect the safety of RNAV operations, need to be reported on the appropriate report manifest.
Specific examples may include:

- Airplane system malfunctions during RNAV operations which lead to:
  - Navigations errors not associated with transitions between different navigation modes;
  - Significant navigation errors attributed to incorrect data or a navigation database coding error;
  - Unexpected deviations in lateral or vertical flight path not cause by Pilot input;
  - Significant misleading information without a failure warning;
  - Total loss or multiple navigation equipment failure.
- Problems with ground navigational facilities leading to significant navigational errors not associated with transitions between different navigation modes.

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UNS-1K FLIGHT MANAGEMENT SYSTEM

The information contained herein supplements the information of the basic AOM Normal Procedures.

HOLDING

If a Holding Pattern entering is necessary:

FMS ..... AS REQUIRED

The pilot must check the entry type and turn direction of holding pattern before entering it. For entry types other than the direct one, the pilot must activate the procedure holding pattern as soon as the approach procedure is retrieved from the Navigation Data Base.

NOTE: The FMS normal operating procedures are contained in the Universal UNS1 Operator's Manual.

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FMS SOURCE SELECTION

Flight Plan ..... SELECT OR CREATE

FMS Source ..... SELECT

The FMS can be selected as the navigation source through the FMS Selector Button located on the Display Control Panel.

FMS Label..... CHECK

The FMS label appears on the associated PFD and MFD.
On PFD:

For airplanes equipped with dual FMS:
If the FMS is the navigation source to the respective side the label will be magenta, otherwise it will be amber.

For airplanes equipped with single FMS:

- For airplanes Pre-Mod. SB 145-22-0001 or Post-Mod. SB 145-31-0009 or equipped with an equivalent modification factory-incorporated, if the FMS is the navigation source for only one side the color will be magenta, otherwise it will be amber.
- For airplanes Post-Mod. SB 145-22-0001 or with an equivalent modification factory incorporated, the FMS label will be always magenta.

On MFD the label will be always magenta.

For FMS coupling to the Autopilot/Flight Director:

NAV Mode (Flight Guidance Controller) ..... SELECT

The FMS will be coupled to the Autopilot/Flight Director when it is selected and valid at the on side EHSI and crew selects the NAV mode on the associated Flight Guidance Controller. Once coupled, the autopilot will follow the preselected flight plan on the FMS.

APPROACH

NOTE: - ILS approaches can be retrieved from the navigation data base and linked to the flight plan, but cannot be armed or activated as FMS approaches. The FMS can be used to provide navigation up to the final approach course at the point that the PFD must be changed to display raw ILS data.

- GPS will remain selected for GPS and GPS-overlay approved approaches from the navigation database, as well as pilot-defined VFR approaches. Refer to Universal Operator's Manual approaches procedures.

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The FMS LOC, B/C, GPS, NDB, RNAV, VOR, VOR/DME and VFR approaches may be linked into the flight plan and laterally coupled to the autopilot/Flight Director as follows:

APPROACH TRANSITION

When a entire approach transition (e.g., procedure turn, DME arc, etc.) is to be flown, the FMS will automatically enter in the ARM APPR mode at 30 nm from the runway with the lateral deviation scaling of 1 nm (full scale), then:

NAV Mode (Flight Guidance Controller) ..... SELECT

The approach will be automatically activated prior to the FAF and the lateral deviation scaling will change to 0.3 nm full scale.
The VNAV scale will appear on the PFD.

VS or Pitch Hold Mode ..... SELECT AS REQUIRED

Use VS or pitch hold mode mode as required to fly the VNAV flight path.

HEADING VECTORS

If the airplane is given heading vectors by ATC to the final approach course, proceed as follows to manually activate the FMS approach:

HDG Mode (Flight Controller Panel)..... SELECT

If frequency is not already tuned:

TUNE APPR (FMS Control Panel) ..... PRESS

Navigation Frequency..... SELECT

ACT APPR (FMS Control Panel)..... PRESS

The MFD will display the final approach course data. The lateral deviation scaling of 0.3 nm (full scale) displayed on PFD.

When established on an intercept heading and cleared for the approach by the ATC:

NAV Mode (Flight Guidance Controller)..... SELECT

NOTE: Guidance is provided to the runway threshold or missed approach point. It is the pilot's responsibility to level out at the Minimum Descent Altitude if the runway environment is not in sight.

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TRANSITION FROM FMS TO AUTOPILOT ILS APPROACH

ILS Frequency..... SELECT AS REQUIRED

Radio Altitude..... SELECT AS REQUIRED

HDG Mode (Flight Guidance Controller)..... SELECT

Before selection, set the desired interception course on heading bug.

Navigation Source..... SELECT

Select the NAV source on the Display Control Panel (LOC course selected on the PFD).

Autopilot/Flight Director..... AS REQUIRED

APR Mode (Flight Guidance Controller) ..... SELECT

ARC DME APPROACH USING FMS

Pilot Not-flying..... CHECK DME

During Arc DME approach using FMS the pilot not-flying must check DME Raw Data.

MISSED APPROACH

Go-Around Button ..... PRESS

Thrust Levers ..... MAX

Verify that airplane rotates to 10° nose up (Pitch Mode) and changes to Speed Hold Mode after 20 seconds.

Flaps ..... 9°

With a positive rate of climb:

Landing Gear ..... UP

Airspeed..... APPROACH CLIMB SPEED OR ABOVE

NOTE: During the GO-AROUND procedure, the DON'T SINK aural warning may sound. In this case monitor the sink rate and follow the GO-AROUND guidance.

NAV Mode (Flight Guidance Controller) ..... SELECT

Reselecting the NAV mode the airplane will regain the lateral guidance from the FMS to fly the missed approach legs to the missed holding point and to enter holding, as required.

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RVSM OPERATION

The RVSM operation reduces the EMB-145 minimum vertical separation from 2000 ft to 1000 ft between FL 290 and FL 370.

Airworthiness approval alone does not authorize flight into airspace for which an RVSM operational approval is required by an ICAO Regional Navigation Agreement.

LIMITATIONS

MINIMUM EQUIPMENT REQUIRED

During RVSM operation it is necessary that the following equipment and instruments be in proper operating condition:

- 2 Primary Altitude Measurement Systems;
- 1 Autopilot with Altitude Hold Mode operative;
- 1 Altitude Alerter;
- 1 Transponder.

NOTE: - An operating transponder may not be required for entry into all designated RVSM airspace. The operator should determine the requirement for an operational transponder in each RVSM area where operations are intended. The operator should also determine the transponder requirements for transition areas next to RVSM airspace.

- Should any of the required equipment fail prior to the airplane entering RVSM airspace, the pilot should request a new clearance to avoid entering this airspace.

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EMERGENCY AND ABNORMAL PROCEDURES

The procedures presented in the basic AOM Emergency/Abnormal Procedures remain unchanged, except as amended herein.

- In case of emergency or abnormal situation or contingencies (equipment failures, weather, etc.) which affect the ability to maintain the cleared flight level, notify ATC and co-ordinate an action plan that is appropriate to the airspace concerned;
- Notify ATC when encountering greater than moderate turbulence;
- If unable to notify ATC and obtain an ATC clearance prior to deviating from the cleared flight level, follow any established contingency procedures and obtain ATC clearance as soon as possible.

NORMAL PROCEDURES

The procedures presented in the basic AOM Normal Procedures remain unchanged, except as amended herein.

EXTERNAL SAFETY INSPECTION - NOSE SECTION

Sensors, Pitot Tubes and Static Ports .....CONDITION, NO OBSTRUCTION

Particular attention should be paid to the condition of static sources and to the marked area on the fuselage skin near each primary static source.

BEFORE TAKEOFF

Altimeters .....SET TO THE AIRFIELD QNH

Altitude Indications.....CHECK

NOTE: - An alternative procedure using QFE may also be used.
- The maximum difference between altimeters indication should not exceed 23 m (75 ft).

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It has been observed that, during normal operation when flying with the autopilot using ADC 1 as source of information and transponder 2 is selected for transmitting altitude information to ATC or vice versa, the altitude difference between the two ADC's, however small it is, is seen by ATC as discrepancy between the assigned altitude and the actual altitude, adding to the altitude overall error. For this reason, when the autopilot uses ADC 1 as source of information, transponder 1 should be used to report altitude because during normal operation it is connected to ADC 1. The same logic applies when using ADC 2 as source of information, that is, transponder 2 should be used.

CRUISE

Be sure that all required equipment are in proper operating condition.

Ensure that the airplane is flown at the cleared flight level and that ATC clearances are fully understood and followed. Do not depart from cleared flight level without a positive clearance from ATC except for a contingency or emergency situation.

While changing flight levels, do not overshoot or undershoot the cleared flight level by more than 45 m (150 ft).

The autopilot should be operative and engaged during level cruise, except for circumstances such as the need to re-trim the airplane or when it must be disengaged due to turbulence.

AFTER LANDING

In case of failure or malfunction, the following information should be recorded when appropriate:

a) Primary and standby altimeter readings;
b) Altitude selector setting;
c) Subscale setting on altimeter;
d) Flight Director used with the Autopilot to control the airplane and any differences when the other Flight Director was coupled;
e) Use of air data computer selector for fault diagnosis procedure;
f) The transponder selected to provide altitude information to ATC and any difference noted when an alternative transponder was selected.

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ENHANCED/GROUND PROXIMITY WARNING

Aural Warning: WHOOP-WHOOP PULL UP or PULL UP (for EGPWS), SINK RATE, TERRAIN TERRAIN or TERRAIN TERRAIN PULL UP (for EGPWS), CAUTION TERRAIN (for EGPWS), OBSTACLE OBSTACLE PULL UP (for EGPWS), CAUTION OBSTACLE (for EGPWS), DON`T SINK DON`T SINK, TOO LOW TERRAIN, TOO LOW GEAR, TOO LOW FLAPS, GLIDE SLOPE and BANK ANGLE voice messages may be generated, but are not associated with GPWS/EGPWS EICAS message.

When an EGPWS/GPWS alert occurs, use the flight controls and thrust as necessary to correct the airplane attitude, flight path and configuration according to the voice message presented to provide terrain clearance.

CAUTION: FOR EGPWS, THE TERRAIN DISPLAY IS INTENDED TO BE USED AS A SITUATIONAL TOOL ONLY AND MAY NOT PROVIDE THE ACCURACY AND/OR FIDELITY ON WHICH TO SOLELY BASE TERRAIN AVOIDANCE MANEUVERING DECISIONS.

WINDSHEAR PREVENTION/RECOVERY

Aural Warning: WINDSHEAR voice message is generated if WDSHEAR red indication is presented (GPWS warning may also be activated).

Thrust Levers	MAX
Go-around Buttons	PRESS

Rotate the airplane smoothly to minimize altitude loss. Flight guidance on EADI must be followed.

NOTE: Pitch attitude may be well above normal angles.

Maintain airplane configuration. Do not change gear and flap position until terrain clearance is assured and above 1500 ft AGL or after WDSHEAR label is removed from PFD.

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TRAFFIC AND COLLISION AVOIDANCE

Aural Warning: According to the Traffic Advisory (TA) and Resolution Advisory (RA) associated.

The pilot must not initiate evasive maneuvers using information from the traffic display or the voice message only, without visually sighting the traffic. The traffic display and advisories are intended for assistance in visually locating the traffic.

Compliance with TCAS resolution advisory is required unless the pilot considers it unsafe to do so. Maneuvers which are in the opposite direction of the RA are extremely hazardous, especially RAs involving altitude crossing, and are prohibited unless it is visually determined to be the only means to assure safe separation.

TRANSPONDER

In compliance with FAA Airworthiness Directive 2006-19-04, during all flight phases, after completion of any 4096 ATC Code change (also referred to as Mode A Code), check the status of the transponder. If the transponder indicates that it is in standby mode, re-select the desired mode (i.e., the transponder should be in the active mode).

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RNP APPROACH

INTRODUCTION

The material contain herein is a guidance to perform RNP APCH operations.

According to AC 90-105, airplanes conducting GPS approaches under AC 90-94 meet the airworthiness requirements of RNP Approach Operations.

NOTE: Compliance with the above regulations does not constitute operational approvals.

In addition to the guidance of this section, the operator must continue to ensure they comply with the general operating requirements; checking Notices to Airmen (NOTAMs), availability of Navigational Aids (NAVAIDs) for overlay approaches, airworthiness of airplane systems, and aircrew qualification. Pilots should assess their capability to navigate (potentially to an alternate destination) in case of GPS outages or predicted unavailability. In these situations, pilots should rely on other equipment, delay departure, or discontinue IFR operations.

Any required alternate airport should have an approved instrument approach procedure other than GPS which is anticipated to be operational at the estimated time of arrival.

NAVIGATION DATA VALIDATION

The navigation database must be obtained by a supplier complying with AC 20-153 or equivalent and is expected to be current for the duration of the flight.

NOTE: If the AIRAC cycle will change during the flight, the locations of the waypoints used to define procedures must be verified with current navigational charts.

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GENERAL GUIDANCE

While performing RNP APCH operations, pilots are required to use the Flight Director and/or Autopilot in lateral navigation mode.

RNP APCH operations require flight crew monitoring of lateral track deviations on the PFD to ensure the airplane remains within the bounds defined by the procedure. The lateral scale and CDI are automatically changed according the current phase of flight as presented in the following table:

DEVIATION	ENROUTE (nm)	TERMINAL (nm)	APPROACH (nm)
0	0	0	0
1 dot	2.5	0.5	0.15
2 dots	5.0	1.0	0.30

NOTE: In the PFD display, the phases of flight are identified as follows:
- Terminal phase is presented as TERM.
- Approach phase is presented as APP.
- Enroute phase is recognized in case neither of these two denominations is presented.

All pilots are expected to maintain centerlines, as depicted by onboard lateral deviation indicators and/or flight guidance. For normal operations, cross-track error/deviation (the difference between the RNAV system computed path and the airplane position relative to the path) should be limited to half the navigation accuracy associated with the procedure (i.e., 0.15 nm for RNP APCH operations).

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PRIOR TO FLIGHT

Airplane Minimum Configuration..... CHECK

Check the airplane configuration complies with the applicable list below:

For RNP APCH Operation:

- 1 FMS.
- 1 GPS.
- 1 DME (*).
- 1 VOR/LOC (*).
- 1 ADF(*).
- 4 Display units.
- 1 Flight Director.
- 1 CDU.

(*) Since the Flight crew should ensure sufficient means are available to navigate and land at the destination or at an alternate aerodrome in the case of loss of RNP AR airborne, this equipment may be required to comply with this condition. This equipment may also be required to comply with the missed approach procedure if it is based on conventional navaids.

NAV Database ..... VERIFY CURRENCY

Verify that the Navigation Data Base (NDB) is current for the duration of the flight.

Predictive RAIM ..... CONFIRM AVAILABLE

The performance capability may be checked from an offline station, or with the airplane own capability. If using the airplane capability, insert the appropriate GPS NOTAMs to allow for an accurate predictive RAIM.

NOTAM NAVAIDS ..... DESELECT

NAVAIDs are continuosly monitored for reasonableness and are automaticaly de-selected with a notification to the pilot when out of bounds. NAVAIDs, except VORs, cannot be manually inhibited from automatic selection process.

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APPROACH BRIEFING

Procedure ..... CONFIRM

The flight crew must retrieve the approach procedure by procedure name from the FMS and confirm that the correct approach and missed approach procedures have been selected by comparing the FMS waypoints and distances with the aeronautical charts.

Display Control Panel ..... SET

Select the FMS as the source for the PFD and Bearing Pointer.

NOTE: - The manual entry or creation of new waypoints, by manual entry of latitude and longitude or position/bearing/distance values is not permitted.

- Slight differences between the navigation information portrayed in the chart and CDI (magenta) may occur. Differences of 3° or less are considered acceptable.

LNAV Mode ..... AS REQUIRED

GPS is in use by the FMS..... CONFIRM

NOTE: If the ETA is more than 15 minutes from the pre-flight ETA, a new RAIM availability check should be performed.

APPROACH

Track deviation ..... MONITOR

The deviation can be monitored through the lateral scales and CDI on PFD. Lateral deviation should not exceed 0.15 nm except briefly during and immediately after turns. If the deviation exceeds this limit perform a missed approach.

At the IAF:

Altimeters..... SET

2 NM before the FAF:

APP Annunciation..... CHECK

The annunciation indicates that the FMS is in the flight approach phase and the lateral deviation scaling has been set to approach scale factor.

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ABNORMAL PROCEDURES

In case of loss of GPS based navigation capability, alternate non-GPS procedures at the destination airport must be available.

LOSS OF SIGNAL IN SPACE

During a RNP APCH operations, if at any time GPS signal is lost a red X is displayed over the Course Deviation Scale and the INTEG annunciation may be displayed. The APP annunciation is not automatically removed from the PFD.

If any of these situations happens, if not visual, declare missed approach.

DEGRADED NAVIGATION

The navigation will be degraded whenever the FMS cannot guarantee that the accuracy of the system meets the requirements for the current phase of flight or if the sensors being used for navigation are not approved for the current phase of flight.

Select the non-affected FMS. For single FMS installations, if not visual, declare missed approach.

FMS FAILURE

Select the cross side FMS. For single FMS installation, if not visual, declare missed approach.

FLIGHT DIRECTOR FAILURE

If flight director is lost, If not visual, declare missed approach.

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PERFORMANCE BASED NAVIGATION (PBN)

INTRODUCTION

The material contain herein is a guidance to perform PBN operation. It does not consider AC-90-105 or AMC-20-27 which deal with RNP APCH operation. For RNP APCH operation, refer to 1-02-80 RNP Approach.
In addition to the guidance of this section, the operator must continue to ensure compliance with the general operating requirements; checking Notices to Airmen (NOTAMS), availability of Navigational Aids (NAVAID), airworthiness of airplane systems, and flight crew qualification.

NAVIGATION DATA VALIDATION

The navigation database must be obtained by a supplier complying with AC 20-153 or equivalent and is expected to be current for the duration of the flight.

NOTE: If the AIRAC cycle will change during the flight, the locations of the waypoints used to define procedures must be verified with current navigational charts.

GENERAL GUIDANCE

While performing PBN operations, pilots are encouraged to use the Flight Director and/or Autopilot in lateral navigation mode.

The following table presents the EMBRAER ERJ-145 capabilities in terms of the navigation specifications related to PBN. The information provided is based on AFM statements and, when there is no AFM statement, on analysis of the respective guidance material.

It is important to note that some guidance material that are listed on the table may either refer to other documentation for purposes of alternative compliance or may have been superseded by subsequent guidance material.

The ERJ-145 capabilities listed in this publication do not imply operational approval. Appropriate approval from the appropriate local authorities must be granted for each intended operation(s).

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The airplane is compliant with AC 90-100A (RNAV 1 and RNAV 2) and with TGL-10 (P-RNAV and B-RNAV).

RNAV SPECIFICATIONS			
Operation	**Sensors that may be used**	**Guidance FAA**	**Guidance EASA**
RNAV 10 (RNP 10) (1)	2 GNSS (2)	Order 8400.12A	Order 8400.12A
RNAV 5	GNSS DME/DME VOR/DME	AC 90-96A (3a)	AMC 20-4 (3b)
RNAV 2	GNSS (2)	AC 90-100A	-
RNAV 1	GNSS (2)	AC 90-100A	TGL 10 (P-RNAV)

(1) Dual FMS is required.

(2) Off Line RAIM prediction is required.

(3a) According to AC 90-96A, the airplane should be considered eligible for B-RNAV/RNAV 5 operations if the AFM shows the appropriate instrument flight rules (IFR) navigation system installation has received airworthiness approval in accordance with the current edition of AC 20-130. According to AFM, the EMB-145 RNAV system installation is compliant with AC 20-130A.

(3b) AMC 20-4 defines that installations in accordance with AC 20-130() is an acceptable means of compliance for Basic RNAV systems, with no further substantiation. According to AFM, the EMB-145 RNAV system installation is compliant with AC 20-130A.

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LIMITATIONS

- For RNAV operations in terminal airspace, obstacle clearance protection, up to the Final Approach FIX (FAF), will assume that airplane comply with the required RNAV accuracy requirements;
- Obstacle clearance altitude is based upon the infrastructure giving the poorest precision;
- The minimum flight crew are 2 Pilots;
- The system must display essential information in the Pilot's primary field of view such as:
  - Lateral deviation;
  - TO/FROM waypoints;
  - Failure flag (failure of RNAV system);
- Where GNSS is used, the signal must be acquired before the takeoff roll commences and GNSS position may be used instead of runway update;
- Where reliance is placed on the use of radar to assist contingency procedures, its performance has been shown to be adequate for that purpose, and the requirement for a radar service is identified in the AIP;
- RNAV operations must use FMS to control all lateral navigation functions. For FMS limitations, refer to Section 1-01-60 (Limitations, System: FMS) of AOM;
- The airplane RNAV system must display the following information to the flight crew:
  - The active (TO) waypoint and distance/bearing to this point;
  - Ground speed or time to the active (TO) waypoint;
  - RNAV system failure;
  - Alternate means of displaying navigation information, that is sufficient to perform cross-checks.

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NORMAL PROCEDURES

PRE-FLIGHT PLANNING

NOTAM NAVAIDS ..... VERIFY

Verify the availability of the intended RNAV procedure. Verify also if any NAVAID identified in the AIP and on the relevant charts as critical for a specific RNAV procedure is not available.

NOTE: If it is requested to inhibit an individual NAVAID, do not perform an operation that uses VOR/DME for positioning.

Airplane Minimum Configuration..... CHECK

Check if the airplane configuration complies with the applicable list below:

For all but RNAV 10 operations:

– 1 GPS;
– 1 FMS;
– 1 CDU;
– 4 Display units;
– 1 Flight Director.

For RNAV 10 operations:

– 2 GPS;
– 2 FMS;
– 2 CDU;
– 4 Display units;
– 1 Flight Director.

Navigation Infrastructure ..... CHECK AVAILABILITY

Check minimum equipment required acording to local regulation.

Navigation Database..... CHECK

The navigation database must be appropriate for the region of the intended operation and must include the NAVAIDS, waypoints, and coded terminal airspace procedures for the departure, arrival and alternate airfields. In this case, affected procedures must be prohibited by an operator's notice to the flight crew.

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RNAV System (if required) ..... CONFIRM AVAILABILITY

When dual RNAV system is required on the AIP.

RAIM (if applicable) ..... CONFIRM AVAILABILITY

- Confirmation is necessary if a stand-alone GPS is to be used for RNAV 1 and RNAV 2 operations.
- Confirmation is necessary if dual GPS is to be used for RNP 10 operations.

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DEPARTURE (RNAV 1/P-RNAV / RNAV 2)

NAV Database (both pilots) ..... VERIFY CURRENCY

Airplane Position Entry..... CHECK

Desired Path (PNF)..... VERIFY

Airplane Position relative to the Path..... CHECK

Flight Plan ..... CHECK

Compare the navigation charts with the MAP display and the MCDU.

NOTE: - A procedure shall not be used if doubt exists as to the validity of the procedure in the navigation database;
- The creation of new waypoints by manual entry into the RNAV system by the flight crew is not permitted;
- Route modifications in the terminal area may take form of radar headings or direct to clearances.

Airplane Minimum Configuration..... VERIFY AVAILABILITY

Also, where applicable, verify if the correct airport and runway data have been loaded.

NOTE: Where GNSS is used, the signal must be acquired before the takeoff roll commences and GNSS position may be used instead of runway update.

Flight Progress..... MONITOR

During the procedure and where feasible, monitor navigation reasonableness by cross-check with conventional NAVAIDs using the primary displays with the MCDU.

NOTE: When automatic update for departure is not available, the procedure should be flown by conventional navigation means. If a procedure is designed to be started conventionally, then the latest point of transition to the RNAV structure will be marked on the charts. If a Pilot elects to start a RNAV procedure using conventional methods, there may not be any indication on the charts of the transition point to the RNAV structure.

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CONTINENTAL ENROUTE (B-RNAV/RNAV 5/RNAV 1/RNAV 2)

Cleard Flight Plan ..... CHECK

Flight crew should cross-check the cleared flight plan by comparing charts or other applicable resources with the navigation system textual display and the airplane map display, if applicable. If required, the exclusion of specific NAVAIDs should be confirmed.

Flight Progress..... MONITOR

During the flight, and where feasible, monitore navigational reasonableness by cross-check with conventional NAVAIDs using the primary displays in conjunction with the RNAV control and display unit (CDU).

REMOTE ENROUTE (RNAV 10)

Dual FMS and GPS ..... CHECK AVAILABILITY

At least two FMS and two GPS must be operational at the oceanic entry point. If this is not the case, then the pilot should consider an alternate route which does not require that particular equipment or regard to make a diversion for repairs.

Before entering oceanic airspace:

Airplane Position ..... CHECK

The position of the airplane must be checked as accurately as possible by using external NAVAIDs. This may require DME/DME and/or VOR checks to determine navigation system errors through displayed and actual positions.

NOTE: Operator in-flight operating drills must include mandatory cross-checking procedures to identify navigation errors in sufficient time to prevent airplane from inadvertent deviation from ATC-cleared routes.

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ARRIVAL (RNAV 1/P-RNAV AND RNAV 2)

RNAV arrival operation may only be performed down to the FAF, and shall not be used on Final Approach, i.e. from FAF to RWY or during Missed Approach.

Active Flight Plan ..... CHECK

Prior to the arrival phase, verify that the correct terminal procedure has been loaded. Then, compare the charts with the MAP display and the MCDU. This includes confirmation of the waypoint sequence, reasonableness of track angles and distances, any altitude or speed constraints, and, where possible, which waypoints are fly-by and which are fly-over.

NOTE: If required by procedure, a check will need to be made to confirm that updating will exclude a particular NAVAID. A procedure shall not be used in case of doubt regarding the procedure in the navigation database.

Flight Progress ..... MONITOR

During the procedure and where feasible, monitor navigation reasonableness by cross-checks with the conventional NAVAIDs using the primary displays with the MCDU.

NOTE: - When the contingency plan is to revert to a conventional arrival procedure the flight crew must make the necessary preparation.

- For GNSS-based RNAV systems, the absence of an integrity alarm is considered sufficient. If the check fails, a conventional procedure must be flown.

- Route modifications in the terminal area may take the form of radar headings or “direct to” clearances and the flight crew must be capable of reacting in a timely manner. This may include the insertion of tactical waypoints loaded from the database. Manual entry or modification by the flight crew of a loaded procedure, using temporary waypoints or fixes not provided in the database is not permitted.

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Altitude/Speed Constraints ..... CHECK

Flight crew must be aware of any published altitude or speed constraints in the procedure.

CONTINGENCY PROCEDURES

ATC..... NOTIFY

Notify any problem with the RNAV system that results in the loss of required navigation capability, together with the proposed course of action.

COMMUNICATION FAILURE

Continue with the RNAV procedure in accordance with the published lost communication procedure.

RNAV CABABILITY LOSS

Navigate using an alternative means of navigation. The alternate means does not need to be based on RNAV system.

NAVIGATION SENSORS FAILURE

Discontinue the RNAV procedure following the approved missed approach procedure or if feasible revert to a conventional or IRS procedure and inform ATC.

MULTIPLE SYSTEM FAILURES

If multiple system failures occur such as those affecting GNSS, Flight Director, and any other used for RNAV procedure, perform a missed approach and inform ATC.

If the Autopilot fails, continue the approach using manually, and in case the flight path cannot be followed, perform a missed approach procedure and inform ATC.

If the DGRAD annunciation is displayed:

Select the non-affected FMS. For single FMS installations, use the procedures from the following tables:

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Operation	Required Action
Non-RNP Terminal or En-route (including B-RNAV)	Crosscheck FMS data with raw data from VOR, DME and NDB. De-select sensor causing error, if detectable.
P-RNAV	Contact ATC, advise inability to continue P-RNAV.
Non-RNP (excluding GPS required) Approach	Use alternate sourse (VOR, NDB or visual references) if available. If not, declare Missed Approach.
Non-RNP Remote	Crosscheck FMS data with raw data from GPS or IRS. De-select error causing sensor, if detectable.

FMS 1(2) FAILURE

Select the cross-side FMS.

In case both FMS are unavailable, use the procedures from the following table:

Operation	Required Action
Non-RNP Terminal or En-route	Use alternate sourse (VOR, NDB, DME).
B-RNAV, P-RNAV	Contact ATC, advise inability to continue B-RNAV or P-RNAV operations.
Non-RNP (excluding GPS required) Approach	Use alternate sourse, if available (VOR, NDB or visual references) if available. If not, declare Missed Approach.
Remote Operations	Contact ATC and declare loss of long range navigation capability.

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INCIDENT REPORTING

Significant incidents associated with the operation of the airplane which affect or could affect the safety of RNAV operations, need to be reported on the appropriate report manifest.
Specific examples may include:

- Airplane system malfunctions during RNAV operations which lead to:
  - Navigations errors not associated with transitions between different navigation modes;
  - Significant navigation errors attributed to incorrect data or a navigation database coding error;
  - Unexpected deviations in lateral or vertical flight path not cause by Pilot input;
  - Significant misleading information without a failure warning;
  - Total loss or multiple navigation equipment failure.
- Problems with ground navigational facilities leading to significant navigational errors not associated with transitions between different navigation modes.

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ENGINE START WITH AIRPLANE BATTERIES AND LOW PRESSURE UNIT (LPU)

This procedure may be used when operating without APU or GPU but with the batteries and a Low Pressure Unit (LPU) available for engine start.

NOTE: - Before attempting to start the engines using the batteries ensure that minimum batteries voltage is 24.0 VDC.

- Accomplish a BEFORE START - FIRST FLIGHT procedure as soon as the electrical source is established.
- The Captain may elect to start the remaining engine using the LPU or to perform a crossbleed start.
- The engines pneumatic start does not affect the electrical system or the individual loads connected to it. The voltage of the buses fed by the batteries remain steady during engine starts, with no power transients. After the first engine start and with generators on line, the normal electrical system voltage will be between 24 V and 28.5 V.
- It is recommended that audio communication with the ground crew be used instead of signaling.

BEFORE START

Internal and External
Safety Inspections ..... ACCOMPLISH
Parking Brake ..... ON
Batteries 1 & 2 ..... AUTO
Avionics Masters ..... ON
Batteries Voltage ..... CHECK
Avionics Masters ..... OFF
Emergency Lights ..... ARM
Fire Detection System ..... CHECK
Crossbleed ..... AUTO or OPEN
Packs ..... OFF
Engine Bleeds ..... CLOSE

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CLEARED TO START

Doors and Windows ..... CLOSED
Red Beacon ..... ON
Fuel Pump (associated engine) ..... ON
Start Pressure ..... AVAILABLE

START

Start/Stop Selector (associated engine)..... START, THEN RUN

Turn the start selector to RUN for 2 seconds, then turn the switch to the START position momentarily (signals the initiate start sequence to the FADEC) and then to RUN, and start the stopwatch.

Engine Indication..... MONITOR

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ENGINE START ASSISTED BY THE OPPOSITE ENGINE (CROSS START)

This procedure may be used to start the second engine using the operating engine bleed as the pneumatic source.

APU Bleed ..... CLOSE
Crossbleed..... AUTO or OPEN
Engine Bleed (non-operating engine) ..... CLOSE
Engine Bleed (operating engine) ..... OPEN

N2 of the operating engine must be accelerated to above 80%.

Start/Stop Selector..... START,THEN RUN

Turn the start selector to RUN for 2 seconds, then turn the switch to the START position momentarily (signals the initiate start sequence to the FADEC) and then to RUN, and start the stopwatch.

Engine Indication ..... MONITOR

NOTE: After the start is completed, reduce operating engine power to idle.

ENGINE START ASSISTED BY THE APU

This procedure may be used to start the engine using the APU bleed as the pneumatic source.

APU bleed..... OPEN
Crossbleed ..... OPEN or AUTO
Engine Bleeds..... CLOSED

Start/Stop Selector..... START,THEN RUN

Turn the start selector to RUN for 2 seconds, then turn the switch to the START position momentarily (signals the initiate start sequence to the FADEC) and then to RUN, and start the stopwatch.

Engine Indication ..... MONITOR

NOTE: With the APU Bleed Valve open and the Crossbleed Valve in AUTO position, the Engine 1 will always be started assisted by the APU, even when the Engine 2 is running with associated Engine Bleed Valve open.

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SINGLE ENGINE TAXI

The procedures below are provided to allow operators to perform a single engine taxi. This procedure can be adopted at crowded airports, where the taxi time may be too long, leading to unnecessary fuel waste and air pollution.

For single engine taxi, change or complement the normal procedures according to the following.

BEFORE START

Evaluate which engine will be started based on fuel distribution on tanks, passenger boarding and baggage loading. If the airplane is operating under MEL with one engine driven generator inoperative, choose the engine which has both generators operating.

NOTE: Batteries charge may be preserved by using all available generators.

AFTER START

FADEC Control Knob ..... RESET, THEN ALTN

Electric Hydraulic Pumps ..... AUTO

Check on MFD Hydraulic Page that both hydraulic systems pressure are within green range.

Air Conditioning and Pneumatic System ..... AS REQUIRED

If both air conditioning packs are required, select Crossbleed to OPEN.

Shed Buses ..... OVRD

Check all DC Buses energized and operating generators load. If required, turn off equipment not essential (galley, coffee maker, etc.). In such case, inform flight attendant that those equipment shall be off until second engine start.

TAXI

Monitor both fuel quantities to avoid excessive fuel imbalance.

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BEFORE TAKEOFF

Non Operating Engine ..... START
Crossfeed ..... OFF
Shed Buses..... AUTO
Electric Hydraulic Pumps ..... AUTO
Air Conditioning and Pneumatic System..... AS REQUIRED

AFTER LANDING

Shed Buses..... OVRD
Electric Hydraulic Pumps ..... AUTO
Air Conditioning and Pneumatic System..... AS REQUIRED
Selected Engine ..... SHUTDOWN

ABNORMAL PROCEDURES

If the operating engine fails, stop the airplane as soon as possible, apply Parking Brakes and turn off both hydraulic pumps and any unnecessary equipment. APU may be used to start remaining engine and return to gate.

NOTE: Batteries will be discharging until APU or remaining generators are turned on.

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ALTIMETER MISCOMPARE TOLERANCES

This Section provides information regarding maximum allowed tolerances between PFD altitude indications and standby altimeter.

For the EMB-145, ERJ-140 and EMB-135 models, there are two pitot probes, four static probes and one pitot static probe. Pitot probes 1 and 2 and the static ports send information to ADCs 1 and 2. The third (auxiliary) pitot probe sends information directly to the standby indicators.

The standby altimeter system is a back-up navigation source to be used in the event of a total loss of the primary source (ADC).

The differences between the readings of ADC 1 and 2 altimeters and between these and the standby system altimeter, with the airplane on ground or in flight, can occur due to a number of reasons and may vary with altitude, airspeed and airplane configuration. In addition, the static port for the standby system and the static port for the primary system are located in different positions.

This criterion considers additional parameters, as follows: measurement errors, installation deviations, internal and skin waviness distortions and airplane sideslip condition that bear an influence on data variations when comparing the two systems. The new range of values is applicable to both the Integrated Standby Instrument System and the Conventional Standby System.

For all EMB-145, ERJ-140 and EMB-135 models, the maximum acceptable difference between both ADC altimeter indications and between the ADC altimeters and the Standby System are shown in the table on the next page.

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To verify if altimeter difference is within tolerance, the flight crew should proceed as follows:

Altitude.....STABILIZE

Maintain variation within +/- 50 ft.

Air Speed.....STABILIZE

Maintain variation within +/- 5 kt.

Wait a minimum of 15 seconds in straight and leveled flight, preferably with Autopilot engaged, to compare the difference between altitudes using the following table:

ALTITUDE (ft)	MAXIMUM DIFFERENCE BETWEEN PILOT AND COPILOT'S ALTIMETERS (ft)	MAXIMUM DIFFERENCE BETWEEN PILOT OR COPILOT'S ALTIMETERS AND STANDBY ALTIMETER (ft)
0	50	150
5000	60	200
10000	60	280
15000	70	320
20000	70	500
25000	100	600
30000	120	750
35000	150	750
37000	160	750
39000	180	800

Differences greater than the values in the table must be verified by maintenance checks.

In flight, if a discrepancy is reported between the values shown in the table, a double check must be performed using the previous and the next referenced altitude level.

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CAT II OPERATION

The information contained herein supplements the information of the the basic AOM Normal Procedures.

AUTOPILOT COUPLED CAT II APPROACH

BEFORE INTERCEPTING LOCALIZER COURSE

- Perform the Descent/Approach/Before Landing checklists, as appropriate.
- Perform the Radio Altimeter test.
- Set the CAT II Decision Height on both Display Control Panels.
- Check radio altimeter information on both PFD.
- Select the same ILS frequency on both RMU.

NOTE: - After test, if Radio Altimeter is checked not functioning properly the CAT II approach must discontinued.

- A minimum distance of 4 NM to the Outer Marker is recommended for interception and stabilization along the approach course.

BEFORE INTERCEPTING THE GLIDE SLOPE

- Monitor radio altimeter information.
- Lower landing gear (one dot below GS interception) and set flaps to 22°.
- Set the Approach Speed (V_{APP}) for flaps 22° on AP bug (green bug).

NOTE: The V_{APP} is determined by adjusting the V_{APP} for head wind component and gust according to the following equation:
$V_{APP} = V_{REF}$ + WIND CORRECTION, where:
WIND CORRECTION = ½ head wind component + full gust, limited to 20 kt.

- Stabilize and maintain the Approach Speed (V_{APP}) for flaps 22°.
- Set approach climb speed on SPD reference speed bug (cyan bug).
- Be sure that Marker Beacon audio is on.

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AFTER PASSING THE OUTER MARKER INBOUND

- The pilot flying should maintain the Approach Speed (V_{APP}) for flaps 22°.
- Both pilots must monitor the progress of the approach on their displays down to approximately 200 ft above the decision height. At this point the pilot not flying looks out for external visual references while the pilot flying continues to monitor his displays down to the decision height.
- At 80 ft above the decision height setting the GPWS will call out "APPROACHING MINIMUM".
- At the decision height setting the GPWS will call out "MINIMUM", and the pilot not flying will call out "LANDING" or "GO AROUND", as appropriate.
- If visual contact is not made upon reaching the decision height or if any malfunction could not be promptly identified during approach, a missed approach shall be immediately initiated.

FLIGHT DIRECTOR CAT II APPROACH (ONLY APPLICABLE TO EMB-135 AND EMB-145XR MODELS)

The procedures for Flight Director CAT II Approach are the same as those for Autopilot Coupled CAT II Approach except that the approach is performed manually following the Flight Director indications.

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MISSED APPROACH

GO-AROUND Procedure..... ACCOMPLISH

LANDING

Reaching the Decision Height with runway in sight:

Autopilot..... DISENGAGE
Speed ..... $V_{REF\ 22°}$
Landing..... PERFORM

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HGS OPERATION

The information presented in this Supplement enables the establishment of the conditions required to accomplish the HGS operation.

The Flight Dynamics Model 3300 Head-Up Guidance System (HGS) is approved for use throughout the full flight regime as a supplemental display.

The CAT IIIa operation is predicated upon the use of an ILS facility with performance and integrity equivalent to, or between, an ICAO Annex 1 Facility Performance CAT III ILS, an US Type II or Type III ILS, or equivalent.

This AOM Supplement does not constitute approval to conduct takeoff operations or CAT II or CAT IIIa approach and landing operations below established operational minima. Approval must be obtained from the appropriate regulatory authority prior to conducting these operations.

For limitations, procedures and performance information not contained in this Supplement, refer to the basic AOM.

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LOW VISIBILITY TAKEOFF - CONDITIONS OF OPERATION

The low visibility takeoff display and Ground Roll Guidance Cue are automatically provided to the pilot once the following conditions have been established:

- Primary mode selected;
- IRS in NAV mode;
- All NAV receivers tuned to same ILS frequency;
- Runway length set between 6000 ft (1829 m) to 13500 ft (4114 m);
- Selected heading bug set to runway heading;
- Selected course set to runway heading or approach course.

NOTE: Misleading/removal of the guidance is not annunciated. Safe operation in this condition was demonstrated and is predicated on the pilot's ability to see outside visual references.

AIII MODE - APPROACH AND LANDING - CONDITIONS OF OPERATION

The system conditions that must be met in order to achieve AIII capability include:

- IRS in NAV mode;
- AHRS 2 in Full Performance mode;
  NOTE: AHRS is not applicable in case of dual IRS configuration.
- All reversion selections in NORMAL position;
- All NAV receivers tuned to same ILS frequency;
- Basic attitude (pitch, roll, heading) data from dual sources within defined limits;
- All sensors/input data valid and no HGS BIT faults present;
- Radio altitude greater than 500 ft;
- Glideslope set between -2.50° and -3.00°.

AIII becomes available for selection as the active mode when the above conditions are satisfied and the Approach On Course (AOC) logic is met. Approach On Course is dependent on the following criteria:

- Flight Director Lateral Capture Mode indicates LOC and FD Vertical Capture mode indicates GS;
- No Localizer and Glideslope deviation for a period of 5 seconds;
- Difference between IRS Magnetic Track and the Selected Course 1 less than 15°.

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USE OF HGS IN MODES OTHER THAN LOW VISIBILITY TAKEOFF AND AIII

The use of HGS in all modes other than for Low Visibility Takeoff and AIII must be in accordance with the limitations, emergency and abnormal procedures, normal procedures and performance data contained in the basic AOM. When using PRI or IMC modes to monitor autopilot-coupled approaches, refer to the CAT II limitations, emergency and abnormal procedures, in the basic AOM.

CAT II OPERATIONS USING AIII MODE

For CAT II operations using AIII mode, the limitations, emergency and abnormal procedures and normal procedures data contained in this Supplement must replace or complement the information contained in the CAT II limitations, emergency and abnormal procedures and performance, in the basic AOM.

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NORMAL PROCEDURES

The procedures below must replace or complement the Normal Procedures contained in the basic AOM.

BEFORE START

IRS	SET TO NAV
HGS Combiner	SET
HGS Control Panel:	
HGS Mode	PRI
RUNWAY LENGTH	SET
RUNWAY ELEVATION	SET
GLIDESLOPE	SET
Display Control Panel 1	SET TO NAV 1
Display Control Panel 2	SET TO NAV 2
ALL 3 NAV Receivers	SET TO ILS
Course Selector 1	SET TO RUNWAY HEADING
Course Selector 2	SET TO RUNWAY HEADING

NOTE: - The Low Visibility Takeoff must only be performed in PRI mode.

- Although it is recommended to perform the Low Visibility Take Off, a normal takeoff can also be performed using the IMC or VMC modes.

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BEFORE TAKEOFF

Low Visibility Takeoff Briefing ..... PERFORM
Aircraft Reference Symbol ..... SET TO RUNWAY CENTERLINE
Course Selector 1 ..... READJUST WITH RUNWAY CENTERLINE
Course Selector 2 ..... READJUST WITH RUNWAY CENTERLINE
Heading Bug ..... SET TO RUNWAY CENTERLINE
Ground Roll Guidance Cue ..... CHECK
Display Intensity ..... ADJUST

CAUTION: RUNWAY REMAINING IS A SUPPLEMENTAL SITUATION AWARENESS DISPLAY DECREASING IN 500 FT INCREMENTS AVAILABLE IN LOW VISIBILITY TAKEOFF. THE DATA DISPLAYED IS NOT INTENDED TO BE USED FOR PERFORMANCE MONITORING PURPOSES.

CLIMB/CRUISE

HGS Mode ..... AS REQUIRED
HGS Display ..... MONITOR

NOTE: Although it is recommended to perform CLIMB/CRUISE in PRI mode, the IMC or VMC can also be used.

DESCENT

HGS Combiner ..... SET
HGS Control Panel:
HGS ..... SET AND X CHECK
HGS Mode ..... AS REQUIRED
AIII Approach Briefing ..... PERFORM AS REQUIRED

NOTE: Although it is recommended to perform DESCENT in PRI mode, the IMC or VMC can also be used.

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APPROACH

AIII MODE APPROACH

NOTE: The approach must be initiated with the airplane in final configuration and stabilized.

Display Control Panel 1 ..... SET TO NAV 1
Display Control Panel 2 ..... SET TO NAV 2
ALL 3 NAV Receivers ..... SET TO ILS
Course Selector 1 ..... SET TO RUNWAY HEADING
Course Selector 2 ..... SET TO RUNWAY HEADING
Decision Height (DH) 1 ..... SET
Decision Height (DH) 2 ..... SET
HGS Control Panel:
- HGS Mode ..... AIII
- RUNWAY LENGTH ..... CHECK
- RUNWAY ELEVATION ..... CHECK
- GLIDESLOPE ..... CHECK

Flaps ..... 22°
Speed ..... SET AIII V_{APP}

NOTE: The AIII V_{APP} is determined by adjusting the V_{APP} for head wind component and gust according to the following equation:
AIII V_{APP} = V_{REF} + WIND CORRECTION, where:
WIND CORRECTION = ½ head wind component + full gust, limited to 20 kt.

Autopilot and Yaw Damper ..... DISENGAGE ABOVE 500 FT

NOTE: During approach, the reference for selected airspeed will change from Speed Bug to V_{APP} (MFD Green Bug) when the following conditions are met: RA below 1300 ft; Landing Gear is down; aircraft in air; the Flight Director mode TO, WSHR or GA not engaged. This transition will be indicated by the replacing of “SPD” symbol by “VAP” symbol flashing initially for 5 seconds on the Combiner.

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CAUTION:
- IF VISUAL CONTACT IS NOT MADE UPON REACHING THE DECISION HEIGHT OR IF ANY MALFUNCTION COULD NOT BE PROMPTLY IDENTIFIED DURING APPROACH, A MISSED APPROACH MUST BE IMMEDIATELY INITIATED;
- RUNWAY REMAINING IS A SUPPLEMENTAL SITUATION AWARENESS DISPLAY DECREASING IN 500 FT INCREMENTS AVAILABLE AFTER TOUCHDOWN IN AIII MODE. THE DATA DISPLAYED IS NOT INTENDED TO BE USED FOR PERFORMANCE MONITORING PURPOSES.

PRIMARY, IMC OR VMC APPROACH

Course Selector 1 ..... SET TO RUNWAY HEADING
Course Selector 2 ..... SET TO RUNWAY HEADING
HGS Control Panel:
HGS Mode ..... AS REQUIRED
RUNWAY LENGTH ..... SET
RUNWAY ELEVATION..... SET
GLIDESLOPE ..... SET

NOTE: In IMC or VMC modes, if the “ALIGN HUD” annunciation is displayed on the Combiner, it should be repositioned to eliminate the annunciation prior to use.

CAUTION: THE FLARE GUIDANCE IS ADVISORY INFORMATION ONLY. THE CREW MUST PERFORM A VISUAL LANDING.

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WINDSHEAR PREVENTION/RECOVERY

The HGS will display a “WDSHEAR” message when the GPWS/EGPWS detects a windshear.

In the event of a windshear, the HGS will display a “WDSHEAR” on the combiner and on the PFD. A voice message will be presented in case of a red “WDSHEAR” indication on the PFD.

When the go around mode is selected after a windshear warning, the primary mode is selected and a windshear guidance cue is provided.

TRAFFIC AND COLLISION AVOIDANCE

The HGS will display TCAS Resolution Advisories (RA) to alert the crew to traffic conflicts. Preventive and Corrective Resolution Advisories provided are similar to MFD indications.

Preventive Advisories do not require that action be taken by the crew to alter the flight path of the airplane, but indicate an unsafe zone.

Corrective Advisories displayed on the HGS require a vertical evasive maneuver.

Preventive and corrective resolution advisory use angled lines to guide the fly path to box or preventive bracket to indicate the unsafe or no-fly zone.

In this case, the lines out of the box bottom will flash until the flight path is positioned within the safe zone.

Preventive RA procedure:

- Ensure the airplane flight path remains clear of unsafe zones.

Corrective RA procedure:

- Fly the airplane to box and outside of the unsafe zone indicated by the lines off the fly-to box.
- Maintain action as required by TCAS RA.

NOTE: In case the operating Transponder fails, the “TCAS FAIL” flag will not be displayed on the Combiner.

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HIGH ALTITUDE OPERATION

The information presented herein is only applicable to airplanes properly equipped for takeoff and landing operation above 8000 ft.
Airplanes properly equipped accomplished any of the following Service Bulletins or have an equivalent modification factory incorporated:
- SB 145-00-0031
- SB 145-00-0033
- SB 145-21-0050.

NOTE: During high altitude operations, at least one pilot is required to use oxygen continuously, until the cabin altitude has reached 8000 ft.

BEFORE START

Pressurization ..... 8000 FT
If flying from an airport above 8000 ft:
High Altitude Mode ..... ON
Check that HI ALT LDG-T/O advisory message is displayed on the EICAS.
Crew Oxygen Mask ..... DON

CLIMB

When cabin altitude is below 9700 ft:

High Altitude Mode ..... OFF
Check that HI ALT LDG-T/O advisory message is no longer displayed the EICAS.

DESCENT

Pressurization ..... SET
Set the destination airport altitude.
If flying in an airport above 8000 ft:
High Altitude Mode ..... ON
Check that HI ALT LDG-T/O advisory message is displayed on the EICAS.
Crew Oxygen Mask ..... DON

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OPERATION IN AIRPORTS UP TO 8500 FT

The actions listed in the procedure below must complement the equivalent procedure contained in the basic AOM. The remaining Normal Procedures section remains unchanged.

BEFORE START

Pressurization ..... 8000 ft

NOTE: In airports with pressure altitude between 8000 ft and 8500 ft, the cabin altitude displayed in EICAS may be amber.

DESCENT

Pressurization ..... SET
Set the destination airport altitude.

NOTE: When flying to an airport with pressure altitude between 8000 ft and 8500 ft, the cabin altitude displayed in EICAS may become amber during approach.

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BOUNCED LANDING RECOVERY

The key factor for a successful landing is a stabilized approach and proper thrust/flare coordination. Do not extend the flare at idle thrust as it will significantly increase landing distance. Reducing to idle before the flare will also require an increase in pitch. Flaring high and quickly reducing thrust to idle can cause the plane to settle abruptly. Do not apply stabilizer trim during the flare.

When a light bounce occurs, maintain or re-establish a normal landing attitude. Increasing pitch can lead to a tail strike. Beware of the increased landing distance and use power as required to soften the second touchdown. When a more severe bounce occurs, initiate a go-around – do not attempt to land. Press the go-around button and advance thrust levers to MAX. Hold the flare attitude until the engines spool up, then reset stabilizer trim while completing normal go-around procedures.

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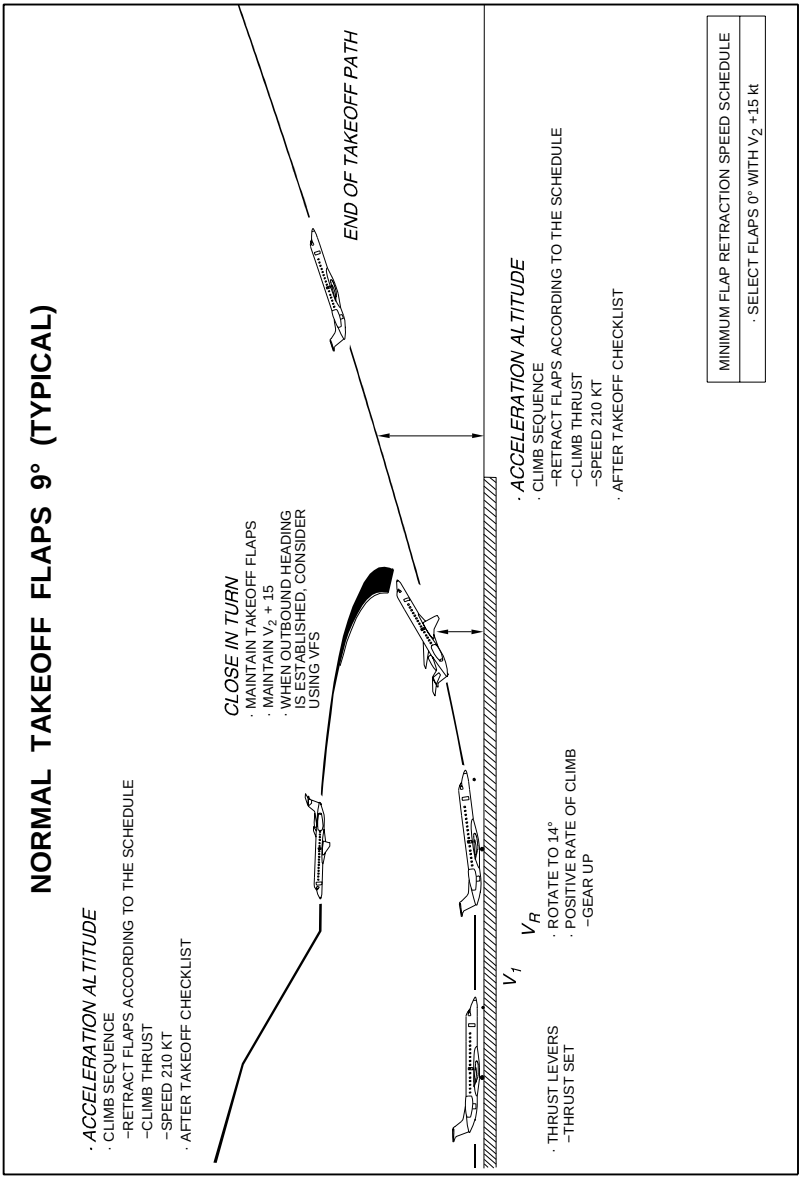
PROFILES



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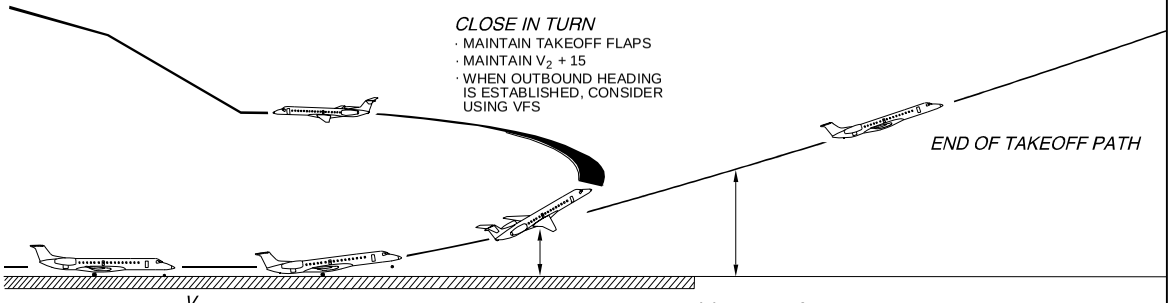
NORMAL TAKEOFF FLAPS 18° (TYPICAL)

· *ACCELERATION ALTITUDE*
· CLIMB SEQUENCE
  −RETRACT FLAPS ACCORDING TO THE SCHEDULE
  −CLIMB THRUST
  −SPEED 210 KT
· AFTER TAKEOFF CHECKLIST



· THRUST LEVERS
  −THRUST SET

· ROTATE TO 13°
· POSITIVE RATE OF CLIMB
  −GEAR UP

· *ACCELERATION ALTITUDE*
· CLIMB SEQUENCE
  −RETRACT FLAPS ACCORDING TO THE SCHEDULE
  −CLIMB THRUST
  −SPEED 210 KT
· AFTER TAKEOFF CHECKLIST

MINIMUM FLAP RETRACTION SPEED SCHEDULE
· SELECT FLAPS 9° WITH V_2 +10 kt
· SELECT FLAPS 0° WITH V_2 +30 kt

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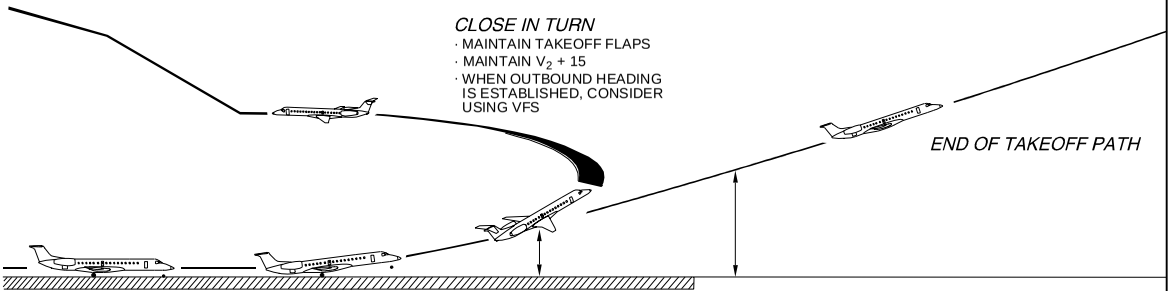
NORMAL TAKEOFF FLAPS 22° (TYPICAL)

· *ACCELERATION ALTITUDE*
· CLIMB SEQUENCE
  −RETRACT FLAPS ACCORDING TO THE SCHEDULE
  −CLIMB THRUST
  −SPEED 210 KT
· AFTER TAKEOFF CHECKLIST



· THRUST LEVERS
  −THRUST SET

· ROTATE TO 12°
· POSITIVE RATE OF CLIMB
  −GEAR UP

· *ACCELERATION ALTITUDE*
· CLIMB SEQUENCE
  −RETRACT FLAPS ACCORDING TO THE SCHEDULE
  −CLIMB THRUST
  −SPEED 210 KT
· AFTER TAKEOFF CHECKLIST

MINIMUM FLAP RETRACTION SPEED SCHEDULE	
· ALL ENGINES EXCEPT AE3007A1P	· AE3007A1P ENGINES
· SELECT FLAPS 9° WITH V_2 +5 kt	· SELECT FLAPS 9° WITH V_2 +10 kt
· SELECT FLAPS 0° WITH V_2 +25 kt	· SELECT FLAPS 0° WITH V_2 +30 kt

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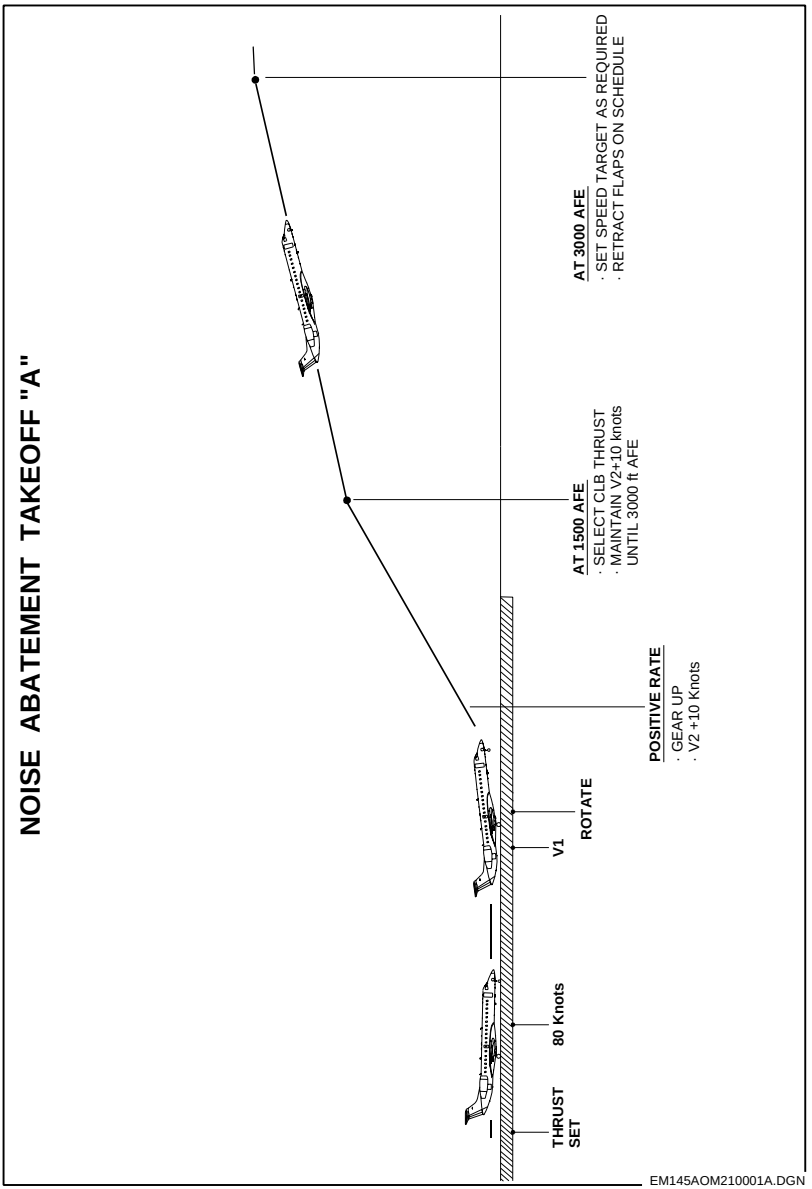
NOISE ABATEMENT TAKEOFF "A"



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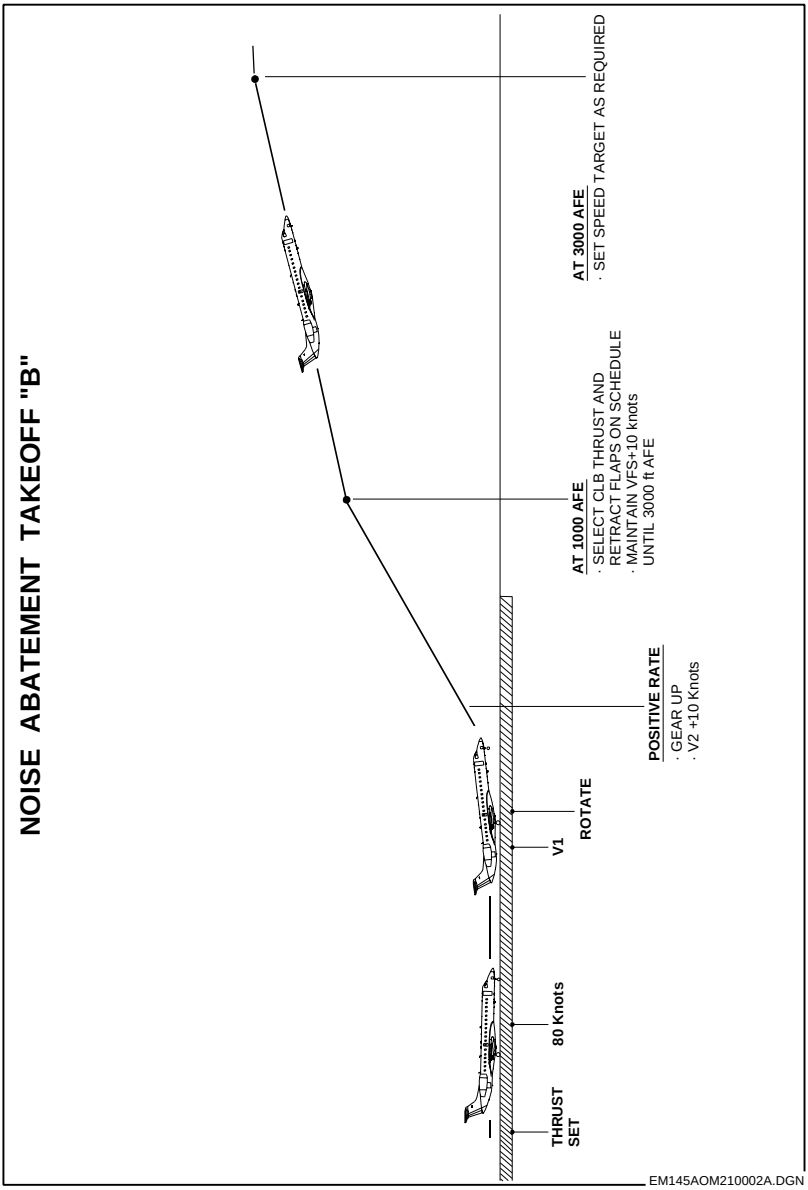

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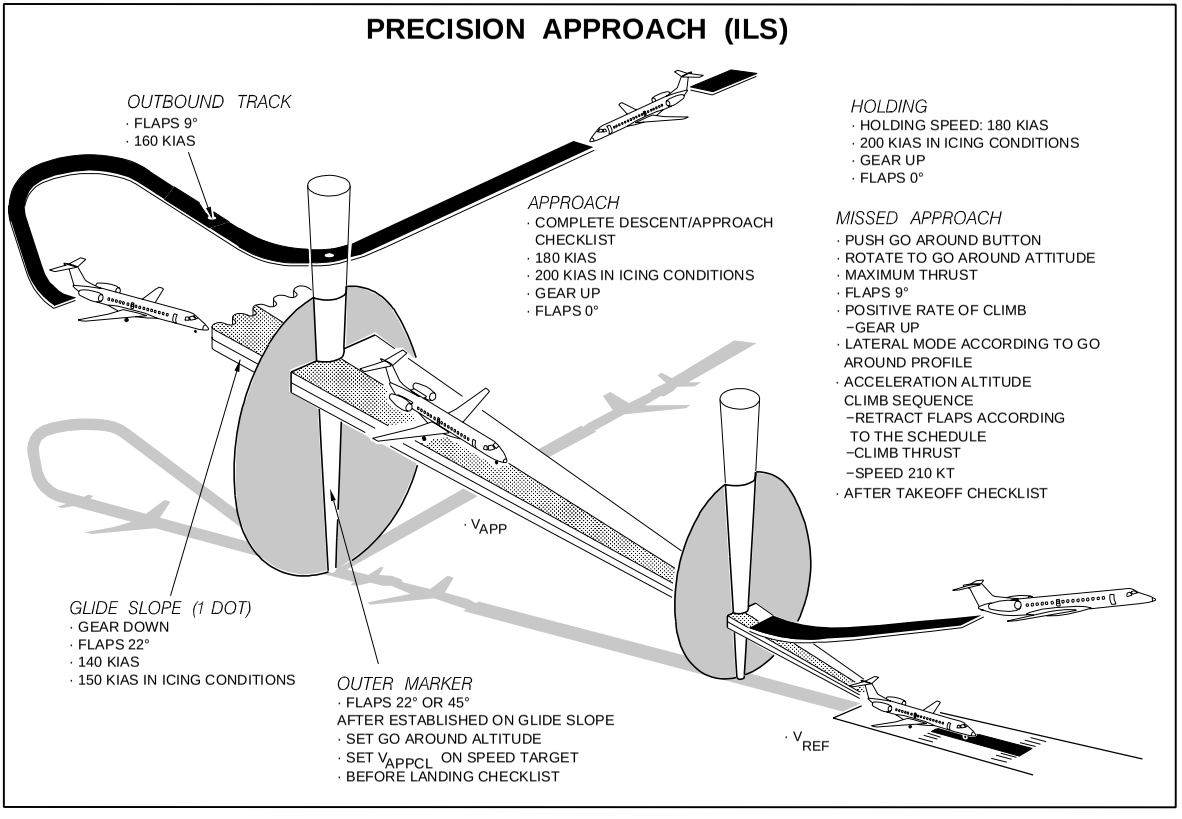
PRECISION APPROACH (ILS)



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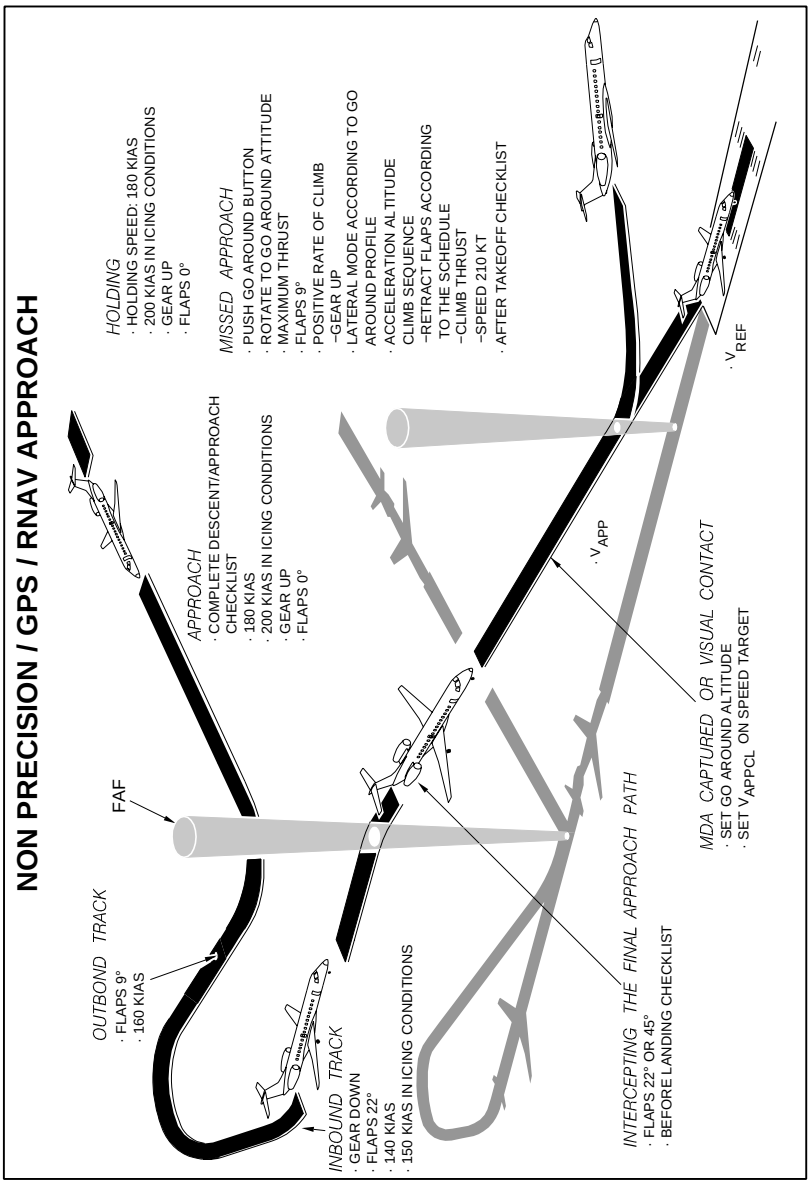

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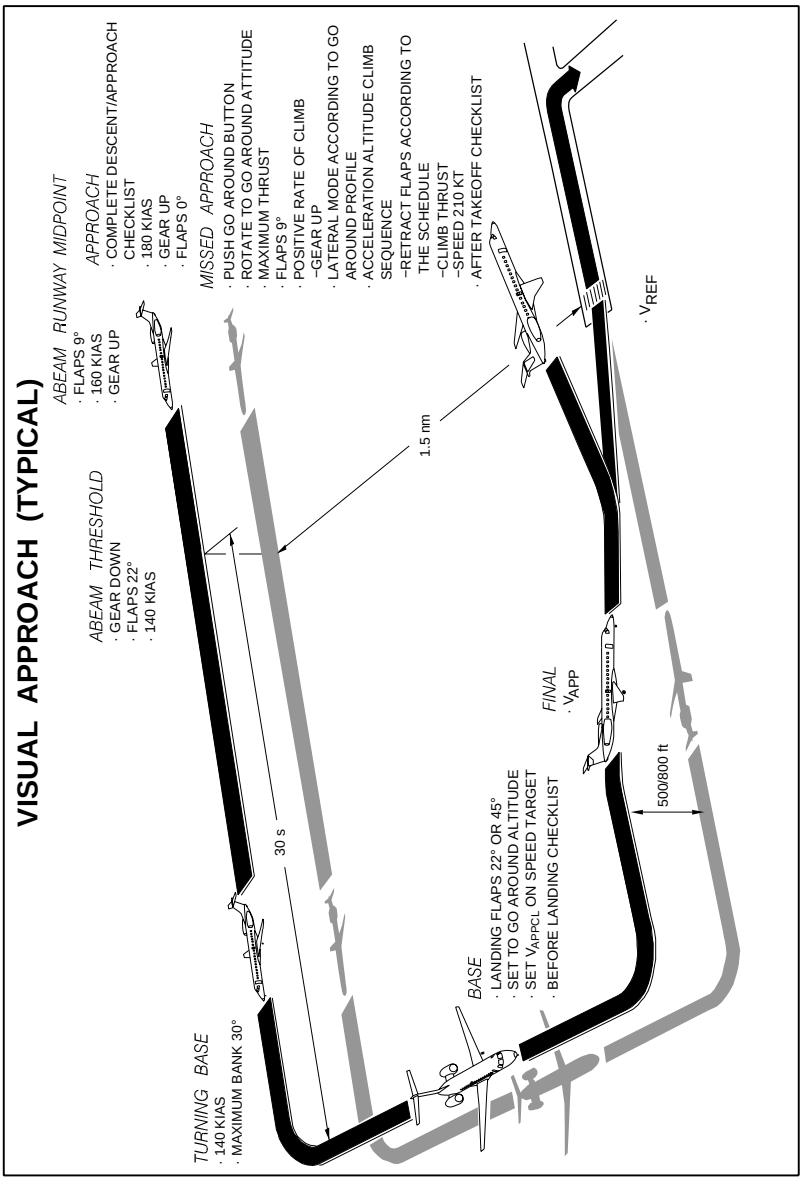
VISUAL APPROACH (TYPICAL)



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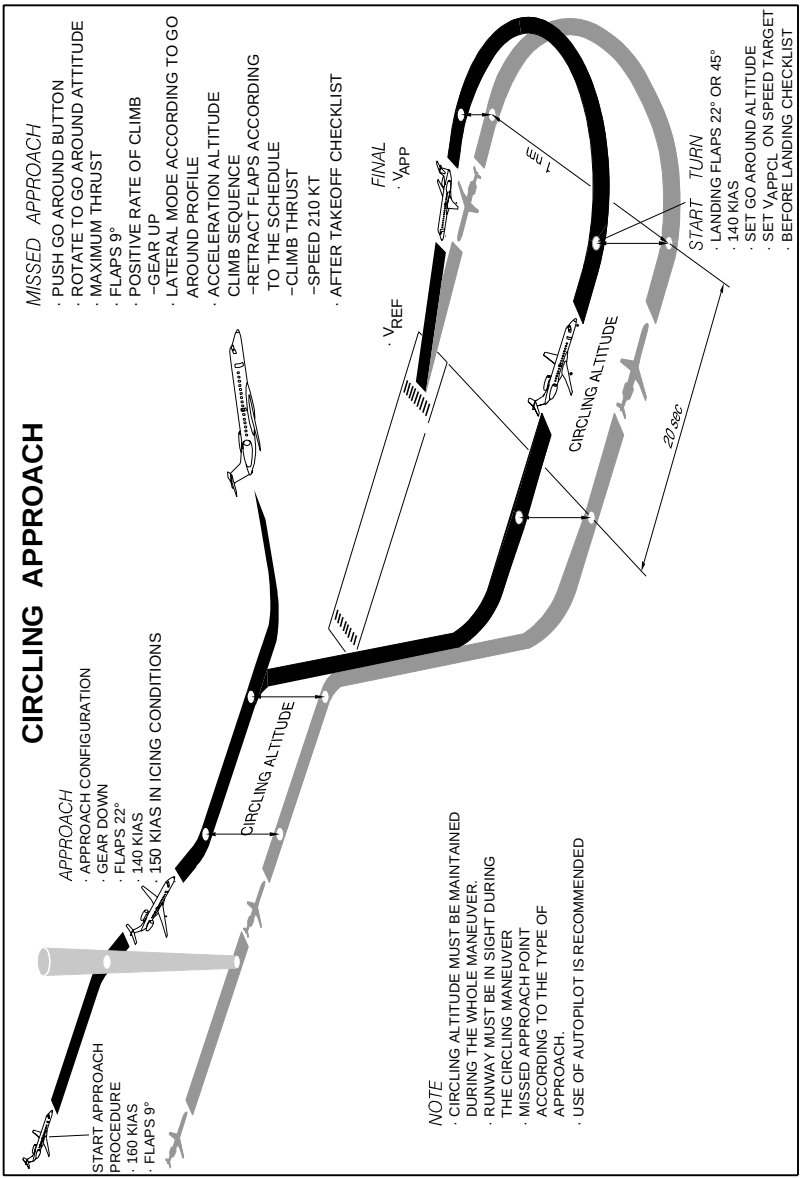

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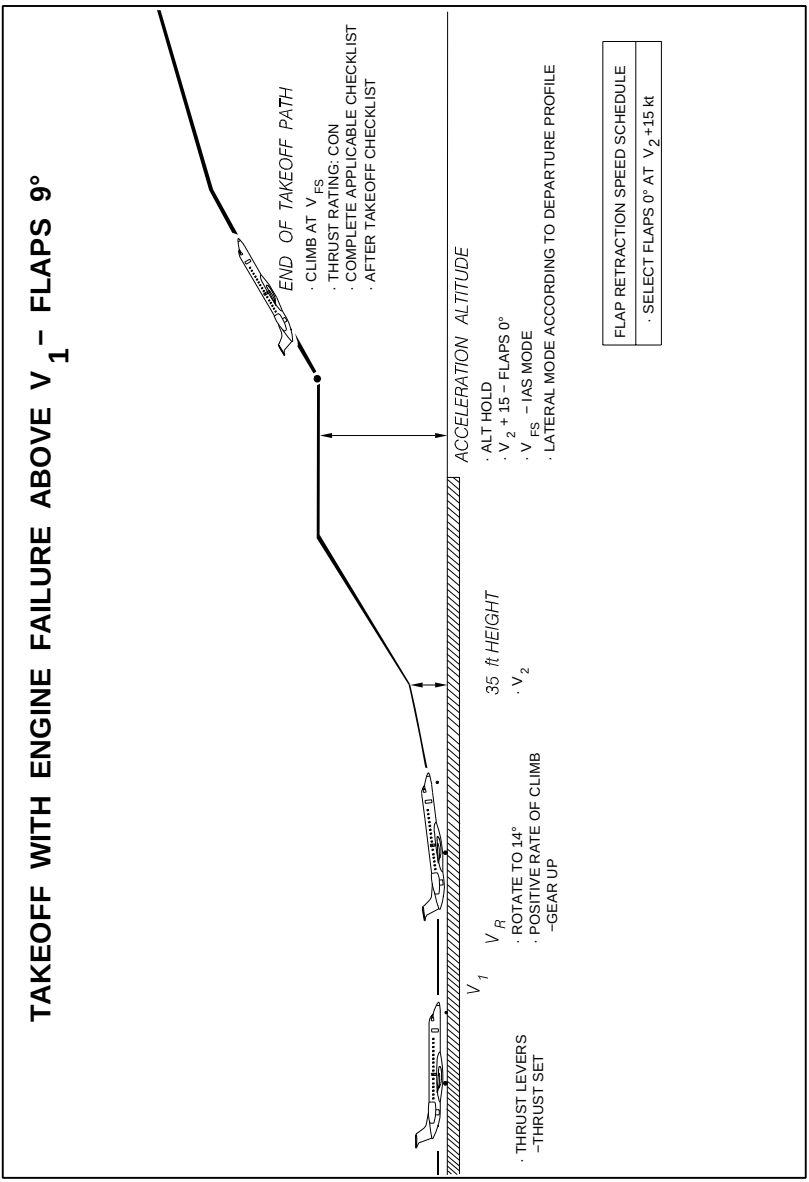
TAKEOFF WITH ENGINE FAILURE ABOVE V_1 – FLAPS 9°



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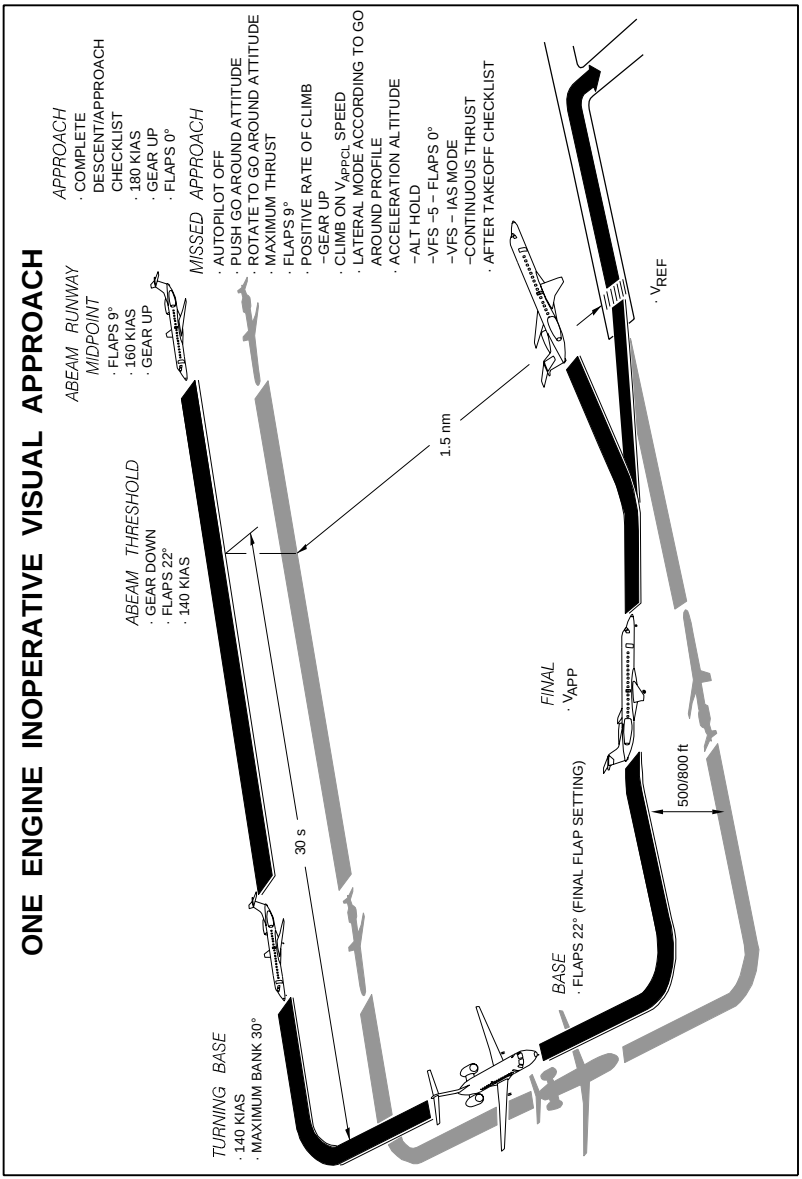

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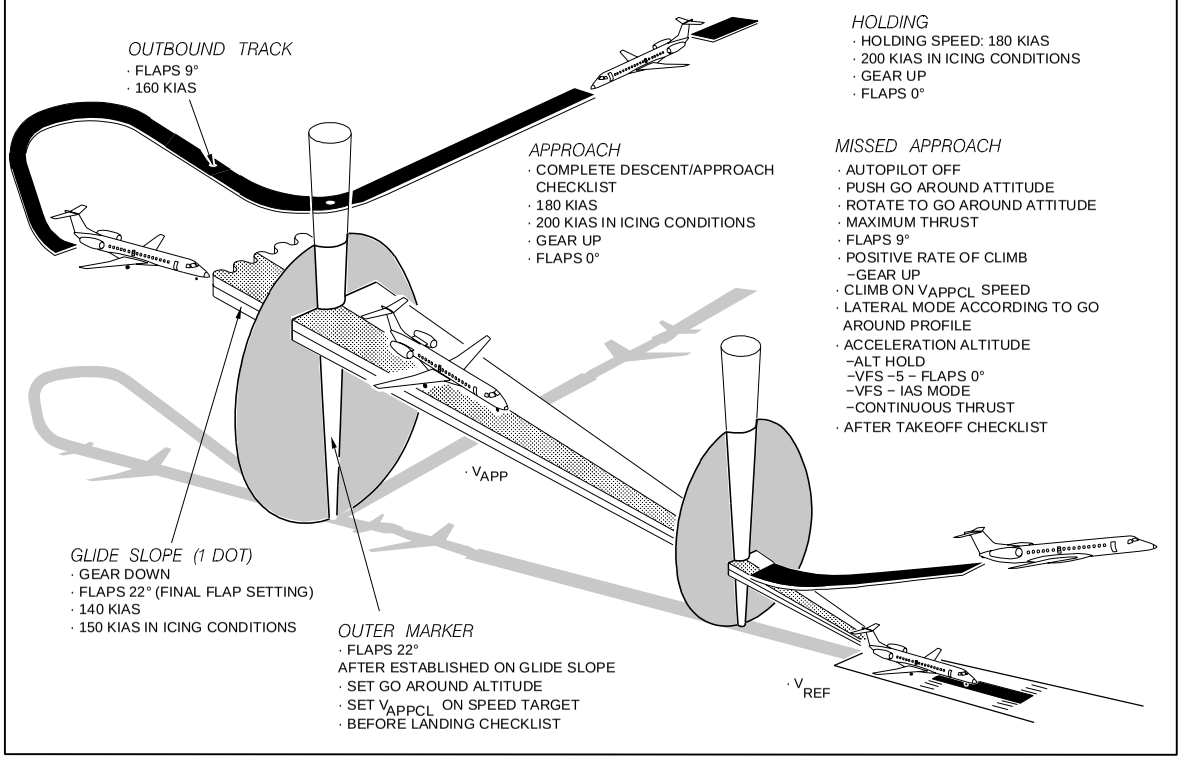
ONE ENGINE INOPERATIVE PRECISION APPROACH (ILS)



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ONE ENGINE INOPERATIVE NON PRECISION APPROACH (VOR/NDB)

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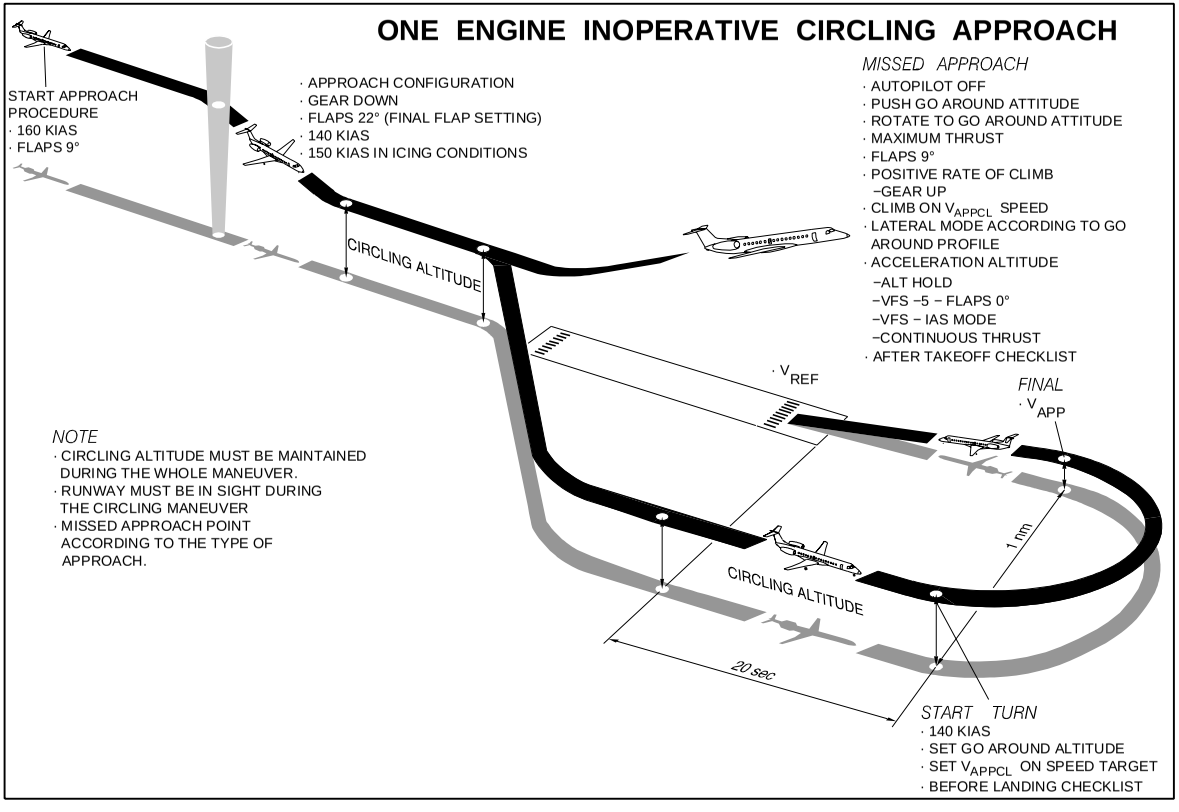
ONE ENGINE INOPERATIVE CIRCLING APPROACH



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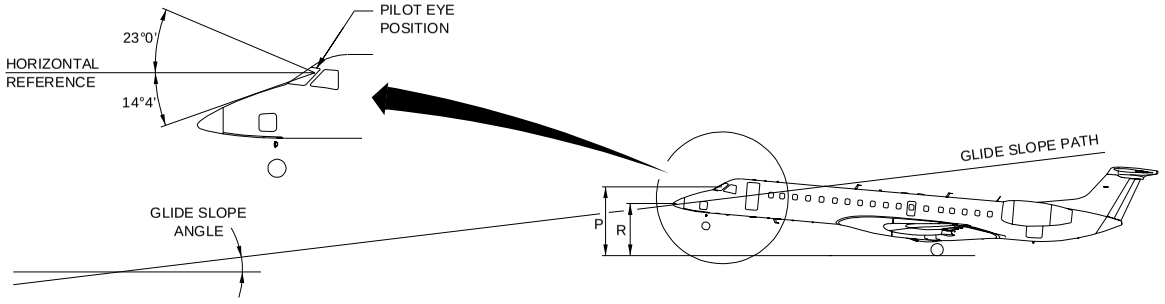
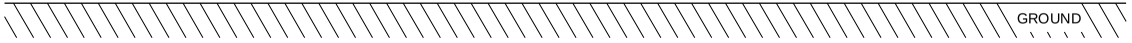
CAT II OR AIII MODE APPROACH GEOMETRY AT DECISION HEIGHT

JAA FLAPS 22°



P − HEIGHT OF THE PILOT'S EYE ABOVE THE WHEELS
R − HEIGHT OF GLIDE RECEIVER ANTENNA ABOVE THE WHEELS



GLIDE SLOPE ANGLE (DEGREES)	AIRPLANE ATTITUDE (DEGREES)	P (FEET)	R (FEET)
2,5	4,9	14,9	11,4
3,0	4,4	14,6	11,0

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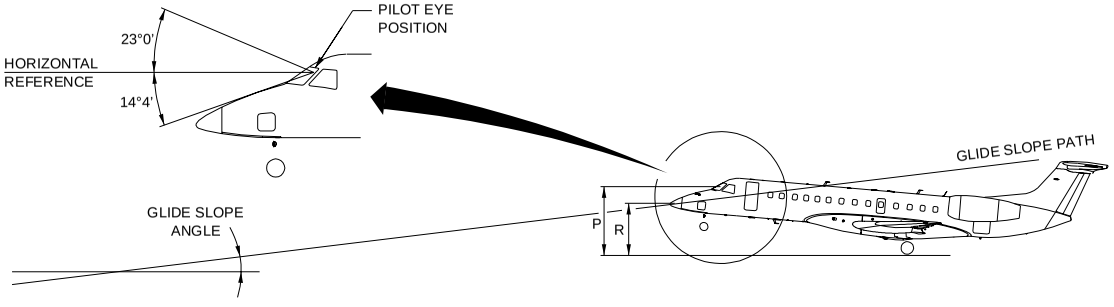
CAT II APPROACH GEOMETRY AT DECISION HEIGHT

JAA FLAPS 22°



P − HEIGHT OF THE PILOT'S EYE ABOVE THE WHEELS
R − HEIGHT OF GLIDE RECEIVER ANTENNA ABOVE THE WHEELS

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GLIDE SLOPE ANGLE (DEGREES)	AIRPLANE ATTITUDE (DEGREES)	P (FEET)	R (FEET)
2,5	4,3	14,1	10,4
3,0	3,8	13,7	10,0

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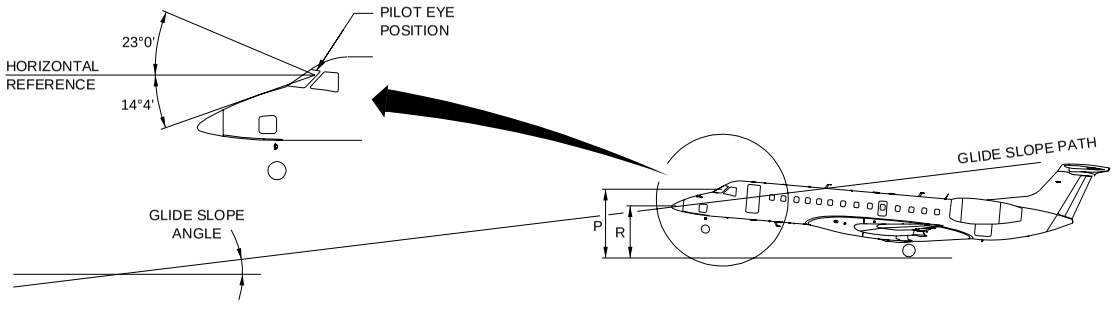
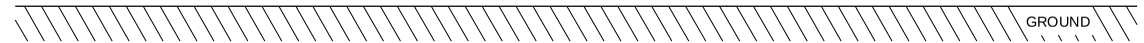
CAT II APPROACH GEOMETRY AT DECISION HEIGHT

JAA FLAPS 22°



P − HEIGHT OF THE PILOT'S EYE ABOVE THE WHEELS
R − HEIGHT OF GLIDE RECEIVER ANTENNA ABOVE THE WHEELS



GLIDE SLOPE ANGLE (DEGREES)	AIRPLANE ATTITUDE (DEGREES)	P (FEET)	R (FEET)
2,5	4,3	14,1	10,4
3,0	3,8	13,7	10,0

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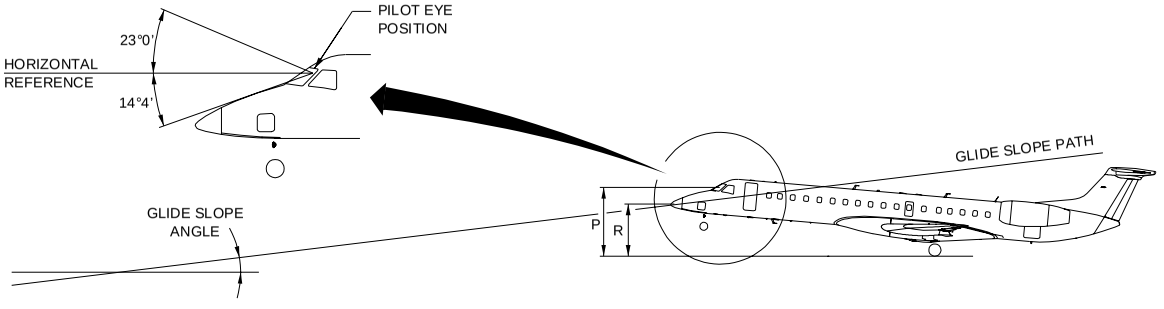
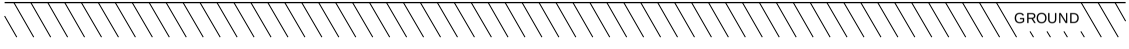
CAT II APPROACH GEOMETRY AT DECISION HEIGHT

FAA/CTA FLAPS 22°



P − HEIGHT OF THE PILOT'S EYE ABOVE THE WHEELS
R − HEIGHT OF GLIDE RECEIVER ANTENNA ABOVE THE WHEELS



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GLIDE SLOPE ANGLE (DEGREES)	AIRPLANE ATTITUDE (DEGREES)	P (FEET)	R (FEET)
2,5	5,8	15,6	12,2
3,0	5,3	15,2	11,8

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PITCH, N1 AND SPEED TABLE

WEIGHT (kg)	GEAR	PITCH	N1	FLAPS	SPEED (kt)
20000	UP	2.7	61.5	0	250
20000	UP	4.8	55.3	0	200
20000	UP	6.3	53.6	0	180
20000	UP	6.3	53.6	0	180
20000	UP	6.4	55.3	9	160
20000	UP	6.6	57.2	18	150
20000	UP	6.8	59.8	22	140
19000	DN	3.7	66.9	9	180
19000	DN	5.1	65.4	18	160
19000	DN	6.4	64.2	22	140
19000	DN	4.9	72.5	45	130
19000	DN	1.2	61.9	45	130
18000	UP	2.3	60.3	0	250
18000	UP	4.3	53.4	0	200
18000	UP	5.5	51.7	0	180
18000	UP	5.3	52.7	9	160
18000	UP	5.4	55.3	18	150
18000	UP	5.5	56.8	22	140

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SECTION 1-03

EMERGENCY AND ABNORMAL PROCEDURES

TABLE OF CONTENTS

Page Block

Introduction 1-03-00

Emergency Procedures

- Doors 1-03-01
- Crew Awareness 1-03-02
- Electrical 1-03-03
- Fire Protection 1-03-05
- Fuel 1-03-07
- APU 1-03-09
- Powerplant 1-03-11
- Landing Gear 1-03-14
- Flight Controls 1-03-20
- Air Conditioning/Pressurization/Ice Protection 1-03-24
- Autopilot 1-03-26
- Forced Landing 1-03-30

Abnormal Procedures

- Equipment & Furnishings 1-03-35
- Crew Awareness 1-03-36
- Electrical 1-03-37
- Lighting 1-03-38
- Fire Protection 1-03-39

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Fuel 1-03-40
APU 1-03-41
Powerplant 1-03-45
Hydraulic 1-03-48
Landing Gear 1-03-50
Flight Controls 1-03-53
Air Conditioning, Pneumatics and Pressurization 1-03-56
Ice Protection 1-03-57
Oxygen 1-03-58
Navigation 1-03-59
Autopilot 1-03-60
CAT II Operation 1-03-65
HGS Operation (*) 1-03-66
Steep Approach Operation (*) 1-03-67
Miscellaneous 1-03-70
Runway Awareness and Advisory System (*) 1-03-75
Emergency Profiles 1-03-95
Abnormal Profiles 1-03-97

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NOTE: Items marked with an asterisk (*) may not be present in this manual.

INTRODUCTION

The source document for all procedures contained herein is the approved Airplane Flight Manual (AFM). In the event that any procedure disagrees with the AFM, the AFM will prevail. In the event that any of the procedures are missing or unusable, operations may be continued provided the approved AFM is available for use.

This Section provides the emergency and abnormal procedures to be performed in case of a system malfunction or failure, in order to protect passengers and/or crew from serious harm and to maintain the airworthiness of the airplane.

Some procedures require a landing at the nearest suitable airport. Such information is provided with the intent of establishing that the flight should be terminated at the pilot's discretion. It is the pilot's responsibility to use good judgement concerning the time and place to land, as well as to evaluate factors such as airplane condition, weather, etc.

The decision to reject takeoff should be considered if any undesirable event occurs.

However, it is emphasized that for fire or smoke that cannot be positively located and extinguished, an immediate descent, landing and passenger evacuation should be performed.

The procedures are presented as follows:

- The actions contained in a box are vital actions. They must be performed expeditiously and from memory to minimize hazards. The other actions should be performed as soon as the condition permits.
- All the actions must be performed in the order given.

Procedures contained herein assume that:

- It is normal crew action to confirm the message by the following procedures:
  1. Calling associated system page on MFD and checking system parameters.
  2. If the MFD is not available, checking the messages for both sides of the failed system, when applicable.
- Airplane systems are operating normally prior to the failure.
- Normal procedures have been properly accomplished.

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- System controls are in normal condition prior to initiation of the associated procedure.
- Aural warnings are silenced as applicable. Master Warning/Caution lights are reset as soon as the failure is recognized.
- Oxygen masks and smoke goggles are donned when cabin altitude is excessive or ambient air is contaminated.
- Crew communication is established when required.
- Circuit breakers are checked.

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EMERGENCY PROCEDURES

MAIN OR SERVICE DOOR OPEN

EICAS WARNING: MAIN DOOR OPN or SERVICE DOOR OPN
LIGHT: Master Warning
INDICATION: Associated door pictorial indication and a DOOR OPEN inscription on MFD are displayed in red.

Fasten Seat Belts..... ON

Check doors pictorial indication on MFD Takeoff Page. If message is confirmed or if MFD is not available:

Door Internal Lock Indicators (red marks)..... CHECK

If the door is confirmed locked:

Monitor cabin pressure.

If the door internal lock indicators are not aligned or it is not possible to maintain the pressurization, proceed:

Altitude..... MEA OR 10000 ft, WHICHEVER IS HIGHER
Cabin ..... DEPRESSURIZE
Land at the nearest suitable airport.

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STALL PROTECTION INOPERATIVE

EICAS WARNING: SPS 1 (2) INOP
LIGHT: Master Warning

Associated Stall Protection System ..... OFF
Avoid skidding the airplane.

Add 5 KIAS to go-around speeds.

NOTE: The remaining stick shaker is available.

Approach and landing configuration:

Landing Gear ..... DOWN

Flaps ..... 45°

Airspeed ..... $V_{REF\ 45}$ + 5 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.10.

STICK PUSHER FAILURE

EICAS WARNING: SPS 1-2 INOP
EICAS CAUTION: STICK PUSHER FAIL
LIGHT: Master Warning and Master Caution

Control Column ..... PUSH FORWARD TO NEUTRAL

Stall Protection is not available.

Airspeed ..... 1.2 V_{SR} MINIMUM

TAKEOFF CONFIGURATION WARNING

EICAS WARNING: NO TAKEOFF CONFIG
LIGHT: Master Warning
or
AURAL WARNING: Voice Messages TAKEOFF-BRAKES, TAKEOFF-FLAPS, TAKEOFF-SPOILERS or TAKEOFF-TRIM

Do not takeoff.

Airplane configuration ..... CORRECT

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ENHANCED/GROUND PROXIMITY WARNING

EICAS WARNING: GPWS
LIGHT: Master Warning
Voice Messages: WHOOP-WHOOP PULL UP or PULL UP (for EGPWS), SINK RATE, TERRAIN TERRAIN or TERRAIN TERRAIN PULL UP (for EGPWS), CAUTION TERRAIN (for EGPWS), OBSTACLE OBSTACLE PULL UP (for EGPWS), CAUTION OBSTACLE (for EGPWS), DON`T SINK DON`T SINK, TOO LOW TERRAIN, TOO LOW GEAR, TOO LOW FLAPS, GLIDE SLOPE and BANK ANGLE voice messages may be generated, but are not associated with GPWS/EGPWS EICAS message.

EGPWS/GPWS CAUTION

If an EGPWS/GPWS CAUTION occurs, adjust the airplane flight path until the CAUTION alert ceases.

EGPWS/GPWS WARNING

If an EGPWS/GPWS WARNING occurs and unless operating in visual meteorological condition (VMC) and/or the pilot determines, based on all available information, that a turning in addition to the procedures established below is the safest course of action, proceed:

Disconnect the autopilot and set thrust levers to MAX position.
Rotate the airplane to increase pitch attitude to the highest possible value.
When stick shaker is encountered, reduce pitch rate/angle of attack to keep the shaker speed as minimum.
Do not retract flaps or landing gear until safe climb-out is assured.
Once warning ceases, resume the normal level flight attitude.

CAUTION: FOR EGPWS, THE TERRAIN DISPLAY IS INTENDED TO BE USED AS A SITUATIONAL TOOL ONLY AND MAY NOT PROVIDE THE ACCURACY AND/OR FIDELITY ON WHICH TO SOLELY BASE TERRAIN AVOIDANCE MANEUVERING DECISIONS.

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WINDSHEAR PREVENTION/RECOVERY

INDICATION: WDSHEAR on PFD (red or amber)

AURAL WARNING: WINDSHEAR voice message is generated if WDSHEAR red indication is presented and CAUTION WINDSHEAR voice message is generated if WDSHEAR amber indication is presented (GPWS warning may also be activated).

CONDITION: Airplane loses altitude after windshear is encountered and threat of ground contact exists.

Thrust Levers	MAX
Go-around Buttons	PRESS

Rotate the airplane smoothly to minimize altitude loss. Flight guidance on EADI must be followed.

NOTE: Pitch attitude may be well above normal angles.

Maintain airplane configuration.

CAUTION: DO NOT CHANGE GEAR AND FLAP POSITION UNTIL TERRAIN CLEARANCE IS ASSURED AND ABOVE 1500 FT AGL OR AFTER WDSHEAR LABEL IS REMOVED FROM PFD.

TRAFFIC AND COLLISION AVOIDANCE

AURAL WARNING: According to the Traffic Advisory (TA) and Resolution Advisory (RA) associated.

The pilot must not initiate evasive maneuvers using information from the traffic display or the voice message only, without visually sighting the traffic. The traffic display and advisories are intended for assistance in visually locating the traffic.

Compliance with TCAS resolution advisory is required unless the pilot considers it unsafe to do so. Maneuvers which are in the opposite direction of the RA are extremely hazardous, especially RAs involving altitude crossing, and are prohibited unless it is visually determined to be the only means to assure safe separation.

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AIRPLANE OVERSPEED

AURAL WARNING: Voice Message HIGHSPEED

LIGHT: Master Warning

INDICATION: Airspeed and Mach indications on PFD enter the red range.

Airspeed	BELOW V_{MO}/M_{MO}

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BATTERY OVERTEMPERATURE

EICAS WARNING: BATT 1 (2) OVTEMP
LIGHT: Master Warning
INDICATION: Associated battery temperature indication on MFD becomes red.

Associated Battery ..... OFF

Check that the associated BATT OFF BUS message is on.

If the associated BATT OFF BUS message is not on, land at the nearest suitable airport.

ELECTRIC ESSENTIAL TRANSFER FAILURE

EICAS WARNING: ELEC ESS XFR FAIL
LIGHT: Master Warning

If no generator is available:
LOSS OF ALL GENERATORS
Procedure ..... ACCOMPLISH
If the message remains:
Bus Ties ..... OFF
If the message still remains:
Shed Buses ..... OFF
Turn off equipment not essential for the flight. Begin with the equipment connected to DC Buses 1 and 2 (Circuit Breaker Panel rows D, E, F, G, H).
Land at the nearest suitable airport.

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LOSS OF ALL GENERATORS

EICAS CAUTION: GEN 1, 2, 3, 4 OFF BUS and APU GEN OFF BUS
LIGHT: Master Caution

Airspeed ..... MAXIMUM 250 KIAS
Altitude ..... MEA OR 10000 ft, WHICHEVER IS HIGHER
Essential Power ..... ON
Crew Oxygen ..... AS REQUIRED
Passenger Oxygen ..... AS REQUIRED
Emergency Lights ..... OFF

If required, turn on Emergency Lights before landing.

Land at the nearest suitable airport.

Landing Gear ..... DOWN

FLAPS POSITION	MINIMUM AIRSPEED
0° TO 8°	$V_{REF\ 45}$ + 30 KIAS
9° TO 21°	$V_{REF\ 45}$ + 10 KIAS
22° TO 44°	$V_{REF\ 45}$ + 5 KIAS
45°	$V_{REF\ 45}$

CAUTION:
- MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.95.
- BATTERY DURATION IS 40 MINUTES. THIS DURATION IS VALID WITH UP TO THREE APU START ATTEMPTS IN FLIGHT.

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NOTE: - For EMB-145XR airplanes, ISIS battery duration is 4 hours.
- The nose landing gear doors will open if DC Bus 2 is off, therefore the pilot should expect noise increase.
- The following warning messages will be presented: SPS 1-2 INOP and ICE COND-A/I INOP.
- The following caution messages will be presented: STICK PUSHER FAIL, SPS ADVANCED, GPWS INOP, WINDSHEAR INOP, CHECK PFD 1, IC BUS FAIL, APU GEN OFF BUS, GEN 1-2-3-4 OFF BUS, DC BUS 1-2 OFF, SHED BUS 1-2 OFF, 115 VAC BUS OFF, EMERG LT NOT ARMD, E1-2 CTL A-B FAIL, ENG 1-2 REV FAIL, LG AIR/GND FAIL, FLAP FAIL, SPOILER FAIL, PITOT 1-2 INOP, W/S 1-2 HEAT FAIL, TAT 1-2 HEAT INOP, STAB A/ICE FAIL, A/ICE SW OFF, WG 1-2 A/ICE FAIL, E1-2 A/ICE FAIL, AOA 1-2 HEAT INOP, ICE DET 1-2 FAIL and ICE DETECTORS FAIL.

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SMOKE EVACUATION

CONDITION: Smoke or odor inside the cabin and/or cockpit requiring smoke removal.

Crew Oxygen Masks	DON, 100%
Smoke Goggles	DON
Crew Communication	ESTABLISH

LAND AT THE NEAREST SUITABLE AIRPORT.

Cockpit Door ..... CLOSE
Reinforced Cockpit Door Louver Vent (if applicable) ... CLOSE
Recirculation Fan ..... OFF
Gasper Fan ..... OFF
Pressurization Manual Controller ..... 1 O'CLOCK
Wait 15 seconds.
Pressurization Mode Selector ..... MAN
Pressurization Manual Controller ..... AS REQUIRED
Passenger Oxygen ..... AS REQUIRED
To evacuate the smoke faster:
- Pressurization Manual Controller ..... UP
- Packs 1 and 2 ..... OFF
- Bleeds (engine or APU) ..... OPEN
- Emergency Descent ..... AS REQUIRED
- Altitude ..... MEA OR 10000 ft, WHICHEVER IS HIGHER

Recover cabin pressure as soon as smoke has been cleared.

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SMOKE FIRE OR FUMES

CONDITION: Smoke fire or fumes visually confirmed or identified by odor without an EICAS warning.

Crew Oxygen Masks	DON, 100%
Smoke Goggles	DON
Crew Communication	ESTABLISH

LAND AT THE NEAREST SUITABLE AIRPORT.

Recirculation Fans ..... OFF
Gasper Fan ..... OFF

If smoke origin is identified, remove the affected source.

If applicable, perform the SMOKE EVACUATION procedure.

If smoke origin is not identified:

Emergency Descent procedure ..... ACCOMPLISH
Smoke Evacuation procedure ..... ACCOMPLISH
Packs 1 and 2 ..... OFF
Shed Buses ..... OFF
Bus Ties ..... OFF
Ventral Pump Selector Button
(if applicable) ..... SET TO A
Fuel Pump 1 ..... 1A OR 1C
Fuel Pump 2 ..... 2B
Battery 2 ..... OFF
Generators 2 and 4 ..... OFF

Shed Buses, Central DC Bus, DC Bus 2 and Essential Bus 2 deenergized.

If able to land soon or if smoke stops or decreases:

NOTE: Landing gear lever can not be moved up.

Icing Conditions ..... EXIT/AVOID
Airspeed ..... MAX 250 KIAS
On Reversionary Panel 2:
SG ..... PRESS

NOTE: PFD or MFD information is available in Display Unit 4.

COM 1 on Digital Audio Panel 1 ..... PUSH IN

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Do not set Thrust Lever 2 below idle in flight.
Anticipate flap actuation.
Monitor fuel quantity indication 2 through FMS.

Landing configuration:

If landing gear has not been selected down:
Abnormal Landing Gear Extension ..... ACCOMPLISH
Flaps ..... 45°
Airspeed ..... $V_{REF\ 45}$ + 5 KIAS

CAUTION: MULTIPLY THE FLAPS 45° UNFACTORED LANDING DISTANCE BY 1.95.

Do not actuate Thrust Reverser 2.
Brake effectiveness will be reduced.

If smoke persists and unable to land soon:

Generators 2 and 4 ..... ON
Battery 2 ..... AUTO
Fuel Pump 1 ..... 1B
Fuel Pump 2 ..... 2A OR 2C
Ventral Pump Selector Button
(if applicable) ..... SET TO B
Battery 1 ..... OFF
Generators 1 and 3 ..... OFF
Shed Buses, Central DC Bus, DC Bus 1 and Essential Bus 1 deenergized.
Emergency lights ..... OFF

If smoke stops or decreases:

NOTE: Landing gear lever can only be moved up using downlock release button (DN Lock Rel).

Icing Conditions ..... EXIT/AVOID
On Reversionary Panel 1:
SG ..... PRESS

NOTE: PFD or MFD information is available in Display Unit 2.

COM 2 on Digital Audio Panel 2 .....PUSH IN
Do not set Thrust Lever 1 below idle in flight.

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Anticipate flap actuation.
Monitor fuel quantity indication 1 through FMS.

Landing configuration:

Emergency lights..... ON
Flaps..... 45°
Airspeed ..... $V_{REF\ 45}$ + 5 KIAS

CAUTION: MULTIPLY THE FLAPS 45° UNFACTORED LANDING DISTANCE BY 1.95.

Do not actuate Thrust Reverser 1.
Brake effectiveness will be reduced.

If smoke persists:

Generators 1 and 3 ..... ON
Battery 1 ..... AUTO
Backup Battery ..... OFF

WARNING: CONSIDER AN IMMEDIATE LANDING.

Landing configuration:

Emergency lights..... ON
Flaps..... 45°
Airspeed ..... $V_{REF\ 45}$

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LAVATORY SMOKE

EICAS WARNING: LAV SMOKE (may be presented)
LIGHT: Master Warning

Lavatory Flush/Lavatory Light CB's (E11 and E12) ..... PULL

Establish contact with the cabin crew.

If necessary, consider a diversion and accomplish the Smoke Evacuation Procedure.

BAGGAGE COMPARTMENT SMOKE

EICAS WARNING: BAGG SMOKE
LIGHT: Master Warning

Baggage Fire Extinguishing Button (if installed)..... PRESS

LAND AT THE NEAREST SUITABLE AIRPORT.

Shed Buses ..... OFF
Diversion ..... CONSIDER
Altitude ..... MAINTAIN
Delay the descent as long as possible.

NOTE: - The extinguishing agent duration is approximately 50 minutes.
- Advise ground crew of possible presence of Halon vapors and smoke trapped in the compartment.

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FUEL LEAK

CONDITION:
- FMS Fuel Remaining quantity is above the MFD or EICAS total fuel indication.
- Excessive Fuel flow from one of the engines.
- Fuel imbalance develops.
- Fuel quantity of a tank decreases at an abnormal rate.

Land at the nearest suitable airport.

Crossfeed Selector ..... OFF

Affected Fuel Tank..... IDENTIFY

Asymmetric Thrust..... AS REQUIRED

If the leak is on the right side tank:

APU ..... OFF

Right tank supplies fuel to the APU.

The pilot may consider to shutdown the engine if fuel leakage continues and is severe:

Associated Thrust Lever ..... IDLE

Start/Stop Selector ..... STOP

NOTE: Engine will not shutdown with the Start/Stop Selector unless associated Thrust Lever is first moved to IDLE. If STOP is selected before Thrust Lever is retarded to IDLE, momentarily cycle START/STOP Selector to RUN and back to STOP.

Fire Extinguishing Handle ..... PULL (DO NOT ROTATE)

Thrust Rating..... CONTINUOUS

TCAS..... TA ONLY

Altitude ..... MAX 25000 FT, MIN MEA

WARNING: IF IN ICING CONDITIONS, REFER TO SINGLE ENGINE OR SINGLE BLEED OPERATION IN ICING CONDITIONS PROCEDURES.

ONE ENGINE INOPERATIVE APPROACH AND LANDING Procedure ..... ACCOMPLISH

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FUEL LOW LEVEL

EICAS WARNING: FUEL 1 (2) LO LEVEL

LIGHT: Master Warning

INDICATION: Fuel quantity indication enters in red range.

Thrust Levers ..... REDUCE TO LONG RANGE SET

Level the airplane and check both fuel quantities.

If fuel quantity is sufficient, complete the flight normally.

If fuel quantity is not sufficient, avoid pitch attitudes in excess of 10° nose down or 12° nose up attitude, uncoordinated maneuvers and negative g's.

CROSSFEED OPERATION

Procedure ..... AS REQUIRED

Land at the nearest suitable airport.

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APU FIRE

EICAS WARNING: APU FIRE
LIGHT: Master Warning
AURAL WARNING: BELL

APU Fuel Shutoff Valve ..... CLOSE

APU Master Knob ..... OFF
APU FUEL SOV CLSD message
on EICAS ..... CONFIRM
If the valve is not confirmed closed and the fire message remains:
Right Electric Fuel Pumps ..... OFF
Crossfeed ..... OFF
Initiate a descent to 25000 ft or MEA, whichever is higher.
After 30 seconds, if the APU FIRE message remains displayed or if the APU FIREDET FAIL message is displayed:
APU Fire Extinguishing Button ..... PRESS
Land at the nearest suitable airport.

WARNING: DO NOT ATTEMPT TO RESTART APU.

APU OVERTEMPERATURE

EICAS Indication: EGT enters amber or red range.

APU Bleed ..... CLOSE

Wait 10 seconds.
If EGT still in red or yellow range:
APU Fuel Shutoff Valve ..... CLOSE
APU Master Knob ..... OFF

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ENGINE FIRE, SEVERE DAMAGE OR SEPARATION

EICAS WARNING: ENG 1 (2) FIRE (may be presented)
LIGHT: Engine Fire Handle (may be illuminated)
AURAL WARNING: BELL (in case of fire) (may sound)

Associated Thrust Lever	IDLE
Associated Start/Stop Selector	STOP
Associated Fire Extinguishing Handle	PULL (DO NOT ROTATE)

Land at the nearest suitable airport.

If E1 (2) FUELSOV CLSD advisory message is displayed on the EICAS:

After 30 seconds from pulling the Fire Handle:
Fire Extinguishing Handle (1st shot)..... ROTATE
If the fire message remains displayed on EICAS after 30 seconds from 1st shot:
Fire Extinguishing Handle (2nd shot)..... ROTATE

If E1 (2) FUELSOV CLSD advisory message is not displayed on the EICAS:

Crossfeed Selector Knob..... OFF
Associated Fuel Pumps..... OFF

After 30 seconds from selecting the fuel pumps to off:
Fire Extinguishing Handle (1st shot)..... ROTATE
If the fire message remains displayed on EICAS after 30 seconds from 1st shot:
Fire Extinguishing Handle (2nd shot)..... ROTATE

If the E1 (2) FIREDET FAIL message is displayed:
Fire Extinguishing Handle (one shot, if available) ... ROTATE
In flight:
TCAS ..... TA ONLY
Affected Engine Bleed ..... CLOSE
Remaining Engine Thrust Rating ..... CON
APU ..... START
APU Bleed ..... AS REQUIRED
Crossbleed..... AS REQUIRED

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CONTINUED FROM PREVIOUS PAGE

EMERGENCY EVACUATION Procedure..... AS REQUIRED

WARNING:
- **DO NOT ATTEMPT TO RESTART ENGINE.**
- **IF IN ICING CONDITIONS, REFER TO SINGLE ENGINE OR SINGLE BLEED OPERATION IN ICING CONDITIONS PROCEDURE.**

NOTE: - If in flight below 9700 ft, the air conditioning pack valves may close automatically. The APU may be used as pneumatic source by closing the remaining engine bleed valve.

- Engine will not shutdown with the START/STOP Selector unless associated Thrust Lever is first moved to IDLE. If STOP is selected before Thrust Lever is retarded to IDLE, momentarily cycle START/STOP Selector to RUN and back to STOP.

ENGINE LOW N1

EICAS WARNING: E1 (2) LOW N1
LIGHT: Master Warning

Do not takeoff.

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ENGINE ATTCS NO MARGIN

EICAS WARNING: E1 (2) ATTCS NO MRGN
LIGHT: Master Warning

Consider not taking off.

For airplanes equipped with A, A1/1, A1 or A3 engines:

Perform a Thrust Assurance Check before the next takeoff, as follows:

Thrust Levers ..... MAX
Check engine parameters.

If engine parameters are within normal range, another takeoff may be attempted. Alternate Takeoff modes are prohibited.

CAUTION:
- BRAKES TEMPERATURE MUST BE CHECKED AFTER REJECTED TAKEOFFS.
- CHECK THE AREA AROUND THE AIRPLANE FOR F.O.D. OR LOOSE OBJECTS PRIOR TO THE RUN-UP CHECK.

For airplanes equipped with A1P, A1/3 or A1E engines:

Another takeoff is not permitted.

ATTCS FAILURE

EICAS WARNING: ATTCS FAIL
LIGHT: Master Warning

Thrust Levers ..... MAX

Another takeoff is not permitted.

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DUAL ENGINE FAILURE

EICAS WARNING: ENG 1-2 OUT
LIGHT: Master Warning

Airspeed	MINIMUM 260 KIAS
Oxygen Mask (if required)	DON

Altitude ..... MAX 25000 ft

ENGINE AIRSTART Procedure ..... ACCOMPLISH

CAUTION: IF APU HAS BEEN USED TO START THE ENGINES, DO NOT ALTERNATE THE FADECS AFTER START.

NOTE: If APU is not available, only equipment supplied by the Essential DC Bus 1 and 2 will be available. Engine windmilling should drive engine driven pumps and supply hydraulic pressure.

If neither engine can be restarted:

FORCED LANDING Procedure ..... ACCOMPLISH

ENGINE OIL LOW PRESSURE

EICAS WARNING: E1 (2) OIL LOW PRESS (may be presented)
LIGHT: Master Warning
INDICATION: Oil pressure indication may be red.

Oil Pressure Indication ..... CHECK
If flight conditions permit, reduce N2 below 88% and monitor oil temperature and oil quantity indication.

Monitor oil pressure for the remainder of the flight. If oil pressure is in the red range:

Associated Thrust Lever ..... IDLE
If oil pressure is still in the red range:
PRECAUTIONARY ENGINE
SHUTDOWN Procedure ..... ACCOMPLISH

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ENGINE REVERSER FAILURE/DISAGREE

EICAS CAUTION: ENG1 (2) REV FAIL or
ENG1 (2) REV DISAGREE

LIGHT: Master Caution

Do not takeoff.

During landing:

Affected Thrust Lever ..... IDLE

In flight:

N1 ..... CHECK

If N1 is decreasing:

Associated Thrust Lever..... IDLE

Airspeed ..... MAXIMUM 200 KIAS

PRECAUTIONARY ENGINE SHUTDOWN Procedure..... ACCOMPLISH

Land at the nearest suitable airport.

REJECTED TAKEOFF (AT OR BELOW V_1)

CONDITION: In the event of engine failure, engine fire, or any condition affecting safety of flight, occuring prior to V1.

Thrust Levers	IDLE OR MAX REVERSE
Brakes	APPLY MAXIMUM
Directional Control	MAINTAIN

Immediately after stopping:

Precautionary Engine Shutdown or
ENGINE FIRE, SEVERE DAMAGE OR SEPARATION Procedure ..... AS REQUIRED

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TAKEOFF WITH ENGINE FAILURE ABOVE V_1

(APPLICABLE TO ALL MODELS EXCEPT EMB-145 XR)

Maximum Takeoff Thrust ..... CHECK
At V_R rotate the airplane to 14° (flaps 9°), 13° (flaps 18°) or 12° (flaps 22°).
With positive rate of climb:
Landing Gear ..... UP
Airspeed ..... V_2

Maintain V_2 up to the level off altitude. If maneuvering is required, maintain a maximum bank of 15°.

During takeoff with flaps 9°, when reaching the level off height:

At V_2 + 15 KIAS:
Flaps ..... UP
Airspeed ..... ACCELERATE TO FINAL SEGMENT SPEED

During takeoff with flaps 18° or 22°, when reaching the level off height:

For airplanes equipped with AE3007A, or AE3007A1 or AE3007A1/1 engines:

At V_2 + 5 KIAS:
Flaps ..... 9°

At V_2 + 25 KIAS:
Flaps ..... UP
Airspeed ..... ACCELERATE TO FINAL SEGMENT SPEED

For airplanes equipped with AE3007A1P or AE3007A1/3 engines:

At V_2 + 10 KIAS:
Flaps ..... 9°

At V_2 + 30 KIAS:
Flaps ..... UP
Airspeed ..... ACCELERATE TO FINAL SEGMENT SPEED

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CONTINUED FROM PREVIOUS PAGE

After flaps are retracted:
PRECAUTIONARY ENGINE SHUTDOWN or
ENGINE FIRE, SEVERE DAMAGE OR
SEPARATION Procedure..... AS REQUIRED
After a maximum of 5 minutes at Takeoff Thrust:
Thrust Rating ..... AS REQUIRED

TAKEOFF WITH ENGINE FAILURE ABOVE V_1

(APPLICABLE TO EMB-145XR MODEL)

Maximum Takeoff Thrust..... CHECK
At V_R rotate the airplane to 13° (flaps 9°) or 12° (flaps 18°).
With positive rate of climb:
Landing Gear..... UP
Airspeed..... V_2

Maintain V_2 up to the level off altitude. If maneuvering is required, maintain a maximum bank of 15°.

During takeoff with flaps 9°, when reaching the level off height:

At V_2 + 15 KIAS:
Flaps..... UP
Airspeed ..... ACCELERATE TO FINAL SEGMENT SPEED

During takeoff with flaps 18°, when reaching the level off height:

At V_2 + 10 KIAS:
Flaps..... 9°
At V_2 + 30 KIAS:
Flaps..... UP
Airspeed..... ACCELERATE TO FINAL SEGMENT SPEED

After flaps are retracted:
PRECAUTIONARY ENGINE SHUTDOWN or
ENGINE FIRE, SEVERE DAMAGE OR
SEPARATION Procedure..... AS REQUIRED
After a maximum of 5 minutes at Takeoff Thrust:
Thrust Rating ..... AS REQUIRED

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LANDING GEAR/LEVER DISAGREE

EICAS WARNING: LG/LEVER DISAGREE
LIGHT: Master Warning.
EICAS Indication: Landing gear indication may be present one or more boxes cross-hatched or red.

Airspeed ..... MAXIMUM 200 KIAS
Landing Gear ..... CYCLE
If the message persists:
- In a retraction:
  - Landing Gear ..... DOWN
  - Airspeed ..... MAXIMUM 250 KIAS
  - Land at the nearest suitable airport. Leave and avoid icing conditions.
- In an extension:
  - ABNORMAL LANDING GEAR EXTENSION Procedure ..... ACCOMPLISH

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PITCH TRIM RUNAWAY

EICAS WARNING: AUTOPILOT FAIL (may be presented)
EICAS CAUTION: AUTO TRIM FAIL (may be presented)
LIGHT: Master Warning light illuminates if AUTOPILOT FAIL message is presented. Message Caution light illuminates if AUTO TRIM FAIL message is presented.
CONDITION: Uncommanded pitch and respective trim pictorial indication changes

Quick Disconnect Button ..... PRESS AND HOLD

NOTE: Do not change flap setting.

At safe altitude:
Pitch Trim Main System..... OFF
Pitch Trim Back Up System..... OFF
Quick Disconnect Button ..... RELEASE

WARNING: DO NOT OPEN THE SPEED BRAKE.

If control column forces are excessive, try to recover airplane control by turning one system on and trimming the airplane as necessary. Initiate with the Backup System. Leave the failed system off.

Autopilot..... AS REQUIRED

If neither Main nor Back Pitch Trim system is operative:
PITCH TRIM INOPERATIVE Procedure..... ACCOMPLISH

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PITCH TRIM INOPERATIVE
(APPLICABLE TO EMB-135 AND EMB-145 AIRPLANES)

EICAS WARNING: PIT TRIM 1(2) INOP or
PTRIM MAIN INOP, PTRIM BACKUP INOP
(may be presented)

EICAS CAUTION: AUTO TRIM FAIL (may be presented)

If at least one message is presented without pressing any Pitch Trim Switch:

Affected Pitch Trim System ..... OFF

Use the remaining Pitch Trim System.

If both Pitch Trim Systems become inoperative:

Pitch Trim Main System..... OFF
Pitch Trim Back Up System ..... OFF
Consider landing at the nearest suitable airport.

If no message is presented or is only presented when pressing any Pitch Trim Switch:

Airspeed..... REDUCE

Airspeed reduction alleviates control column forces and may permit Pitch Trim command to be recovered.

If Pitch Trim command is reestablished continue using the remaining Pitch Trim System.

NOTE: - For the EMB-145 XR model, if the PTRIM BACKUP INOP message is displayed the maximum airspeed allowed is Mach 0.78.

- Do not engage the Autopilot if the Main Pitch Trim System is inoperative.

- If only one segment of the Pitch Trim Switch is pressed, the TRIM aural warning message will be generated.

WARNING: IF PITCH TRIM COMMAND IS NOT REESTABLISHED, DO NOT OPEN SPEEDBRAKE.

If pitch trim command is not reestablished and the airplane presents a NOSE UP tendency:

Airspeed..... REDUCE

If it is necessary to reduce airspeed below 180 KIAS (or 200 KIAS in icing conditions), extend flaps to 9° (at 20000 ft maximum).

CONTINUES ON THE NEXT PAGE

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

CONTINUED FROM PREVIOUS PAGE

If it is necessary to reduce airspeed below 160 KIAS, extend flaps to 22°.

NOTE: Turning the airplane and extending the landing gear helps to maintain minimum airspeed with unwanted pitch up tendency.

Pitch Trim Command..... CHECK ALL SWITCHES

If pitch trim is recovered, re-trim the airplane and proceed with flight normally.

If pitch trim is not recovered:

Consider landing at the nearest suitable airport.

Approach and landing configuration:

Landing Gear ..... DOWN

Flaps..... 22°

Airspeed ..... $V_{REF\ 45}$ + 10 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.45.

If pitch trim command is not reestablished and the airplane presents a NOSE DOWN tendency:

Airspeed ..... REDUCE

Below 250 KIAS:

Flaps (at 20000 ft maximum) ..... 9°

Below 200 KIAS:

Flaps..... 22°

Approach and landing configuration:

Landing Gear..... DOWN

NOTE: Gear extension should be delayed as long as possible.

Flaps..... 22°

Airspeed ..... $V_{REF\ 45}$ + 25 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.75.

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PITCH TRIM INOPERATIVE
(APPLICABLE TO ERJ-140 AIRPLANES)

EICAS WARNING: PIT TRIM 1(2) INOP or
PTRIM MAIN INOP, PTRIM BACKUP INOP

EICAS CAUTION: AUTO TRIM FAIL

If at least one message is presented without pressing any Pitch Trim Switch:

Affected Pitch Trim System ..... OFF

Use the remaining Pitch Trim System.

If both Pitch Trim Systems are inoperative:

Pitch Trim Main System ..... OFF

Pitch Trim Back Up System ..... OFF

Consider landing at the nearest suitable airport.

If message is presented when pressing any Pitch Trim Switch:

Airspeed ..... REDUCE

Airspeed reduction alleviates control column forces and may permit Pitch Trim command to be recovered.

If Pitch Trim command is reestablished continue using the remaining Pitch Trim System.

NOTE: - Do not engage the Autopilot if the Main Pitch Trim System is inoperative.

- If only one segment of the Pitch Trim Switch is pressed, the TRIM aural warning message will be generated.

WARNING: IF PITCH TRIM COMMAND IS NOT REESTABLISHED, DO NOT OPEN SPEEDBRAKE.

If pitch trim command is not reestablished and the airplane presents a NOSE UP tendency:

Airspeed ..... REDUCE

If it is necessary to reduce airspeed below 180 KIAS (or 200 KIAS in icing conditions), extend flaps to 9° (at 20000 ft maximum).

If it is necessary to reduce airspeed below 160 KIAS, extend flaps to 22°.

NOTE: Turning the airplane and extending the landing gear helps to maintain minimum airspeed with unwanted pitch up tendency.

Pitch Trim Command ..... CHECK ALL SWITCHES

CAUTION: IF PITCH TRIM IS RECOVERED, RETRIM THE AIRPLANE AND PROCEED WITH FLIGHT NORMALLY.

CONTINUES ON THE NEXT PAGE

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

CONTINUED FROM PREVIOUS PAGE

If pitch trim is not recovered:

Consider landing at the nearest suitable airport.

Approach and landing configuration:

Landing Gear ..... DOWN

Flaps..... 22°

Airspeed ..... $V_{REF\ 45}$ + 10 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.45.

If pitch trim command is not reestablished and the airplane presents a NOSE DOWN tendency:

Airspeed..... REDUCE

Below 250 KIAS:

Flaps (at 20000 ft maximum)..... 9°

Below 200 KIAS:

Flaps..... 22°

Approach and landing configuration:

Landing Gear..... DOWN

NOTE: Gear extension should be delayed as long as possible.

Flaps..... 22°

Airspeed ..... $V_{REF\ 45}$ + 25 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.75.

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JAMMED ELEVATOR

EICAS WARNING: SPS 1-2 INOP (may be presented)
EICAS CAUTION: STICK PUSHER FAIL (may be presented)
LIGHT: Master Warning and Master Caution lights illuminate if STICK PUSHER FAIL and SPS 1-2 INOP messages are presented.
CONDITION: Both control columns can not be moved either forward or backward.

Elevator Disconnect	PULL

Autopilot ..... OFF
Airspeed ..... MAXIMUM 200 KIAS
Pitch Trim ..... AS REQUIRED
Avoid landing at airports with anticipated turbulence or crosswind.

Approach and landing configuration:
- Landing Gear ..... DOWN
- Flaps ..... 22°
- Airspeed ..... $V_{REF\ 45}$ + 10 KIAS

If both elevators are jammed, pitch trim may be used to land the airplane.
If left elevator is jammed, Stick Pusher will not be available.
Depending on the jammed elevator position, the remaining elevator power to flare the airplane will be reduced.
Do not reengage autopilot.

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.45.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

AILERON/ROLL TRIM RUNAWAY

CONDITION: Uncommanded roll noticed by pilots.
INDICATION: Trim pictorial indication if caused by roll trim runway.

Quick Disconnect Button	PRESS AND HOLD
Aileron System 1 and 2	OFF

Roll Trim Circuit Breaker (F23) ..... PULL
Quick Disconnect Button ..... RELEASE
Airspeed ..... MAXIMUM 250 KIAS

If necessary, turn on one aileron hydraulic system at a time to identify the failed system. Prepare to overcome the roll generated by the failed aileron system. If the failure is confirmed in one aileron system, the roll trim system may be used as required.

If the message AIL SYS 1-2 INOP is displayed on EICAS:

Aileron is operating under mechanical reversion mode. Expect greater aileron control force. If required, both pilots should act together to control airplane. Avoid landing at airports with anticipated turbulence or crosswind. Perform a long final approach.

Approach and landing configuration:

Landing Gear ..... DOWN
Flaps ..... 22°
Airspeed ..... $V_{REF\ 45}$ + 30 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.85.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

JAMMED AILERON

CONDITION: Both control columns can not be moved to either side.

Aileron Disconnect	PULL

Autopilot ..... OFF
Airspeed ..... MAXIMUM
200 KIAS

NOTE: Roll rate with aileron disconnected is lower than with full system.

After control is regained:

If the copilot's aileron is operative, roll trim and artificial feel are available.

If the pilot's aileron is operative, roll trim and artificial feel are not available. Do not make sudden and large aileron inputs. Do not increase bank angle above 20°.

Airspeed ..... MAXIMUM
200 KIAS

In either case, autopilot must not be reengaged.

If both ailerons are jammed, use rudder to control the airplane.

Avoid landing at airports with anticipated turbulence or crosswind.

Approach and landing configuration:

Landing Gear ..... DOWN
Flaps ..... 45°
Airspeed ..... $V_{REF\ 45}$ + 5 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.10.

User: fnhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

JAMMED RUDDER

CONDITION: Pedals can not be moved.

Command rudder through yaw trim. If not possible:
Rudder System 2 ..... OFF

If still jammed:
Rudder System 2 ..... ON
Rudder System 1 ..... OFF

If rudder control through pedals is not restored:
Airspeed ..... MAXIMUM 200 KIAS

Avoid landing at airports with anticipated turbulence or crosswind.

Approach and landing configuration:
Landing Gear ..... DOWN
Flaps ..... 22°
Airspeed ..... $V_{REF\ 45}$ + 5 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.62.

If required, use asymmetric thrust to trim the airplane directionally, and maintain the engine thrust until nose gear contact in order to avoid lateral and directional miscontrol.

During final approach, the pilot not flying must keep the Steering Disengage Button pressed to avoid inadvertent nose wheel deflection once on ground.

When the airplane is firmly on ground, use the Steering Handle to control the airplane still keeping the Steering Disengage Button pressed and then reduce the engine thrust to IDLE. The message STEER INOP may appear while not using the Steering Handle.

If necessary, use differential braking to steer the airplane.

NOTE: The Steering Handle is effective even with the Steering Disengage Button pressed.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

INADVERTENT SPOILER OPENING IN FLIGHT

EICAS CAUTION: SPOILER FAIL (may be presented)

LIGHT: Master Caution

CONDITION: Sudden airspeed or altitude loss, buffeting or roll tendency.

INDICATION: SPLRS OPN

Speed Brake	CLOSE

Speed Brake Circuit Breaker (F13) ..... PULL

Ground Spoiler Outboard
Circuit Breaker (F14) ..... PULL

Ground Spoiler Inboard
Circuit Breaker (F21) ..... PULL

If any panel is jammed closed, open or is floating:

Approach and landing configuration:

Landing Gear ..... DOWN
Flaps ..... 22°
Airspeed ..... $V_{REF\ 45}$ + 10 KIAS

Do not reduce engine thrust during flare to avoid abrupt lateral and directional corrections before touchdown.

CAUTION:

- IN CASE OF PANEL JAMMED CLOSED OR FLOATING, TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.50.
- IN CASE OF PANEL JAMMED OPEN, TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.45.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

BLEED LEAK

EICAS WARNING: BLD 1 (2) LEAK or BLD APU LEAK
LIGHT: Master Warning and leak inscription in the associated bleed button illuminated.

Crossbleed ..... CLOSE
Confirm the failed side and proceed.

Associated Bleed and APU Bleed ..... CLOSE
Check on EICAS the following messages: CROSS BLD SW OFF and associated BLD VLV CLSD. Check APU bleed button not illuminated.

Altitude ..... MAX 25000 ft
MINIMUM MEA

Icing Conditions ..... EXIT/AVOID

Wait 3 minutes.

If the message remains on, but the associated advisory message on EICAS (BLD 1 or 2 VLV CLSD) indicates the valve is closed:

Opposite Bleed ..... CLOSE
Associated Bleed ..... OPEN
Wait 3 minutes.

If the message still remains:

Associated Bleed ..... CLOSE
Altitude ..... MEA OR 10000 ft WHICHEVER IS HIGHER

If the message remains on and is associated with a failed engine bleed valve (BLD 1 or 2 VLV FAIL caution message):

Associated Thrust Lever ..... IDLE
Wait 3 minutes.

If the message still remains:

Associated Engine (or APU) ..... SHUTDOWN

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BLEED OVERTEMPERATURE

EICAS WARNING: BLD 1 (2) OVTEMP
LIGHT: Master Warning
INDICATION: Pointer on MFD may be out of view and indication may be red.

Crossbleed	OPEN
Cross-side Bleed	OPEN
Associated Bleed	CLOSE
Altitude	MAX 25000 ft MINIMUM MEA

WARNING: IF IN ICING CONDITIONS, REFER TO SINGLE ENGINE OR SINGLE BLEED OPERATION IN ICING CONDITIONS PROCEDURE.

RAPID CABIN DEPRESSURIZATION

AURAL WARNING: CABIN
CONDITION: Cabin altitude indication has exceeded 10000 ft and becomes red.

Crew Oxygen Masks	DON
Crew Communication	ESTABLISH
Emergency Descent	AS REQUIRED

Passenger Oxygen	AS REQUIRED
Altitude	MEA OR 10000 ft, WHICHEVER IS HIGHER

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ANTI-ICING INOPERATIVE IN ICING CONDITIONS

EICAS WARNING: ICE COND-A/I INOP with any or all Anti-icing System EICAS CAUTION

LIGHT: Master Warning and Master Caution.

On the ground, whenever the message is displayed, do not takeoff and perform the test below:

Thrust Levers..... IDLE
Ice Detection Override Knob..... AUTO
Ice Detection Test Knob ..... 1, THEN 2

Test knob must be held for 5 seconds in each test position.

For each side separately, check that OPEN inscriptions in the anti-icing buttons are flashing and that ICE DET 1 (or 2) FAIL caution message and ICE CONDITION advisory message are displayed on the EICAS.

If any OPEN inscription does not flash do not takeoff.

If the message ICE COND-A/I INOP persists do not takeoff.

If the message ICE COND-A/I INOP disappears within 60 seconds:
TAKEOFF ..... ACCOMPLISH

In flight:

Ice Detection Override Knob..... ALL
If necessary, refer to the specific anti-icing system failure.
If the message persists, exit and avoid icing conditions.

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AUTOPILOT FAILURE

EICAS WARNING: AUTOPILOT FAIL
LIGHT: Master Warning
AURAL WARNING: AUTOPILOT (only below 2500 ft radio altitude, when autopilot is disconnected)

Autopilot ..... DISENGAGE

Trim the airplane as required.

NOTE: If associated with autopilot hardover a sudden deviation from the expected flight path may occur.

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EMERGENCY DESCENT

Cabin Crew	NOTIFY
Fasten Belts	ON
Thrust Levers	IDLE
Speed Brakes	OPEN
Airspeed	250 KIAS
Landing Gear	DOWN
Altitude	MEA OR 10000 FT WHICHEVER IS HIGHER

Transponder 7700
ATC ..... NOTIFY

CAUTION: THIS PROCEDURE ASSUMES THAT THE INTEGRITY OF THE STRUCTURE IS NOT AFFECTED. IF STRUCTURAL DAMAGE IS SUSPECTED, USE THE FLIGHT CONTROLS WITH CAUTION AVOIDING HIGH MANEUVERING LOADS AND REDUCING AIRSPEED AS APPROPRIATE.

NOTE: - It is recommended that descent be initiated by a turn with a bank angle of 30°.

- Anti-Icing System failure messages may be presented if icing conditions are encountered during the descent. In this case, emergency descent must be completed before performing the associated failure procedure.

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FORCED LANDING

This procedure is recommended for landings, with engines operative or not, including places other than a runway.

ATC and Cabin Crew ..... NOTIFY
Transponder 7700
ELT ..... ON
Emergency Lights ..... ON
Passenger ..... PREPARE FOR FORCED LANDING
Cabin (below 10000 ft) ..... DEPRESSURIZE
When committed to land:

Landing Gear ..... AS REQUIRED
Flaps ..... 45°

If it is not possible to achieve the selected flap position, maintain airspeed according to the following:

FLAPS POSITION	MINIMUM AIRSPEED
0° to 8°	$V_{REF\ 45}$ + 30 KIAS
9° to 21°	$V_{REF\ 45}$ + 10 KIAS
22° to 44°	$V_{REF\ 45}$ + 5 KIAS
45°	$V_{REF\ 45}$

If necessary, inhibit EGPWS/GPWS (CB J7 or CB J8) and Aural Warning System (CBs B4 and E30) by pulling their circuit breakers.

If crash is unavoidable, just before touchdown:

Cabin ..... ANNOUNCE IMPACT
Fire Extinguishing Handles ..... PULL
APU Fuel Shutoff Valve ..... CLOSE
Ventral Tank Transfer Knob (EMB-145XR only) ..... OFF

When the airplane comes to a complete stop:

EMERGENCY EVACUATION Procedure ..... ACCOMPLISH

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DITCHING

WARNING: THE EMB-145 WAS NOT TESTED FOR DITCHING. BELOW ARE THE RECOMMENDED PROCEDURES, WHICH HAVE BEEN DEVELOPED BASED ON PREVIOUS EXPERIENCE.

ATC/Cabin Crew ..... NOTIFY
Transponder 7700
ELT ..... ON
Emergency Lights ..... ON
Passengers ..... PREPARE FOR DITCHING
Cabin (below 10000 ft) ..... DEPRESSURIZE

If necessary, inhibit EGPWS/GPWS (CB J7 or CB J8) and Aural Warning System (CBs B4 and E30) by pulling their circuit breakers.

When reaching 1000 ft:

Ventral Tank Transfer Knob (EMB-145XR only) ..... OFF
Air Conditioning 1 and 2 ..... OFF
Engine Bleeds ..... CLOSE

Approach configuration:

Landing Gear ..... UP
Flaps ..... 45°

If it is not possible to achieve the selected flap position, maintain airspeed according to the following:

FLAPS POSITION	MINIMUM AIRSPEED
0° to 8°	$V_{REF\ 45}$ + 30 KIAS
9° to 21°	$V_{REF\ 45}$ + 10 KIAS
22° to 44°	$V_{REF\ 45}$ + 5 KIAS
45°	$V_{REF\ 45}$

The final path should be made with airplane straight and level. Yaw angles should be limited to one ball of sideslip. If possible, ditching should be made parallel to the line of the wave crests.

Before touchdown:

Cabin ..... ANNOUNCE IMPACT
Rate of Descent ..... LESS THAN 180 ft/MIN
Attitude ..... 4° NOSE UP

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CONTINUED FROM PREVIOUS PAGE

Upon water contact:

Start/Stop Selectors ..... STOP

EMERGENCY EVACUATION Procedure ..... ACCOMPLISH

WARNING: **AIRPLANE EVACUATION MUST BE DONE THROUGH THE OVERWING EMERGENCY EXITS ONLY. DO NOT OPEN REMAINING DOORS.**

EMERGENCY EVACUATION

Parking Brake (if necessary) ..... APPLY
Cabin ..... DEPRESSURIZE
Fire Extinguishing Handles ..... PULL
APU Fuel Shutoff Valve ..... CLOSE
APU and Engine Fire Extinguishing
Bottles (if necessary) ..... DISCHARGE
Ventral Tank Transfer Knob (if applicable) ..... OFF
Electric Fuel Pumps ..... OFF
Electric Hydraulic Pumps ..... OFF
Cabin Crew ..... NOTIFY
Emergency Lights ..... ON
Evacuation ..... INITIATE

NOTE: Cockpit door blow-out panels may be broken to be used as an alternative way to leave cockpit.

ATC ..... NOTIFY
Before leaving the airplane:
Batteries ..... OFF

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ABNORMAL PROCEDURES

EQUIPMENT AND FURNISHINGS

EMERGENCY EXIT OPEN

EICAS CAUTION: EMERG EXIT OPEN
LIGHT: Master Caution

Fasten Belts ..... ON
Verify door handle pushed in and remove passengers from the seats near the associated emergency exit.
If emergency exit is not confirmed locked or it is not possible to maintain the pressurization:

Altitude	MEA OR 10000 ft, WHICHEVER IS HIGHER
Cabin Pressure	DEPRESSURIZE

BAGGAGE/ACCESS DOOR OPEN

EICAS CAUTION: BAGGAGE DOOR OPN or ACCESS DOORS OPN
LIGHT: Master Caution

Avoid rapid maneuvers.
If it is not possible to maintain the pressurization, proceed:

Altitude	MEA OR 10000 ft, WHICHEVER IS HIGHER
Pressurization	MONITOR

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MAIN DOOR BLOCKED

LIGHT: Door Blocked Closed (Attendant's panel)

To open the door on ground:

Check that the door opening area is free of both people and ground equipment.

Hydraulic System 1 ..... OFF

Main Door Alternative Opening Valve ..... ACTUATE DURING 2 MINUTES

Unlock the door and open it.

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CREW AWARENESS

ERRONEOUS STALL PROTECTION ACTUATION

Immediately and simultaneously:
Quick Disconnect Button ..... PRESS
Both Stall Protection Systems ..... CUTOUT

Avoid skidding the airplane.

Add 5 KIAS to approach, landing and go-around speeds.

Landing configuration:
Flaps..... 45°
Airspeed ..... $V_{REF\ 45}$ + 5 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.10.

ADVANCED STALL PROTECTION

EICAS CAUTION: SPS ADVANCED
LIGHT: Master Caution

If altitude is above 25000 ft:

Airspeed..... ABOVE 150 KIAS

Add 5 KIAS to go-around speed to prevent stall protection from being actuated.

Approach and landing configuration:
Landing Gear..... DOWN
Flaps..... 45°
Airspeed ..... $V_{REF\ 45}$ + 5 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.10.

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STICK PUSHER JAMMING

EICAS CAUTION: STICK PUSHER FAIL
LIGHT: Master Caution

Elevator Disconnection Handle..... PULL
Copilot must fly the airplane.

Avoid landings at airports with anticipated turbulence or crosswinds.

GPWS INOPERATIVE

EICAS CAUTION: GPWS INOP or TERR INOP (for EGPWS)
LIGHT: Master Caution

Monitor any trend toward terrain contact, excessive sink rate, marginal flight path and airplane configuration.

Do not perform CAT II or CAT III approaches.

AURAL WARNING FAILURE

EICAS CAUTION: AURAL WARN FAIL
LIGHT: Master Caution

Monitor airplane instruments.

Do not perform CAT II or CAT III approaches.

WINDSHEAR DETECTION INOPERATIVE

EICAS CAUTION: WINDSHEAR INOP
LIGHT: Master Caution

Avoid windshear.

STALL PROTECTION SYSTEM UNTESTED

LIGHT: Stall Protection Test Button is illuminated.

Stall Protection Test Button (on ground)..... PRESS

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ELECTRICAL

APU CONTACTOR CLOSED

EICAS CAUTION: APU CNTOR CLOSED
LIGHT: Master Caution

Bus Ties ..... OFF
Battery 2 ..... OFF

BACKUP BATTERY OFF BUS

EICAS CAUTION: BKUP BATT OFF BUS

Backup Battery ..... VERIFY ON

BATTERY OFF BUS

EICAS CAUTION: BATT 1 (2) OFF BUS
LIGHT: Master Caution

Affected Battery ..... AUTO

DC BUS OFF

EICAS CAUTION: DC BUS 1 (2) OFF
LIGHT: Master Caution

Bus Ties ..... OVERRIDE
If associated bus is still off:
  Bus Ties ..... AUTO
Remaining Buses ..... CHECK
If DC Bus 2 is off:
  Airspeed ..... MAXIMUM 250 KIAS

NOTE: The nose landing doors will open, therefore the pilot should expect noise increase.

Icing Conditions ..... EXIT/AVOID

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ELECTRICAL EMERGENCY ABNORMAL TRANSFER

EICAS CAUTION: ELEC EMERG ABNORM
LIGHT: Master Caution

Essential Power ..... CHECK
PUSHED OUT

If message persists:

Land at the nearest suitable airport.

Bus Ties ..... OFF
Batteries 1 and 2 ..... OFF

If message persists:

Bus Ties ..... AUTO
Batteries 1 and 2 ..... AUTO
APU Generator (if serviceable) ..... ON
Altitude ..... MEA OR
10000 ft,
WHICHEVER
IS HIGHER

At 10000 ft:

Packs 1 and 2 ..... OFF
Pressurization Mode Selector ..... MAN
Pressurization Manual Controller ..... FULL UP

CAUTION: IF APU GENERATOR IS NOT AVAILABLE OR THE MESSAGE REMAINS, BATTERY DURATION WILL BE 40 MINUTES.

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ESSENTIAL BUS 1 OFF

EICAS CAUTION: ESS BUS 1 OFF
LIGHT: Master Caution
MFD Indication: ESS BUS may be amber.

On Reversionary Panel 1:
SG ..... PUSH IN
Fuel Pump 1 ..... 1B OR 1C
Fuel Pump 2 ..... 2A OR 2C
Altitude ..... MAX 25000 FT, MINIMUM MEA

WARNING: **IF IN ICING CONDITIONS, REFER TO SINGLE ENGINE OR SINGLE BLEED OPERATION IN ICING CONDITIONS PROCEDURE.**

COM 2 on Digital Audio Panel 2 ..... PUSH IN
Monitor fuel quantity indication 1 through FMS.
Brake effectiveness will be reduced.

If the EICAS is not energized:
DAU 1 on EICAS Rev ..... PUSH IN
At pilot's discretion, on Reversionary Panel 1:
MFD Knob ..... EICAS

Landing configuration:
Landing Gear ..... DOWN
Flaps ..... 45°
Airspeed ..... $V_{REF\ 45}$

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.45.

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ESSENTIAL BUS 2 OFF

EICAS CAUTION: ESS BUS 2 OFF
LIGHT: Master Caution
MFD Indication: ESS BUS may be amber.

Fuel Pump 1 ..... 1A OR 1C
Fuel Pump 2 ..... 2B OR 2C
Icing Conditions ..... EXIT/AVOID
Altitude ..... MAX 25000 FT, MINIMUM MEA

Monitor fuel quantity indication 2 through FMS.

Brake effectiveness will be reduced.

When necessary to extend landing gear:
ABNORMAL LANDING GEAR EXTENSION ..... ACCOMPLISH

Landing configuration:
Landing Gear ..... DOWN
Flaps ..... 45°
Airspeed ..... $V_{REF\ 45}$

CAUTION:
- DO NOT USE CROSSFEED.
- TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.45.

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ESSENTIAL BUS 1-2 OFF

EICAS CAUTION: ESS BUS 1-2 OFF

Bus Ties ..... OFF
MFD Electrical Page ..... CHECK
If both DC buses are energized:
  Batteries 1 and 2 ..... OFF
  Check if the essential buses remain off.
  Associated ESS BUS OFF Procedure ..... ACCOMPLISH

If only DC BUS 1 is energized:
  Battery 1 ..... OFF
  Check which essential bus is off.
  Associated ESS BUS OFF Procedure ..... ACCOMPLISH

If only DC BUS 2 is energized:
  Battery 2 ..... OFF
  Check which essential bus is off.
  Associated ESS BUS OFF Procedure ..... ACCOMPLISH

GENERATOR BEARING FAILURE

EICAS ADVISORY: GEN 1 (2, 3, 4) BRG FAIL

Crew awareness.

GENERATOR OFF BUS

EICAS CAUTION: GEN 1 (2, 3, 4) OFF BUS or APU GEN OFF BUS
LIGHT: Master Caution

Affected Generator ..... OFF, THEN ON
If the generator does not reset:
  APU Generator ..... AS REQUIRED

CAUTION:
- IF ALL GENERATORS ARE OFF BUS, CABIN WILL DEPRESSURIZE. REFER TO LOSS OF ALL GENERATORS PROCEDURE.
- BATTERY DURATION IS 40 MINUTES.

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GENERATOR OVERLOAD

EICAS CAUTION: GEN 1 (2, 3, 4) OVLD or APU GEN OVLD
LIGHT: Master Caution

Shed Buses ..... OFF
If the message remains:
Electrical Load (on affected generator) ..... REDUCE
If APU generator is not affected and any generator is overloaded:

APU Generator ..... ON

SHED BUS OFF

EICAS CAUTION: SHED BUS 1 (2) OFF
LIGHT: Master Caution

If message is confirmed and shed buses are off, monitor the system for the remainder of the flight.

115 V AC BUS OFF

EICAS CAUTION: 115 VAC BUS OFF
LIGHT: Master Caution

AC Power ..... OFF, THEN ON
If unsuccessful:
AC Power ..... OFF

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LIGHTING

EMERGENCY LIGHTS NOT ARMED

EICAS CAUTION: EMERG LT NOT ARMD
LIGHT: Master Caution

Emergency Lighting Selector ..... ARM
If unsuccessful, check that Attendant Emergency Light Control Button is set to NORM.

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FIRE PROTECTION

ENGINE TAILPIPE FIRE

CONDITION: Tailpipe fire was detected visually by crew or ground personnel. No EICAS message displayed.

Affected engine:
- Thrust Lever ..... IDLE
- Start/Stop Selector ..... STOP
- Ignition ..... OFF
- Fuel Pump ..... OFF
- XFeed Selector Knob ..... OFF
- Start/Stop Selector ..... START, THEN RUN

ITT ..... MONITOR

ATC ..... NOTIFY

Wait 90 seconds.

Associated Start/Stop Selector ..... STOP

Associated Fire Extinguishing Handle ..... PULL (DO NOT ROTATE)

NOTE: If fire is not extinguished while the engine is motored, ground personnel support must be requested.

FIRE DETECTION FAILURE

EICAS CAUTION: E1 (2) FIREDET FAIL or APU FIREDET FAIL
LIGHT: Master Caution

Engine or APU ..... MONITOR

If engine fire or overheat is suspected or if E1 (2) FIREDET FAIL message appears simultaneously with engine failure:

ENGINE FIRE, SEVERE DAMAGE OR SEPARATION Procedure ..... ACCOMPLISH

If APU fire or overheat is suspected or if APU FIREDET FAIL message appears simultaneously with APU failure:

APU FIRE Procedure ..... ACCOMPLISH

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FIRE EXTINGUISHING INOPERATIVE

EICAS CAUTION: E1 (2) EXTBTLA INOP, E1 (2) EXTBTLB INOP, APU EXTBTL INOP or BAGG EXTBL INOP (if installed)

LIGHT: Master Caution

CONDITION: Associated bottle has not been discharged intentionally.

On Engines:

Only one discharge will be available from the remaining bottle, to protect both engines against fire.

On APU:

Consider shutting APU down (or not starting it) if bleed extraction or electrical generation is not essential.

On Baggage Compartment:

In flight:

If associated with the BAGG SMOKE message, land at the nearest suitable airport.

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FUEL

FUEL LOW PRESSURE

EICAS CAUTION: E1 (2) FUEL LO PRESS
LIGHT: Master Caution
CONDITION: One or more associated tank electric fuel pump may be inoperative.

Select another electric fuel pump on the associated tank.
If all pumps in one tank are inoperative:

Altitude ..... MAX 25000 ft
MINIMUM MEA

NOTE: If required, Crossfeed may be open above 25000 ft.

Avoid rapid thrust lever movements and set minimum required thrust.

FUEL LOW TEMPERATURE

EICAS CAUTION: FUEL TANK LO TEMP or E1 (2) FUEL LO TEMP
LIGHT: Master Caution
CONDITION: Fuel temperature in amber range.

WARNING: IF FUEL TANK LO TEMP MESSAGE IS PRESENTED, IN ANY CASE, OR E1 (2) FUEL LO TEMP IS PRESENTED WITHOUT ICING INHIBITOR, ENGINE FLAMEOUT MAY OCCUR.

On ground:

Low temperature in the engine (E1 or E2 FUEL LO TEMP):

Before takeoff, check that fuel icing inhibitor has been added to the fuel.

Low temperature in the tank (FUEL TANK LO TEMP):

Check tank temperature. If message is confirmed or if MFD is not available, do not takeoff.

In flight:

Descend to lower altitude and monitor engine indications as long as the message remains.

If the low temperature is in the tank (FUEL TANK LO TEMP) and MFD is available, tank temperature may be checked on the MFD Fuel Page, before descending.

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FUEL CROSSFEED FAILURE

EICAS CAUTION: FUEL XFEED FAIL
LIGHT: Master Caution

Fuel Imbalance..... MONITOR
Asymmetric Thrust..... AS REQUIRED

FUEL IMBALANCE

EICAS CAUTION: FUEL IMBALANCE
LIGHT: Master Caution

If fuel imbalance is confirmed:
CROSSFEED OPERATION
Procedure ..... ACCOMPLISH

REFUELING COMPARTMENT DOOR OPEN

EICAS CAUTION: FUELING DOOR OPN
LIGHT: Master Caution

On ground:
Check the door for positive locking before takeoff. If the message remains, repair is required before takeoff.

ENGINE FUEL SHUTOFF VALVE FAILURE

EICAS CAUTION: E1 (2) FUEL SOV INOP
LIGHT: Master Caution

Confirm the failed valve.
Engine Fuel Indications..... MONITOR
If the message has been presented during a fire procedure:
Crossfeed..... OFF
Associated Fuel Pumps ..... OFF
If valve is confirmed closed during normal operation (fuel flow decreasing to zero):
Fire Extinguishing Handle ..... CHECK IN
If valve remains closed and it is not possible to restart the affected engine, land at the nearest suitable airport.
PRECAUTIONARY ENGINE
SHUTDOWN Procedure..... ACCOMPLISH
If engine is running normally, disregard the message.

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ENGINE FUEL SHUTOFF VALVE CLOSED

EICAS ADVISORY: E1 (2) FUEL SOV CLSD

Fire Extinguishing Handle ..... CHECK IN
If valve is open and engine is running normally, disregard the message.
If valve remains closed and it is not possible to restart the affected engine:
PRECAUTIONARY ENGINE SHUTDOWN Procedure ..... ACCOMPLISH
Land at the nearest suitable airport.

APU FUEL SHUTOFF VALVE FAILED

EICAS CAUTION: APU FUEL SOV INOP

LIGHT: Master Caution

Check that APU Fuel Shutoff Button is not pressed.
If valve remains closed and it is not possible to restart the APU:
APU Master Knob ..... OFF
If APU is running normally, disregard the message.

APU FUEL SHUTOFF VALVE CLOSED

EICAS ADVISORY: APU FUEL SOV CLSD

If valve is open and APU is running normally, disregard the message.

APU FUEL LOW PRESSURE

EICAS CAUTION: APU FUEL LO PRESS
LIGHT: Master Caution

Select another right electric fuel pump on the associated tank.
If message remains, repeat the procedure. If MFD is available check pumps operation on MFD Fuel Page.

FUEL CROSSFEED OPEN

EICAS ADVISORY: FUEL XFEED OPEN

If not required, close crossfeed.

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CROSSFEED OPERATION

NOTE: Crossfeed must be OFF during takeoff and landing.

If fuel imbalance is verified:

Attitude ..... WINGS LEVELED

If left wing presents lower level:

Crossfeed Selector LOW1

If right wing presents lower level:

Crossfeed Selector LOW2

Avoid rapid thrust levers movement.

Monitor fuel imbalance. When the desired balance is achieved:

Crossfeed Selector ..... OFF

FUEL CROSSFEED MISCOMMAND

EICAS CAUTION: FUEL EQ XFEED OPN

Crossfeed Selector Knob ..... OFF
Fuel Imbalance..... CHECK
Crossfeed Selector Knob ..... AS REQUIRED
Check Crossfeed Selector Knob properly positioned to correct wing fuel imbalance.

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AUXILIARY POWER UNIT

APU OIL LOW PRESSURE/OIL HIGH TEMPERATURE

EICAS CAUTION: APU OIL LO PRESS, APU OIL HI TEMP
LIGHT: Master Caution

If the APU is not essential for the flight:
APU ..... SHUTDOWN

If APU is essential, monitor APU EGT and RPM.
If the APU EGT enters the red or amber range, apply the APU OVERTEMPERATURE Procedure.

If RPM enters red range:
APU ..... SHUTDOWN

APU AUTOMATIC SHUTDOWN

EICAS CAUTION: APU FAIL
LIGHT: Master Caution

If shutdown occurs with APU running:
Do not try to restart the APU.

If shutdown occurs during APU start cycle and provided there is no obvious safety hazard:
APU Start Procedure ..... AS REQUIRED
If APU fails to restart, two more APU start attempts may be accomplished.

NOTE: Refer to APU STARTER LIMITS in AOM Limitations section between start attempts.

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POWER PLANT

ENGINE FAILURE

Remaining Engine Thrust Rating..... CON
Altitude..... MAX 25000 ft
MINIMUM MEA
ENGINE AIRSTART Procedure ..... AS REQUIRED
TCAS ..... TA ONLY

WARNING: IF IN ICING CONDITIONS, REFER TO SINGLE ENGINE OR SINGLE BLEED OPERATION IN ICING CONDITIONS PROCEDURE.

In flight, the air conditioning pack valves will close automatically when:

- For AE3007A or AE3007A1/1 engines Pre-Mod. SB 145-73-0010: below 15000 ft, TAT above -18°C and the remaining engine at T/O-1 or CON mode.
- For AE3007A1 engines and AE3007A or AE3007A1/1 engines Post-Mod. SB 145-73-0010: below 9700 ft, TAT above 19°C at sea level, decreasing linearly to -5°C at 9700 ft and the remaining engine is at T/O-1 mode.
- For AE3007A1P or AE3007A1/3 engines: below 9700 ft, TAT above 19°C at sea level, decreasing linearly to -5°C at 9700 ft and the remaining engine is at T/O or T/O RSV mode.

If APU bleed is being used, the packs are not shut down.

ONE ENGINE INOPERATIVE APPROACH AND LANDING

Inoperative Engine Thrust Lever ..... IDLE
Landing Gear ..... DOWN
Thrust Rating ..... TAKEOFF
MODE

When landing is assured:
Flaps ..... 22°
Airspeed..... V_{REF45} + 10
KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.48.

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ONE ENGINE INOPERATIVE GO-AROUND

Quick Disconnect Button..... PRESS
Go Around Button ..... PRESS
Operative Engine Thrust Lever ..... MAX

NOTE: If during approach an engine fails and a go around is initiated, advance both thrust levers to MAX.

Rotate to go-around attitude (10° nose up).
Flaps ..... 9°
With positive rate of climb:
Landing Gear ..... UP
Minimum Airspeed ..... APPROACH CLIMB SPEED
At level off height, proceed as for TAKEOFF WITH ENGINE FAILURE Procedure.

NOTE: - Limiting bank angle to 5° towards operative engine improves climb performance.
- During GO-AROUND procedure, the DON'T SINK aural warning may sound. In this case monitor the sink rate and follow the GO-AROUND guidance.

ENGINE ROTOR BURST

CONDITION: Depending on the burst direction, one of the following conditions may be verified: E1 (or E2) FIREDET FAIL message displayed simultaneously with engine failure, or a sudden cabin depressurization, or impact noise, or hydraulic system failure.

ENGINE FIRE, SEVERE DAMAGE
OR SEPARATION Procedure..... APPLY

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ABNORMAL ENGINE START

Abort engine start immediately when:

- Only on ground, no light-up in 10 seconds after the first fuel flow indication.

NOTE: The start should not be aborted if fuel flow drops to zero pph immediately after light-up.

- ITT approaches start limit.
- N2 remains steady or decreases for more than 30 seconds after light off.
- N2 indicates no rotation up to 10 seconds after the start command.
- Any unusual noise or vibration occurs.
- Engine instruments indicate abnormal conditions.
- Visible burning on the exhaust pipe.
- Oil pressure does not reach at least 34 psi after the engine reaches stabilized idle.

To abort start:
Associated Thrust Lever..... IDLE
Start/Stop Selector ..... STOP

If fire occurs or engine does not shutdown:
Fire Extinguishing Handle..... PULL
ENGINE DRY MOTORING Procedure..... ACCOMPLISH

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ENGINE DRY MOTORING

Dry motor the engine for a minimum of 30 seconds to clear it of unburned fuel prior to attempting another start.

FADEC Control Knob..... ALTN

Check alternation of FADEC-in-control indication on the EICAS.

CAUTION: IF FADEC DOES NOT ALTERNATE, DO NOT PROCEED WITH THE ENGINE DRY MOTORING.

Ignition..... OFF

Check IGN OFF indication on EICAS display.

Start/Stop Selector..... START, THEN RUN

NOTE: If N2 indicates no rotation after 10 seconds, abort dry motoring attempt immediately.

After 30 seconds:

Start/Stop Selector..... STOP

Ignition Selector..... AUTO

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PRECAUTIONARY ENGINE SHUTDOWN

CONDITION: Engine malfunction that is likely to result in an engine damage.

Associated Thrust Lever ..... IDLE
Associated Start/Stop Selector ..... STOP

NOTE: - In the event of a thrust lever inoperative above Flight Idle, engine may be shutdown using associated engine fire handle.

- Engine will not shutdown with the Start/Stop Selector unless associated Thrust Lever is first moved to IDLE. If STOP is selected before Thrust Lever is retarded to IDLE, momentarily cycle START/STOP Selector to RUN and back to STOP.

If engine shutdown does not occur:

Fire Extinguishing Handle ..... PULL (DO NOT ROTATE)
Remaining Engine Thrust Rating ..... CON
Verify N2 and ITT decreasing below IDLE values.
APU ..... START
APU Bleed ..... AS REQUIRED
Crossbleed ..... AS REQUIRED
Land at the nearest suitable airport.
TCAS ..... TA ONLY

WARNING: IF IN ICING CONDITIONS, REFER TO SINGLE ENGINE OR SINGLE BLEED OPERATION IN ICING CONDITIONS PROCEDURE.

In flight, the air conditioning pack valves will close automatically when:

- For AE3007A or AE3007A1/1 engines Pre-Mod. SB 145-73-0010: below 15000 ft, TAT above -18°C and the remaining engine at T/O-1 or CON mode.
- For AE3007A1 engines and AE3007A or AE3007A1/1 engines Post-Mod. SB 145-73-0010: below 9700 ft, TAT above 19°C at sea level, decreasing linearly to -5°C at 9700 ft and the remaining engine is at T/O-1 mode.
- For AE3007A1P or AE3007A1/3 engines: below 9700 ft, TAT above 19°C at sea level, decreasing linearly to -5°C at 9700 ft and the remaining engine is at T/O or T/O RSV mode.

If APU bleed is being used, the packs are not shut down.

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ENGINE AIRSTART

Affected engine:

One Electric Fuel Pump (A or B) ..... ON
Ignition ..... AUTO
Start/Stop Selector ..... STOP
Engine Bleed ..... CLOSE
Thrust Lever ..... IDLE
Airspeed and Altitude..... REFER TO AIRSTART ENVELOPE

Perform an assisted start or windmilling, as required:

CAUTION: IN ICING CONDITIONS DO NOT USE APU BLEED START, TO AVOID LOSS OF ANTI-ICE SYSTEM PERFORMANCE.

Assisted start:

Crossbleed start:

N2 (operating engine)..... ABOVE 80%
Crossbleed ..... AUTO OR OPEN
Engine Bleed (operating engine)..... OPEN
Start/Stop Selector ..... START, THEN RUN
Engine Indication..... MONITOR

Check ignition. Check N2 rising. Observe limits. Abort start immediately if an Abnormal Engine Start is detected.

APU bleed start:

APU ..... START
APU Bleed..... OPEN
Crossbleed ..... AUTO OR OPEN
Engine Bleed (operating engine)..... CLOSE

If only the APU Generator is operative:

Windshield Heating ..... OFF
Electric Hydraulic Pump (inoperative engine)..... OFF

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Start/Stop Selector..... START, THEN RUN
Engine Indication ..... MONITOR
Check ignition. Check N2 rising. Observe limits. Abort start immediately if an Abnormal Engine Start is detected.

If Windshield Heating and Electric Hydraulic Pump were turned off before engine start:
Windshield Heating..... ON
Electric Hydraulic Pump ..... AUTO

Windmilling start:
Airspeed..... ABOVE 260 KIAS
Minimum N2..... 10%
Start/Stop Selector..... START, THEN RUN
ITT and N2 ..... MONITOR
Observe limits. Abort start immediately if an Abnormal Engine Start is detected.

NOTE: - Windmilling start will be slower than an assisted start.
- Windmilling start with N2 above 30% and increasing, the loss of altitude may be minimized, by reducing airspeed.
- Initiate windmilling start with N2 as high as possible. Windmilling starts are not possible with N2 below 10%. Once N2 is below 10%, it may not be recovered.

After start:

Affected Engine Bleed ..... AS REQUIRED
Crossbleed..... AUTO
APU Bleed ..... AS REQUIRED

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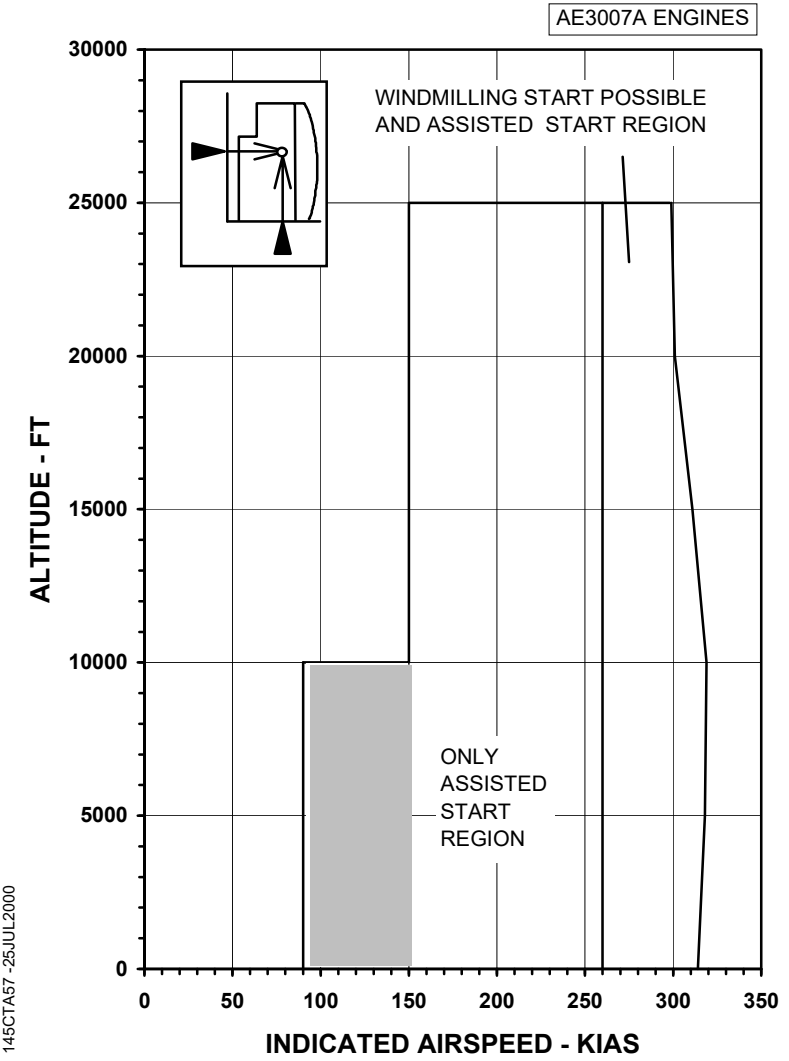
ENGINE AIRSTART ENVELOPE



NOTE: Shaded area may be below 1. 23 V_{SR}

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ENGINE HIGH OIL PRESSURE

Oil Pressure, Oil Temperature,
Oil Level, Engine Vibration ..... MONITOR
If oil temperature, and/or oil level, and/or engine vibration, exceeds normal operation range:
Associated Procedure..... ACCOMPLISH

ENGINE HIGH OIL TEMPERATURE

EICAS Indication: Oil temperature pointers and digits become red.

Associated Thrust Lever ..... REDUCE
Reduce thrust lever and maintain the temperature within limits.
If oil temperature remains high, above 25000 ft:

Altitude ..... MAX 25000 ft
MINIMUM MEA

Monitor oil temperature for the remainder of the flight.
If limits cannot be maintained, perform a precautionary engine shutdown to prevent engine damage.

ENGINE OIL LOW PRESSURE

EICAS Indication: Oil pressure pointers and digits become amber (below 49 psi).

When conditions permit, reduce N2 below 88%, and monitor oil temperature.

ENGINE LOW OIL LEVEL

MFD Indication: Oil level digits become amber.

Monitor oil pressure for the remainder of the flight.
Consider performing a precautionary engine shutdown in order to preserve oil quantity so that engine may be restarted prior to landing.

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ENGINE ATS SHUTOFF VALVE OPEN

EICAS CAUTION: E1 (2) ATS SOV OPN
LIGHT: Master Caution

Associated Bleed (including APU bleed)..... CLOSE
Crossbleed..... CLOSE

On ground:
- Associated Thrust Lever..... IDLE
- Associated Start/Stop..... STOP
- If engine shutdown dows not occur:
  - Fire Extinguishing Handle..... PULL (DO NOT ROTATE)

In flight:
- Altitude..... MAX 25000 ft
- Exit and avoid icing conditions.

ENGINE REFERENCE ANTI-ICE DISAGREE

EICAS CAUTION: ENG REF A/I DISAG
LIGHT: Master Caution

Check ice protection system selection against takeoff data entered.

ENGINE OVERTEMPERATURE

EICAS Indication: ITT pointer and digits become red and flash.

Confirm the affected side.
Associated Thrust Lever..... REDUCE

If the condition remains:
- Associated Bleed..... CLOSE
- Check the associated BLD VLV CLSD message on EICAS:
- Altitude..... MAX 25000 ft MINIMUM MEA
- TCAS..... TA ONLY

If the conditions remains:
- PRECAUTIONARY ENGINE SHUTDOWN or ENGINE FIRE, SEVERE DAMAGE OR SEPARATION Procedure..... ACCOMPLISH

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ENGINE CONTROL FAILURE

EICAS CAUTION: E1 (2) CTL FAIL (may be presented)
LIGHT: Master Caution

CAUTION: DO NOT MANUALLY ALTERNATE ASSOCIATED FADECS.

Verify the associated FADEC in control.
Associated FADEC ..... RESET
If FADEC alternates automatically:
Avoid quick movements of the associated Thrust Lever.

NOTE: Thrust Lever movements may cause surge or an uncommanded engine shutdown.

If the associated engine thrust is no longer controllable:
PRECAUTIONARY ENGINE
SHUTDOWN procedure ..... AS REQUIRED

If FADEC does not alternate automatically:
Engine control is recovered.

ENGINE NO TAKEOFF DATA

EICAS CAUTION: ENG NO TO DATA
LIGHT: Master Caution

Enter takeoff data before takeoff.

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THRUST LEVER FAILURE

EICAS CAUTION: ENG1 (2) TLA FAIL
LIGHT: Master Caution

Associated FADEC ..... RESET

If Thrust Lever command is not available:
Associated FADEC ..... ALTN
Check on EICAS that FADEC in control has changed.

If thrust lever still does not respond thrust can be partially controlled through the Thrust Rating Buttons.

PRECAUTIONARY ENGINE
SHUTDOWN Procedure ..... AS REQUIRED

ENGINE NOT DISPATCHABLE

EICAS CAUTION: E1 (2) NO DISP
LIGHT: Master Caution

Crew awareness.

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ENGINE OUT

EICAS CAUTION: ENG1 (2) OUT
LIGHT: Master Caution

If during takeoff, above V_1 and associated with an engine flameout:

TAKEOFF WITH ENGINE
FAILURE Procedure ..... ACCOMPLISH

If in flight:

PRECAUTIONARY ENGINE
SHUTDOWN Procedure ..... ACCOMPLISH
ENGINE AIRSTART Procedure ..... AS REQUIRED
TCAS ..... TA ONLY

FADEC NOT DISPATCHABLE

EICAS CAUTION: FADEC ID NO DISP
LIGHT: Master Caution

Crew awareness.

ADC DATA FAIL

EICAS ADVISORY: E1 (2) ADC DATA FAIL

Confirm the failed side.
Associated FADEC ..... RESET
If the message remains on:
Associated FADEC ..... ALTN
Check on EICAS that the associated FADEC in control has changed.
If the message remains on:
Avoid unnecessary rapid thrust levers movement.

THRUST LEVER STOP FAILURE

EICAS ADVISORY: E1 (2) IDL STP FAIL

Be careful when reducing engines near IDLE.

NEVER SET THRUST LEVERS BELOW IDLE IN FLIGHT.

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ENGINE ABNORMAL VIBRATION

EICAS Indication: Vibration in the amber range below 2.5 IPS for more than 5 minutes during the takeoff or go-around phases or for more than 10 seconds during the remainder flight phases or equal or above 2.5 IPS.

Associated Thrust Lever ..... REDUCE TO KEEP VIBRATION WITHIN LIMITS

CAUTION: CONTINUOUS VIBRATION ABOVE LIMITS MAY DAMAGE THE ENGINE.

TCAS ..... TA ONLY

If vibration indication remains out of limits:
PRECAUTIONARY ENGINE SHUTDOWN Procedure..... ACCOMPLISH

ENGINE FUEL FILTER IMPENDING BYPASS

EICAS ADVISORY: E1 (2) FUEL IMP BYP

If both engine fuel filters are affected:
Land at the nearest suitable airport.

ENGINE OIL FILTER IMPENDING BYPASS

EICAS ADVISORY: E1 (2) OIL IMP BYP

Crew awareness.

ENGINE FADEC DEGRADED

EICAS ADVISORY: E1 (2) CTL A (B) DEGRAD

Crew awareness.

ENGINE SHORT DISPATCHABLE

EICAS ADVISORY: E1 (2) SHORT DISP

Crew awareness.

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CHECK ENGINE PERFORMANCE

EICAS ADVISORY: CHECK A (A1, A1E, A1P, A3, A1/3) PERF

Associated Engine Performance..... CHECK

LOSS OF ENGINE INDICATIONS

CONDITION: Loss of Thrust Mode, ITT, N1 and N2 indications.

If engine is operative but the indications are lost, proceed:

Associated FADEC ..... RESET

If engine indications are still not available:

Associated FADEC ..... ALTN

If engine indications are still not available:

Monitor the remaining engine indications.

PRECAUTIONARY ENGINE
SHUTDOWN Procedure..... AS REQUIRED

ENGINE LIMITS EXCEEDANCE

EICAS CAUTION: E1 (2) EXCEEDANCE

Do not takeoff:

ENGINE FPMU NOT DISPATCHABLE

EICAS CAUTION: E1 (2) FPMU NO DISP

Do not takeoff.

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HYDRAULIC POWER

BOTH HYDRAULIC SYSTEMS FAILURE

EICAS CAUTION: HYD SYS 1-2 FAIL, RUDDER SYS 1-2 INOP, AIL SYS 1-2 INOP

EICAS ADVISORY: E1-2 HYD PUMP FAIL

LIGHT: Master Caution

INDICATION: Hydraulic pressure indication on MFD may be amber.

Airspeed..... MAXIMUM 250 KIAS

Check hydraulic systems fluid quantity:

If any hydraulic system fluid quantity is in green range:

Associated Electric Hydraulic Pump..... ON

If any hydraulic system fluid quantity is in amber range:

Associated Electric Hydraulic Pump..... OFF

CAUTION: DO NOT OPEN THE SPEED BRAKE.

If one system can be recovered, complete the appropriate procedure for one hydraulic system failure.

If both systems remain inoperative:

Quick Disconnect Button ..... PRESS

Both Electric Hydraulic Pumps ..... OFF

NOTE: The nose landing gear doors will open, therefore the pilot should expect noise increase.

ABNORMAL LANDING GEAR EXTENSION Procedure ..... ACCOMPLISH

Rudder and aileron are operating under mechanical reversion mode. Expect greater rudder pedals and control wheels control forces. Both pilots should act together to control the airplane, if required. Consider the use of aileron and asymmetric thrust to help in yaw control.

Land at the nearest suitable airport. Avoid landings at airports with anticipated crosswind or turbulence. Perform a long final approach.

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Approach and landing configuration:
- Landing Gear ..... DOWN
- Flaps ..... 22°
- Airspeed ..... $V_{REF\ 45}$ + 30 KIAS

Use rudder for directional control on the ground.

EMERGENCY BRAKE
- TECHNIQUE Procedure ..... ACCOMPLISH

Do not attempt to taxi.

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 3.45.

HYDRAULIC SYSTEM 1 FAILURE

EICAS CAUTION: HYD SYS 1 FAIL, RUDDER SYS 1 INOP, AIL SYS 1 INOP

EICAS ADVISORY: E1 HYD PUMP FAIL

LIGHT: Master Caution

INDICATION: Hydraulic pressure indication on MFD may be amber.

Check hydraulic systems fluid quantity:
- If hydraulic system fluid quantity is in green range:
  - Electric Hydraulic Pump 1 ..... ON
- If hydraulic system fluid quantity is in amber range:
  - Electric Hydraulic Pump 1 ..... OFF

If hydraulic power is not recovered:
- Airspeed ..... MAXIMUM 250 KIAS
- Electric Hydraulic Pump 1 ..... OFF

NOTE: As the nose landing gear doors will open, the pilot should expect a noise increasing during flight.

For landing gear extension:
- ABNORMAL LANDING GEAR EXTENSION Procedure ..... ACCOMPLISH

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Do not actuate left Thrust Reverser.
Use rudder and differential braking technique for directional control on ground.

Approach and landing configuration:
- Landing Gear..... DOWN
- Flaps..... 45°
- Airspeed ..... $V_{REF\ 45}$

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.60.

NOTE: The following systems will be inoperative: Inboard Spoiler, Outboard Brakes, LH Thrust Reverser, Landing Gear Extension, Steering and Nose Landing Gear Doors Retraction.

HYDRAULIC SYSTEM 2 FAILURE

EICAS CAUTION: HYD SYS 2 FAIL, RUDDER SYS 2 INOP, AIL SYS 2 INOP

EICAS ADVISORY: E2 HYD PUMP FAIL

LIGHT: Master Caution

INDICATION: Hydraulic pressure indication on MFD may be amber.

Check hydraulic systems fluid quantity:
- If hydraulic system fluid quantity is in green range:
  - Electric Hydraulic Pump 2 ..... ON
- If hydraulic system fluid quantity is in amber range:
  - Electric Hydraulic Pump 2 ..... OFF

If hydraulic power is not recovered:
- Airspeed..... MAXIMUM 250 KIAS
- Electric Hydraulic Pump 2 ..... OFF
- Do not actuate right Thrust Reverser.

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Approach and landing configuration:
Landing Gear ..... DOWN
Flaps ..... 45°
Airspeed ..... $V_{REF\ 45}$

CAUTION: • DO NOT OPEN THE SPEED BRAKE.

• TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.53.

NOTE: - The following systems will be inoperative: Outboard Spoiler, Inboard Brakes, RH Thrust Reverser, and Emergency/Parking Brake.

- The Emergency/Parking Brake will be available only with the accumulator charge.

HYDRAULIC SYSTEM OVERHEAT

EICAS CAUTION: HYD SYS 1 (2) OVHT
LIGHT: Master Caution

Associated Engine Hydraulic Pump ..... SHUTOFF
Associated Electric Hydraulic Pump ..... OFF
Airspeed ..... MAXIMUM 250 KIAS

For the remainder of flight, if required:
Affected Hydraulic system ..... 15 MINUTES OFF, 1 MINUTE ON

During approach and landing or when required:
Affected Hydraulic system ..... ON

After reaching taxi speed or when the system is no longer required:
Affected Hydraulic system ..... OFF

NOTE: To turn the hydraulic system on, first turn the electric pump to AUTO. As soon as the system pressure is recovered, release the engine pump shutoff button.

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HYDRAULIC SYSTEM LOW QUANTITY

EICAS ADVISORY: HYD1 (2) LO QTY
MFD INDICATION: Hydraulic fluid quantity may be amber.

Monitor associated hydraulic system.

NOTE: If hydraulic system 2 is affected, do not open the Speed Brakes.

If HYD SYS 1 FAIL message is presented:

HYDRAULIC SYSTEM 1 FAILURE Procedure ..... ACCOMPLISH

If HYD SYS 2 FAIL message is presented:

HYDRAULIC SYSTEM 2 FAILURE Procedure ..... ACCOMPLISH

HYDRAULIC ENGINE PUMP FAILURE

EICAS ADVISORY: E1 (2) HYD PUMP FAIL

Monitor associated hydraulic system.

If HYD SYS 1 FAIL message is presented:

HYDRAULIC SYSTEM 1 FAILURE Procedure ..... ACCOMPLISH

If HYD SYS 2 FAIL message is presented:

HYDRAULIC SYSTEM 2 FAILURE Procedure ..... ACCOMPLISH

HYDRAULIC PUMP SELECTED OFF

EICAS ADVISORY: HYD PUMP SELEC OFF
Electric Hydraulic Pumps..... AUTO

HYDRAULIC SHUTOFF VALVE CLOSED

EICAS ADVISORY: E1 (2) HYDSOV CLSD
If valve is not intentionally closed:
Engine Pump Shutoff Button ..... CHECK NOT PRESSED

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LANDING GEAR AND BRAKES

GEAR LEVER CANNOT BE MOVED TO UP AFTER TAKEOFF

CONDITION: Landing gear cannot be moved to up position after takeoff in the normal manner.

Wait 10 seconds to verify if the LG AIR/GND FAIL message is displayed.

If the message is presented, do not move Landing Gear Lever.

If the message is not presented:

Downlock Release Button ..... PRESS
Landing Gear Lever..... UP

Landing gear lever will be released, permitting gear retraction.

ABNORMAL LANDING GEAR EXTENSION

CONDITION: Landing gear has not extended by normal means.

Landing Gear Lever..... DOWN

Continue accomplishing this procedure even if Landing Gear Lever cannot be moved DOWN.

Gear Electrical Override ..... DOORS

Wait 3 seconds:

Gear Electrical Override ..... GEAR
Landing Gear Indication ..... CHECK

If any of the gear is not locked down:

Landing Gear Lever..... UP
Gear Electrical Override ..... NORMAL
Wait 10 seconds.
Free Fall Lever ..... ACTUATE

Actuate the free fall lever up to full uplock position.

Landing Gear Lever..... DOWN
Landing Gear Indication ..... CHECK

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If the failure persists:

Free Fall Lever ..... CYCLE

Cycle the free fall lever as long as necessary, but limited to 10 times, to lower the landing gear. Wait 20 seconds, with the lever in the uplock position, between each cycle. Verify lever at full uplock position after cycling.

If the failure still persists:

PARTIAL OR GEAR UP

LANDING Procedure ..... ACCOMPLISH

PARTIAL OR GEAR UP LANDING

EICAS WARNING: LG/LEVER DISAGREE

LIGHT: Master Warning

CONDITION: Airplane committed to land with gear up or in transit.

EICAS Indication: Landing gear indication may present one or more boxes cross-hatched.

Burn fuel to reduce touchdown speed.

Passengers/crew ..... PREPARE FOR EMERGENCY LANDING AND EVACUATION PROCEDURE

Prior to approach:

Inhibit GPWS and landing gear warning by pulling their circuit breakers:

GPWS Circuit Breaker ..... J7 or J8

Aural Warning Circuit Breakers ..... B4 AND E30

Emergency Lights ..... ON

Electric Hydraulic Pumps ..... OFF

Engine Bleeds ..... OFF

Pressurization Dump Button ..... PRESS

Flaps ..... 45°

Landing Gear ..... AS REQUIRED

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NOTE: - The decision to land with all gear up or with any gear extended is left to pilots. The choice of configuration is made with basis on the number of gears available, airplane load distribution, controllability, and conditions of the landing field.

- In case one main gear leg is not down and locked, it is recommended that a gear up landing should be considered.

Landing Briefing ..... PERFORM

Just before touchdown:

Cabin ..... ANNOUNCE IMPACT

Apply thrust reversers (if available) at touchdown. Ground spoilers, thrust reversers, steering and normal brakes will not operate if any main gear is up.

Rudder is available to maintain runway centerline during initial landing phase.

Maintain wings level as long as possible and use brakes and steering (if available) for directional control.

After the airplane comes to a complete stop:

Start/Stop Selector ..... STOP
Electric Fuel Pumps ..... OFF
Fire Extinguishing Handles ..... PULL AND ROTATE

EMERGENCY EVACUATION

Procedure ..... ACCOMPLISH

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LANDING GEAR AIR/GROUND SYSTEM FAILURE

EICAS CAUTION: LG AIR/GND FAIL
LIGHT: Master Caution

If not in icing conditions:
Icing Conditions ..... AVOID

If in icing conditions:
Anti-icing system ..... MONITOR

If any anti-ice valve does not open or anti-ice failure messages appear, exit and avoid icing conditions.

After exiting icing conditions, proceed as follows:
Maximum Bank Angle ..... 30°
Minimum Airspeed for
Flaps up or 9° ..... 190 KIAS

Approach and Landing Configuration:
Landing Gear ..... DOWN
Flaps ..... 45°
Airspeed ..... $V_{REF\ 45}$

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.70.

NOTE: - Thrust Reversers, and Ground Spoiler may not be available. Depending on the failed condition, Ground Idle may not be selectable. Refer to the associated abnormal procedures.

- If message is presented on ground, one pair of brakes (below 10 kt ground speed) and Steering may not be available. Refer to the associated abnormal procedures.

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BRAKE OVERHEAT

EICAS CAUTION: BRAKE OVERHEAT
LIGHT: Master Caution

If during landing and runway length is enough:
- Brake Pressure ..... REDUCE
- Use of full reverse thrust is recommended.

If after takeoff:
- Lower landing gear for cooling as soon as possible.
- Airspeed ..... BELOW 200 KIAS
- Retract gear when brakes temperature is in the green range.
- If MFD is not available, retract gear after message is removed.
- Airspeed ..... AS REQUIRED

When on ground, park the airplane as soon as possible.

Before next takeoff:
- Brakes Temperature ..... CHECK IN GREEN RANGE

If Brakes Temperature Monitoring System is not available:
- Quick Turn Around Chart ..... CHECK
- Wheel Thermal Plugs ..... CHECK

NOTE: - Brake effectiveness may be reduced.
- A positive way to check Wheel Thermal Plugs is to verify that none of the tires are flat.

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BRAKES INOPERATIVE

EICAS CAUTION: BRK OUTBD (INBD) INOP
LIGHT: Master Caution

If one pair of brakes is inoperative, apply brakes normally through the pedals.

If both pair of brakes are inoperative:

EMERGENCY BRAKING
TECHNIQUE Procedure. ..... ACCOMPLISH

In any case:

Landing configuration:
Flaps ..... 45°
Airspeed ..... $V_{REF\ 45}$
During landing run:
Thrust Levers ..... REVERSE

CAUTION: IN BOTH CASES, TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1. 45.

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BRAKES DEGRADED

EICAS CAUTION: BRAKE DEGRADED
LIGHT: Master Caution

Apply brakes normally.
Brake effectiveness may be reduced and braking asymmetry may be felt.

During landing run:
Thrust Levers (if available) ..... REVERSE

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.24.

EMERGENCY BRAKING TECHNIQUE

Pull the emergency brake handle carefully and continuously until the first airplane reaction. Use the parking brake light as a reference for brake application. Modulate brake application until the airplane achieves the desired deceleration.
In case of airplane skidding, release the handle and pull it again as required.

NOTE: Anti-skid protection is not available for emergency/parking brake.

EMERGENCY/PARKING BRAKE LOW PRESSURE

EICAS CAUTION: EMRG BRK LO PRES
LIGHT: Master Caution

If necessary to use the emergency/parking brake, apply it in advance (brake response may be delayed).
When parking the airplane, use wheel blocks.

EMERGENCY/PARKING BRAKE HANDLE DISAGREE

INDICATION: BRAKE ON light illuminated with Emergency/Parking Brake handle not actuated.

Park the airplane as soon as possible.
Do not takeoff.

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STEERING SYSTEM INOPERATIVE OR UNCOMMANDED SWERVING ON GROUND

EICAS CAUTION: STEER INOP (may be presented)
LIGHT: Master Caution

Steering Handwheel	DO NOT USE
Steering Disengagement Button	PRESS

Control the airplane using differential brakes and rudder.
Consider the use of differential thrust reverser if serviceable.

NOTE: Do not actuate the steering handwheel since it will reengage the steering system and will disable the 7° maximum nose wheel deflection protection. This may cause the nose wheel to be steered up to its limit and may exacerbate the swerving effect.

NOSE LANDING GEAR DOOR OPEN

CONDITION: Noise increase due to nose landing gear doors open.

Airspeed	MAX 250 KIAS
Icing Conditions	AVOID/EXIT
Fuel Consumption	MONITOR
ABNORMAL LANDING GEAR EXTENSION Procedure	AS REQUIRED

TIRE BURST

CONDITION: Abnormal noise from any landing gear, visual cues or report of tire burst.

If failure has occurred during takeoff, do not retract gear. Allow a reasonable time for wheels spin down and tires cooling.

PARKING BRAKE RESIDUAL PRESSURE

CONDITION: BRAKE light remained illuminated with Parking Brake Handle released.

Do not attempt to taxi or takeoff.
If required, taxi the minimum distance necessary to clear the area.

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FLIGHT CONTROLS

RUDDER/YAW TRIM RUNAWAY

Quick Disconnect Button	PRESS AND HOLD
Rudder Systems 1 and 2	OFF

Yaw Trim Circuit Breaker (F12) ..... PULL
Quick Disconnect Button ..... RELEASE

Strongly push pedal opposite to the side of the uncommanded yaw, while applying ailerons to control roll.

If necessary, turn on one rudder system at a time to identify the failed system. Prepare to overcome the yaw generated by the failed system.

If both systems remains inoperative:

Expect greater rudder pedals force. Both pilots should act together to control the airplane, if required. Consider the use of aileron to help in yaw control, and asymmetric thrust to trim the airplane.

Do not use yaw trim system for the remainder of the flight.

Avoid landing at airports with anticipated turbulence or crosswind.

Land at the nearest suitable airport.

CAUTION: DO NOT TRY TO RESET THE RUDDER SYSTEMS.

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AILERON SYSTEM INOPERATIVE

EICAS CAUTION: AIL SYS 1 (2) INOP
LIGHT: Master Caution

Associated Aileron System ..... OFF
Airspeed ..... MAXIMUM 250 KIAS

If the remaining system fails:
- Remaining Aileron System ..... OFF
- Quick Disconnect Button ..... PRESS

Aileron is operating under mechanical reversion mode. Expect greater aileron control force. If required, both pilots should act together to control airplane. Avoid landing at airports with anticipated turbulence or crosswind. Perform a long final approach.

Approach and landing configuration:
- Landing Gear ..... DOWN
- Flaps ..... 22°
- Airspeed ..... $V_{REF\ 45}$ + 30 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.85.

RUDDER OVERBOOST

EICAS CAUTION: RUDDER OVERBOOST
LIGHT: Master Caution

Rudder System 2 ..... OFF

Check that only RUDDER 2 SYS INOP message is presented on EICAS.

If the message disappears:
- Continue flight with rudder system 2 off.
- Below 135 KIAS:
  - Rudder System 2 ..... ON

If message remains:
- Rudder System 2 ..... ON
- Rudder System 1 ..... OFF
- Check that only RUDDER 1 SYS INOP message is presented on EICAS.
- Continue flight with the rudder system 1 off.
- Below 135 KIAS:
  - Rudder System 1 ..... ON

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RUDDER HARDOVER PROTECTION FAILURE

EICAS CAUTION: RUD HDOV PROTFAIL
LIGHT: Master Caution

On ground:
Do not takeoff.

In flight:
Hardover protection is not available.

RUDDER SYSTEM INOPERATIVE

EICAS CAUTION: RUDDER SYS 1(2) INOP or RUDDER SYS 1-2 INOP
LIGHT: Master Caution

If only one rudder system is affected:
Affected Rudder System..... OFF

If RUDDER SYS 1-2 INOP message is displayed:
Rudder System 2..... OFF

If RUDDER SYS 1-2 INOP message is still displayed:
Rudder System 1..... OFF

CAUTION: IF THE MESSAGE IS PRESENTED FOLLOWING A RUDDER RUNAWAY, DO NOT TURN ON THE SYSTEMS.

Both Rudder Systems ..... ON

If RUDDER SYS 1-2 INOP message is still displayed:
Expect greater rudder pedal force. If required, both pilots should act together to control the airplane. Consider the use of aileron to help in yaw control, and asymmetric thrust to control the airplane.

Avoid landing at airports with anticipated turbulence, gusts or crosswind.

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FLAP SYSTEM FAILURE
(APPLICABLE TO ALL MODELS EXCEPT EMB-145 XR)

EICAS CAUTION: FLAP FAIL
LIGHT: Master Caution
CONDITION: Flap operation is not possible. Flap position indication may be amber.

Flaps may be at intermediate positions. Maintain airspeed according to the following:

FLAPS POSITION	MAXIMUM AIRSPEED
1° to 9°	250 KIAS
10° to 22°	200 KIAS
23° to 45°	145 KIAS

When landing maintain airspeed according to the following:

FLAPS POSITION	MINIMUM AIRSPEED
0 to 8°	$V_{REF\ 45}$ + 30 KIAS
9° to 21°	$V_{REF\ 45}$ + 10 KIAS
22° to 44°	$V_{REF\ 45}$ + 5 KIAS
45°	$V_{REF\ 45}$

CAUTION:
- TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.65 WHEN LANDING WITH FLAPS BETWEEN ZERO AND 8°.
- TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.40 WHEN LANDING WITH FLAPS BETWEEN 9° AND 21°.
- TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.40 WHEN LANDING WITH FLAPS BETWEEN 22° AND 44°.

NOTE:
- Depending on the flap position, EGPWS/GPWS warnings may sound. If necessary, inhibit EGPWS/GPWS by pulling its circuit breaker (J7 or J8).
- If flap indication on EICAS is not available, use flap position marks on the wing.

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FLAP SYSTEM FAILURE (APPLICABLE TO EMB-145XR MODEL)

EICAS CAUTION: FLAP FAIL
LIGHT: Master Caution
CONDITION: Flap operation is not possible. Flap position indication may be amber.

Flaps may be at intermediate positions. Maintain airspeed according to the following:

FLAPS POSITION	MAXIMUM AIRSPEED	ABOVE 10000 ft AND Y/D DISENGAGED
1° to 9°	250 KIAS	250 KIAS
10° to 22°	200 KIAS	180 KIAS
23° to 45°	160 KIAS	145 KIAS

When landing maintain airspeed according to the following:

FLAPS POSITION	MINIMUM AIRSPEED
0 to 8°	$V_{REF\ 45}$ + 30 KIAS
9° to 21°	$V_{REF\ 45}$ + 10 KIAS
22° to 44°	$V_{REF\ 45}$ + 5 KIAS
45°	$V_{REF\ 45}$

CAUTION:
- TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.65 WHEN LANDING WITH FLAPS BETWEEN ZERO AND 8°.
- TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.40 WHEN LANDING WITH FLAPS BETWEEN 9° AND 21°.
- TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.40 WHEN LANDING WITH FLAPS BETWEEN 22° AND 44°.

NOTE:
- Depending on the flap position, EGPWS/GPWS warnings may sound. If necessary, inhibit EGPWS/GPWS by pulling its circuit breaker (J7 or J8).
- If flap indication on EICAS is not available, use flap position marks on the wing.

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SPEED BRAKE LEVER DISAGREE

EICAS CAUTION: SPBK LVR DISAGREE
LIGHT: Master Caution

Speed Brake Lever ..... CLOSE

FLAP LOW ACTUATION SPEED

EICAS ADVISORY: FLAP LOW SPEED

Anticipate flap actuation.

LOSS OF PITCH OR ROLL COMMAND

CONDITION: Pitch or roll commands are not effective.

If loss of command by one pilot is total or partial, command will be taken over by the other pilot.

If a subsequent jamming occurs:

Affected Surface Disconnection Handle ..... PULL

If the failure persists, control the airplane using rudder, trims, aileron and asymmetric thrust, as required.

Avoid landing at airports with anticipated turbulence or crosswind.

UNCOMMANDED ELEVATOR OR AILERON DISCONNECTION

LIGHT: Amber ELEV DISC or AIL DISC on Control Stand.
CONDITION: One control column or control wheel moves independently of the other.

Affected Surface Disconnection Handle ..... PULL

Avoid landing at airport with anticipated turbulence or crosswind.

NOTE: Since aileron artificial feel unit is installed in the copilot's side, avoid use of pilot's control wheel, when aileron is disconnected.

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AILERON ARTIFICIAL FEEL INOPERATIVE

CONDITION: Control Wheel inputs become light and do not center by itself.

Airspeed ..... BELOW 200 KIAS

Do not make sudden and large aileron inputs.

RUDDER ARTIFICIAL FEEL INOPERATIVE

CONDITION: Rudder pedals become extremely light and do not center by themselves. Yaw trim does not operate properly, although its pictorial indicates normal condition.

Rudder System 2 ..... OFF

If the failure persists:

Rudder System 1 ..... OFF

RUDDER MECHANICAL REVERSION MODE Procedure ..... APPLY

ASYMMETRIC RUDDER OPERATION

CONDITION: Rudder pedals require more effort to be moved to one side than the other. Also, the rudder and yaw trim commands provide different results for both sides.

Rudder System 2 ..... OFF

If the failure persists:

Rudder System 2 ..... ON

Land at the nearest suitable airport.

The remainder of the flight should be made with both rudder systems operational, which provides better rudder performance than in mechanical reversion mode.

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GUST LOCK FAILURE

LIGHT: GUST LOCK (amber)

On ground:

Do not takeoff.

In flight:

Do not push control column full Nose Down.
Avoid flying in turbulence conditions.
Consider diversion.
Avoid landing at airports with anticipated turbulence or crosswind.

NOTE: This procedure is applicable only to airplanes equipped with electromechanical gust lock system.

PITCH TRIM SWITCH INOPERATIVE

EICAS CAUTION: PTRIM CPT SW FAIL, PTRIM F/O SW FAIL,
PTRIM BKP SW FAIL

On ground:

Deenergize the airplane and energize it again.

In flight:

Use another serviceable switch.

STIFFENED ELEVATOR

EICAS WARNING: AUTOPILOT FAIL (may be presented),
SPS 1-2 INOP (may be presented)
EICAS CAUTION: STICK PUSHER FAIL (may be presented)
CONDITION: Elevator control columns movement is stiffened.

Autopilot ..... DISENGAGE
Pitch Trim ..... AS REQUIRED

Avoid abrupt and large elevator inputs.

Consider descent to a warmer altitude.

Freezing conditions may lead to de/anti-icing fluids residues to stiffen the elevator.

If the elevator control columns movement is not recovered:

JAMMED ELEVATOR Procedure ..... ACCOMPLISH

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AIR CONDITIONING, PNEUMATICS AND PRESSURIZATION

BLEED LOW TEMPERATURE

EICAS Caution: BLD 1 (2) LOW TEMP
LIGHT: Master Caution
INDICATION: Pointer on MFD may be out of view or indication may be amber.

If temperature indication on MFD (ECS and Pneumatic Page) is in the green range or the pointer is out of view, disregard the message.
Monitor the bleed temperature.

If the pointer on MFD indicates low temperature (white range):

Associated Thrust Lever ..... ADVANCE

Adjust associated Thrust Lever until the message disappears or until the pointer of the failed side reaches the green range or the remaining pointer.

Advancing Thrust Lever until 86% N2 represents normal system condition.

If the message persists or if the MFD is not available:

Associated Bleed ..... CLOSE
Altitude ..... MAX 25000 ft
MINIMUM MEA

WARNING: IF IN ICING CONDITIONS, REFER TO SINGLE ENGINE OR SINGLE BLEED OPERATION IN ICING CONDITIONS PROCEDURE.

If the message persists, avoid or exit icing conditions.

NOTE: Ice Detection Override Knob must be set to ALL at least 2 minutes after exiting icing conditions or after ICE CONDITION advisory message has disappeared.

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HIGH STAGE VALVE FAILURE

EICAS Caution: HS VLV 1 (2) FAIL
LIGHT: Master Caution

Monitor bleed temperature.
If the bleed temperature is too high:
BLEED OVERTEMPERATURE
Procedure ..... AS REQUIRED

If the bleed temperature is too low:
BLEED LOW TEMPERATURE
Procedure ..... AS REQUIRED

WARNING: IF IN ICING CONDITIONS, REFER TO SINGLE ENGINE OR SINGLE BLEED OPERATION IN ICING CONDITIONS PROCEDURE.

BLEED VALVE FAILURE

EICAS Caution: BLD 1 (2) VLV FAIL
LIGHT: Master Caution

If BLD 2 VLV CLSD message is also displayed on the EICAS:
Crossbleed ..... OPEN
Altitude ..... MAX 25000 ft
MINIMUM MEA

If BLD 1 VLV CLSD message is also displayed on the EICAS:
If APU is not serviceable:
Crossbleed ..... OPEN
Altitude ..... MAX 25000 ft
MINIMUM MEA

If APU is serviceable:
Crossbleed ..... CLOSE
APU ..... START
APU Bleed ..... OPEN

WARNING: IF IN ICING CONDITIONS, REFER TO SINGLE ENGINE OR SINGLE BLEED OPERATION IN ICING CONDITIONS PROCEDURE.

If BLD 1(2) VLV CLSD message is not displayed on the EICAS:
Monitor the system for the remainder of the flight.

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BLEED VALVE CLOSED

EICAS ADVISORY: BLD 1 (2) VLV CLSD

If required and the situation permits:
- Associated Pack ..... OFF THEN ON
- Associated Bleed ..... OPEN

If it is not possible to open bleed valve:
- BLEED VALVE FAILURE Procedure ..... ACCOMPLISH

APU BLEED VALVE FAIL

EICAS Caution: APU BLD VLV FAIL
LIGHT: Master Caution

If valve failed closed:
- Engine Bleed ..... AS REQUIRED

If valve failed open and a duct leak exists (OPEN annunciation in the APU Bleed Button and BLD APU LEAK message displayed):
- APU ..... SHUTDOWN

CROSSBLEED FAILURE

EICAS Caution: CROSS BLD FAIL
LIGHT: Master Caution

If the valve has failed open, associated to a duct leakage or engine overtemperature:
- Both Engine Bleeds ..... CLOSE
- APU Bleed ..... CLOSE
- Altitude ..... MEA OR 10000ft, WHICHEVER IS HIGHER
- Icing Conditions ..... EXIT/AVOID

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CROSSBLEED SELECTED OFF

EICAS Caution: CROSS BLD SW OFF
LIGHT: Master Caution

Crossbleed Knob ..... AUTO

CROSSBLEED OPEN

EICAS ADVISORY: CROSS BLD OPEN

Crew awareness.

RAM AIR VALVE FAILURE

EICAS Caution: RAM AIR VLV FAIL
LIGHT: Master Caution

Air Conditioning System..... MONITOR

If the PACK 1 (2) OVLD or PACK 1 (2) OVHT caution message appears:

- Associated Pack ..... OFF
- Altitude ..... MAX 25000 ft
  MINIMUM MEA

If both packs have been shutoff:

- Altitude ..... MEA OR
  10000 ft,
  WHICHEVER
  IS HIGHER
- Pressurization Mode Selector..... MAN
- Pressurization Manual Controller..... AS REQUIRED
- If necessary:
  - Pressurization Manual Controller ..... FULL UP
  - At least one bleed source, engines or APU, must be kept open.

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PACK OVERLOAD

EICAS Caution: PACK 1 (2) OVLD
LIGHT: Master Caution

Recirculation Fan ..... ON

Associated Temperature & Mode Selector ..... AUTO/
12 O'CLOCK
Associated Pack ..... OFF
Wait 3 minutes.
Associated Pack ..... ON

NOTE: In case the message remains displayed after reset, report to the maintenance personnel.

If the message remains on:
- Associated Temperature & Mode Selector ..... MANUAL/ 12 O´CLOCK
- Associated Pack ..... OFF
- Wait 3 minutes.
- Associated Pack ..... ON

If the message still remains on:
- Associated Pack ..... OFF
- Altitude ..... MAX 25000 ft MINIMUM MEA
- Associated Engine Bleed ..... OPEN

If both packs have been shutoff:
- Altitude ..... MEA OR 10000 ft, WHICHEVER IS HIGHER
- Pressurization Mode Selector ..... MAN
- Pressurization Manual Controller ..... AS REQUIRED
- If required:
  - Pressurization Manual Controller ..... FULL UP

NOTE: At least one bleed source, engines or APU, must be kept open.

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PACK OVERHEAT

EICAS Caution: PACK 1 (2) OVHT
LIGHT: Master Caution

Associated Temperature & Mode
Selector ..... AUTO/FULL COLD
Associated Pack ..... OFF
Wait 3 minutes.
Associated Pack ..... ON
If message remains:
Associated Temperature & Mode
Selector ..... MANUAL/FULL COLD
Associated Pack ..... OFF
Wait 3 minutes.
Associated Pack ..... ON
If the message still remains:
Associated Pack ..... OFF
Altitude ..... MAX 25000 ft MINIMUM MEA
If both packs have been shutoff:
Altitude ..... MEA OR 10000 ft, WHICHEVER IS HIGHER
Pressurization Mode Selector ..... MAN
Pressurization Manual Controller ..... AS REQUIRED
If required:
Pressurization Manual Controller ..... FULL UP

NOTE: At least one bleed source, engines or APU, must be kept open.

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PACK VALVE FAILURE

EICAS Caution: PACK 1 (2) VLV FAIL
LIGHT: Master Caution
If valve failed closed (pack valve closed advisory message is on):
Altitude ..... MAX 25000 ft
MINIMUM MEA

If valve failed open and it is necessary to turn off associated air conditioning system:
Crossbleed ..... CLOSE
Associated Bleed ..... CLOSE
APU Bleed (if left pack failed) ..... CLOSE
Altitude ..... MAX 25000 ft
MINIMUM MEA

WARNING: IF IN ICING CONDITIONS, REFER TO SINGLE ENGINE OR SINGLE BLEED OPERATION IN ICING CONDITIONS PROCEDURE.

If both packs have been shutoff:
Altitude ..... MEA OR 10000 ft, WHICHEVER IS HIGHER
Pressurization Mode Selector ..... MAN
Pressurization Manual Controller ..... AS REQUIRED
If required:
Pressurization Manual Controller ..... FULL UP

NOTE: At least one bleed source, engines or APU, must be kept open.

PACK VALVE CLOSED

EICAS ADVISORY: PACK 1 (2) VLV CLSD
If required and situation permitting:
Associated Pack ..... OFF THEN ON
If it is not possible to open pack valve:
Altitude ..... MAX 25000 ft
MINIMUM MEA

If both packs are closed:
Altitude ..... MEA OR 10000 ft WHICHEVER IS HIGHER

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PRESSURIZATION AUTOMATIC SYSTEM FAILURE/ CABIN DEPRESSURIZATION/ CABIN RATE ABNORMAL FLUCTUATIONS

EICAS Caution: PRESN AUTO FAIL (may be presented)
LIGHT: Master Caution
EICAS INDICATION: Abnormal cabin altitude (amber or red) may be presented.
Erratic cabin rate fluctuations may be presented.

Pressurization Manual Controller ..... 11 O'CLOCK POSITION

NOTE: At least one bleed, engines or APU, must be open.

Pressurization Mode Selector ..... MAN
Wait 20 seconds due to the time response of pressurization system in manual mode.

Pressurization Manual Controller ..... AS REQUIRED
If unsuccessful:
Altitude ..... MEA OR 10000 ft, WHICHEVER IS HIGHER
Pressurization Manual Controller ..... FULL DOWN
Pressurization Mode Selector ..... AUTO
Pressurization Dump Button ..... PRESS

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LOSS OF PRESSURIZATION INDICATION

INDICATION: One or more of the pressurization system indications is not being presented.

Use the remaining indications to maintain cabin altitude below 10000 ft, according to the table below:

AIRPLANE ALTITUDE (ft)	CABIN ALTITUDE (ft)	DIFFERENTIAL PRESSURE (psi)
10000	300	4.4
11000	500	4.7
12000	700	5.0
13000	900	5.2
14000	1100	5.5
15000	1300	5.7
16000	1500	5.9
17000	1700	6.1
18000	1900	6.3
19000	2200	6.5
20000	2400	6.7
21000	2700	6.8
22000	2900	7.0
23000	3200	7.1
24000	3400	7.2
25000	3800	7.3
26000	4100	7.4
27000	4400	7.5
28000	4700	7.6
29000	5000	7.6
30000	5400	7.7
31000	5700	7.7
32000	6100	7.7
33000	6500	7.7
34000	6800	7.8
35000	7200	7.8
36000	7600	7.8
37000	8000	7.8

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ELECTRONIC BAY OVERTEMPERATURE

EICAS Caution: ELEKBAY OVTEMP
LIGHT: Master Caution

Turn off systems and equipment that are redundant or unessential for the current phase of flight.

The following equipment is installed in the forward electronic compartment:

- Air Data Computer (ADC);
- Transponder Mode S;
- Integrated Communication Unit (ICU);
- Aural Warning Computer (AWC);
- Flight Management System (FMS);
- Attitude and Heading Reference System (AHRS);
- Passenger Address;
- Integrated Navigation Unit (INU);
- Inverters;
- Dimmers;
- Backup Battery.

It is recommended to turn off the systems that are unessential, using the table below to assess which system could be turned off. Turn off only systems that are unessential to the present phase of flight.

SYSTEM	POWER OFF CONTROL
Passenger Address	PA CB.....PULL
Dimmers	Panel lights knob (pilot, pedestal and copilot) at left and right side of the glare shield panel .....OFF OR PUSH BUTTONS CB.....PULL
Integrated Navigation Unit	For INU 1: ADF 1 CB, DME 1 CB and VOR/ILS 1 CB.....PULL OR For INU 2: ADF 2 CB, DME 2 CB and VOR/ILS 2 CB.....PULL

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CONTINUED FROM PREVIOUS PAGE

SYSTEM	POWER OFF CONTROL
Inverters	Push out AC PWR Push Button on overhead Electrical System panel. **NOTE:** TCAS and GPWS/Windshear may use 115V AC.

If the message persists, it is recommended to turn off the redundant system and unessential equipment, using the table below to assess which system or equipment could be turned off. Turn off only systems and equipment that are unessential to the present phase of flight.

SYSTEM	POWER OFF CONTROL

FMS	- For Honeywell FMS:
	  - For FMS 1: CMPTR 1 CB.
	  - For FMS 2: CMPTR 2 CB.
	- For Universal FMS:
	  - FMS 1 CB.
	  - FMS 2 CB.
	NOTE: Some airplanes may not be equipped with dual FMS.

Aural Warning Computer	AWS CB.
Transponder Mode S	- For Transponder 1: XPDR 1 CB. - For Transponder 2: XPDR 2 CB.
Integrated Communication Unit	- For ICU 1: XPDR 1 CB and VHF 1 CB. - For ICU 2: XPDR 2 CB and VHF 2 CB.
Attitude and Reference System	- AHRS 1 CB. - AHRS 2 CB.
Air Data Computer	- ADC 1 CB. - ADC 2 CB.
Backup Battery	Backup Power Push Button on overhead Electrical System panel.

If the message remains, maintain a cross-check between main and standby instruments. In case a disagreement arises, assume the main instruments indication is unreliable and land at the nearest suitable airport.

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ICE PROTECTION SYSTEM

WING ANTI-ICING FAILURE

EICAS WARNING: ICE COND-A/I INOP
EICAS CAUTION: WG 1 (2) A/ICE FAIL or WG A/ICE FAIL
LIGHT: Master Warning and Master Caution

Ice Detection Override Knob ..... ALL
Thrust Levers ..... ADVANCE

If failure persists:
Wing Anti-Icing Button ..... CYCLE

If failure persists:
Wing Anti-Icing Button ..... OFF
Avoid or exit icing conditions.

After exiting icing conditions:

Ice Detection Override Knob ..... AUTO

Maximum Bank Angle ..... 30°
Minimum Airspeed for
Flaps up or 9° ..... 190 KIAS

If in icing conditions or if there is any uncertainty as to whether the wing surfaces are clear of ice prior to approach and landing, proceed:

Landing configuration:
Flaps ..... 22°
Airspeed ..... $V_{REF\ 45}$ + 30 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.85.

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STABILIZER ANTI-ICING FAILURE

EICAS WARNING: ICE COND-A/I INOP
EICAS CAUTION: STAB A/ICE FAIL
LIGHT: Master Warning and Master Caution

Ice Detection Override Knob ..... ALL
Thrust Levers ..... ADVANCE

If failure persists:
Stabilizer Anti-Icing Button ..... CYCLE

If failure persists:
Stabilizer Anti-Icing Button ..... OFF
Avoid or exit icing conditions.

After exiting icing conditions:

Ice Detection Override Knob ..... AUTO
Maximum Bank Angle ..... 30°
Minimum Airspeed for
Flaps up or 9° ..... 190 KIAS
Landing configuration:
Flaps ..... 22°
Airspeed ..... $V_{REF\ 45}$ + 15 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.55.

If associated with Wing Anti-icing System failure and if in icing conditions or if there is any uncertainty as to whether the wing surfaces are clear of ice prior to approach and landing, proceed:

Landing configuration:
Flaps ..... 22°
Airspeed ..... $V_{REF\ 45}$ + 30 KIAS

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FORFLAPS 45° BY 1.85.

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ENGINE ANTI-ICING FAILURE

EICAS WARNING: ICE COND-A/I INOP
EICAS CAUTION: E1 (2) A/ICE FAIL
LIGHT: Master Warning and Master Caution

Thrust Levers ..... ADVANCE
If the message persists:
Ice Detection Override Knob ..... ALL
If the message still persists:
Engine Air Inlet Anti-Icing Button ..... CYCLE
If the message still persists:
Icing Conditions ..... AVOID/EXIT
Two minutes after exiting icing conditions:
Ice Detection Override Knob ..... AUTO

NOTE: Ice Detection Override Knob must be set to ALL for at least 2 minutes after exiting icing conditions or after ICE CONDITION advisory message has disappeared. In such condition, caution message NO ICE-A/I ON may be presented, and must be disregarded.

Engine Vibration ..... MONITOR
If vibration increases, advance thrust levers, one at a time, to obtain 60% N1 minimum for 5 seconds, and then return to the former setting.
If vibration increases to unacceptable values or engine parameters indicate abnormal values, exit icing conditions.

SINGLE ENGINE OR SINGLE BLEED OPERATION IN ICING CONDITIONS

Crossbleed ..... OPEN
Altitude ..... MEA OR BELOW 15000 ft, WHICHEVER IS HIGHER

CONTINUES ON NEXT PAGE

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CONTINUED FROM PREVIOUS PAGE

Above 15000 ft:

Anti-icing system performance decreases.

If it is not possible to descend below 15000 ft, failure messages may be presented. In this case, exit icing conditions and refer to the appropriate approach and landing procedure.

Below 15000 ft:

If an anti-icing system failure message is presented, refer to the Associated System Anti-Icing Procedure.

In flight, the air conditioning pack valves will close automatically when:

- For AE3007A or AE3007A1/1 engines Pre-Mod. SB 145-73-0010: below 15000 ft, TAT above -18°C and the remaining engine at T/O-1 or CON mode.
- For AE3007A1 engines and AE3007A or AE3007A1/1 engines Post-Mod. SB 145-73-0010: below 9700 ft, TAT above 19°C at sea level, decreasing linearly to -5°C at 9700 ft and the remaining engine is at T/O-1 mode.
- For AE3007A1P or AE3007A1/3 engines: below 9700 ft, TAT above 19°C at sea level, decreasing linearly to -5°C at 9700 ft and the remaining engine is at T/O or T/O RSV mode.

ANTI-ICING LOW CAPACITY

EICAS WARNING: ICE COND-A/I INOP
EICAS CAUTION: A/ICE LOW CAPACITY
LIGHT: Master Warning and Master Caution

Thrust Lever ..... ADVANCE

Advance Thrust Lever to at least 55% N1 and wait for 5 seconds.

If Thrust Lever advance required to clear the message exceeds 55% N1, report to the maintenance personnel.

If the message still persists, Wing and/or Stabilizer Anti-Icing Failure messages may be presented, then:

Associated System Anti-Icing Failure Procedure ..... PERFORM

ENGINE ANTI-ICING OVERPRESSURE

EICAS ADVISORY: ENG A/ICE OVERPRES

Crew awareness.

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ANTI-ICING ON WITHOUT ICING CONDITIONS

EICAS CAUTION: NO ICE- A/ICE ON
LIGHT: Master Caution

Ice Detection Override Knob..... AUTO
If the message persists, check the overhead panel and turn off all unnecessary anti-ice system.

If the message persists and is associated with Wing or Stabilizer Anti-Icing System:

Altitude..... MAX 25000 ft
MINIMUM MEA
APU ..... START
APU Bleed ..... OPEN
Crossbleed..... OPEN
Engine Bleeds..... CLOSE

ANTI-ICING SWITCH OFF

EICAS CAUTION: A/ICE SWITCH OFF
LIGHT: Master Caution

Turn on all anti-icing system buttons.

ICE DETECTOR FAIL

EICAS CAUTION: ICE DET 1 (2) FAIL or ICE DETECTORS FAIL
LIGHT: Master Caution

Use visual cues (ice accretion on windshield and windshield wipers) and temperature criteria to determine whether icing conditions exist.

When flying in icing conditions:
Ice Detection Override Knob..... ALL

After positively exiting icing conditions:
Ice Detection Override Knob..... AUTO

NOTE: - Icing conditions may exist in flight when Total Air Temperature (TAT) is 10°C or below and visible moisture in any form is present (such as clouds, fog with visibility of one mile or less, rain, snow, sleet, and ice crystals).

- Ice Detection Override Knob must be kept at ALL for at least 2 minutes after exiting icing conditions or after ICE CONDITION advisory message has disappeared. In such condition, caution message NO ICE-A/I ON may be presented, and must be disregarded.

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CLEAR ICE DETECTED (APPLICABLE TO EMB-145XR MODEL)

EICAS CAUTION: CLR ICE 1 (2)
LIGHT: CLR ICE 1(2)
LIGHT: Master Caution

Do not takeoff.
Airplane de-icing is required.
If there is no clear ice on the wing surface, disregard the message.

CLEAR ICE DETECTION SYSTEM FAILURE (APPLICABLE TO EMB-145XR MODEL)

EICAS CAUTION: CLR/I INOP 1 (2)
LIGHT: Master Caution

Check physically if wing surface is free of clear ice before each flight.
If clear ice is found, de-ice the airplane.

WINDSHIELD HEATING FAILURE

EICAS CAUTION: W/S 1 (2) HEAT FAIL
LIGHT: Master Caution

Associated Windshield Heating ..... OFF

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PITOT SENSORS HEATING FAILURE

EICAS CAUTION: PITOT 1 (2, 3) INOP
LIGHT: Master Caution

Information on the instruments supplied by the affected system may be unreliable. Cross-check and do not use the affected system if a disagreement is found.
If the Pitot 3 is the affected one, standby instruments and pressurization system may be affected.

If necessary:
ADC Button (Reversionary Panel) ..... PRESS

AOA SENSOR HEATING FAILURE

EICAS CAUTION: AOA 1 (2) HEAT INOP
LIGHT: Master Warning and Master Caution

Maintain airspeed according to the following:

FLAPS POSITION	MINIMUM AIRSPEED
UP	$V_{REF\ 45}$ + 25 KIAS
9°	$V_{REF\ 45}$ + 5 KIAS
18°	$V_{REF\ 45}$ + 5 KIAS
22°	$V_{REF\ 22}$
45°	$V_{REF\ 45}$

TAT SENSORS HEATING FAILURE

EICAS CAUTION: TAT 1 (2) HEAT INOP
LIGHT: Master Caution

TAS and SAT indication may be unreliable.

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OXYGEN

CREW/PASSENGER OXYGEN LOW PRESSURE

EICAS CAUTION: OXYGEN LO PRESS
CREW (PAX) OXY LOW PRESS
LIGHT: Master Caution
INDICATION: Oxygen pressure may become red or amber on MFD.

Check oxygen pressure on the MFD ECS Page. If message is confirmed or if MFD is not available:

Altitude ..... MEA OR 10000 ft, WHICHEVER IS HIGHER

OXYGEN LEAKAGE

CONDITION: Evidence of oxygen leakage through the crew mask, mask hose, flow indicator (blinker), or oxygen line.

No Smoking ..... ON

If oxygen leakage is verified in the crew mask, mask hose, or flow indicator:

- Stowage Box Doors ..... CLOSE
- Test and Shutoff Sliding Control ..... ACTUATE
- Oxygen Pressure ..... CHECK
- Altitude ..... AS REQUIRED

  If oxygen pressure is below minimum oxygen pressure for dispatch, descend to below 10000 ft or minimum altitude for terrain clearance. The pilot of the affected side should use the crew portable oxygen cylinder, if necessary.

If oxygen leakage is verified in the oxygen line:

- Oxygen Cylinder Shutoff Valve ..... OFF

Altitude ..... MEA OR 10000 ft, WHICHEVER IS HIGHER

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NAVIGATION

AHRS ALIGNMENT

EICAS ADVISORY: AHRS 1 (2) ALN

This message is normally presented during alignment phase. No action is required.

AHRS ALIGNMENT FAULT

EICAS CAUTION: AHRS 1 (2) ALN FAULT
LIGHT: Master Caution

Check and reenter present position. If necessary, reenter present position once again.

AHRS ATTITUDE MODE

EICAS ADVISORY: AHRS 1 (2) ATT MODE

Associated AHRS Reversionary Button ..... PRESS
If cross-side AHRS is not available:

Maintain wings level and constant airspeed until AHRS 1 (2) ALN message is no longer displayed and attitude is recovered (approximately 20 seconds).

CAUTION:
- ATTITUDE OUTPUTS ARE NOT AS ACCURATE AS IN THE NORMAL OPERATIONAL MODE.
- AHRS MAGNETIC HEADING IS NOT AVAILABLE.

NOTE: The Autopilot is not available while AHRS 1 (2) ALN is being displayed.

AHRS BASIC MODE

EICAS ADVISORY: AHRS 1 (2) BASIC MODE

Affected AHRS is reverted to the basic mode due to the TAS signal lost.

AHRS EXCESSIVE MOTION

EICAS ADVISORY: AHRS 1 (2) EXC MOTION

Make sure the airplane is completely stationary.

The AHRS will restart a full alignment 30 seconds after the motion is stopped.

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AHRS FAIL

EICAS CAUTION: AHRS 1 (2) FAIL
LIGHT: Master Caution

Associated AHRS Reversionary Button..... PRESS

NOTE: The Autopilot is not available.

AHRS NO MAGNETIC HEADING

EICAS ADVISORY: AHRS 1 (2) NO MAG HDG

Enter Magnetic Heading.

AHRS NO PRESENT POSITION

EICAS ADVISORY: AHRS 1 (2) NO PPOS

Enter Present Position.

AHRS ON BATTERY

EICAS ADVISORY: AHRS 1 (2) ON BATT

Associated AHRS will operate for 40 minutes.

AHRS OVERHEAT

EICAS CAUTION: AHRS 1 (2) OVERHEAT
LIGHT: Master Caution

AHRS data is valid for 30 minutes after failure. Use standby indicators for reference.

CDU DATA BUS FAIL FMS ANNUNCIATION (UNS-1K)

CONDITION: Affected FMS is not updating CDU.
CDU DATA BUS FAIL message presented on FMS.

Affected FMS ..... OFF, then ON

If CDU DATA BUS FAIL message persists:

Affected FMS ..... OFF

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CENTRAL MAINTENANCE COMPUTER FAILURE

EICAS ADVISORY: CMC FAIL
Crew awareness.

CHECK IC SOFTWARE

EICAS CAUTION: CHECK IC 1 (2) SW
LIGHT: Master Caution
Do not takeoff.

CHECK TRANSPONDER

EICAS CAUTION: CHECK XPDR
LIGHT: Master Caution
Crew awareness.

CHECKLIST MISMATCH

EICAS ADVISORY: CHECKLIST MISMATCH
Do not use Checklist Display.

DAU AIRPLANE ID MISCOMPARE

EICAS CAUTION: DAU AC ID MISCMP
Do not takeoff.

DAU FAILURE

EICAS CAUTION: DAU 1 (2) A FAIL with Master Caution Light or
EICAS ADVISORY: DAU 1 (2) B FAIL
If on ground, do not takeoff.
Confirm the failed side and channel.

For DAU 1 A FAIL caution message proceed:
DAU 1 Reversion..... ON
Check DAU 1 REVERSION message on EICAS.

CONTINUES ON NEXT PAGE

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NOTE: The following indications and messages will not be available:

- Indications: Engine 1 oil (temperature and pressure), Battery 1 and 2 temperature, fuel tank temperature, roll trim position, cockpit temperature, Bleed 1 temperature.
- Messages: BLD 1 OVTEMP, E1 FUEL LO TEMP, FUEL TANK LO TEMP.

- BLD 1 LOW TEMP message will appear.

For DAU 2 A FAIL caution message proceed:
DAU 2 Reversion ..... ON
Check DAU 2 REVERSION message on EICAS.

NOTE: The following indications and messages will not be available:

- Indications: Engine 2 oil (temperature and pressure), Hydraulic quantity 1 and 2, yaw trim position, cabin temperature, Bleed 2 temperature.
- Messages: BLD 2 OVTEMP, E2 FUEL LO TEMP, HYD 1 LO QTY, HYD 2 LO QTY.

- BLD 2 LOW TEMP and APU OIL HI TEMP messages will appear.

If both channels of one DAU have failed:
Exit or avoid icing conditions.
Land at the nearest suitable airport.

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NOTE: - If both channels of DAU 1 have failed, the messages and indications associated with the following systems will not be available:

- All messages and indications: Oxygen, Steering, Pressurization, Landing Gear, Roll Trim, and the message EMERG LIGHT NOT ARMED.
- Some messages and indications: Doors, Stall Protection, Electrical, Fire Protection, Fuel, APU, Power Plant, Thrust Reverser, Flap, Spoiler, Brakes, Air Conditioning, Ice And Rain Protection, Hydraulic.

- If both channels of DAU 2 have failed, the messages and indications associated with the following systems will not be available:
  - All messages and indications: Smoke, Hydraulic, Rudder, Yaw Trim.
  - Some messages and indications: Doors, Stall Protection, Electrical, Fire Protection, Fuel, APU, Power Plant, Thrust Reverser, Flap, Spoiler, Brakes, Air Conditioning, Ice And Rain Protection.

DAU MISCOMPARE

EICAS CAUTION: DAU 1 (2) ENG MISCOMP or DAU 1 (2) SYS MISCOMP or DAU 1 (2) WRN MISCOMP

LIGHT: Master Caution

Associated DAU Reversion ..... ON
Check associated DAU REVERSION message on EICAS.

Analyze the situation before and after the reversion, and take the appropriate corrective action.

NOTE: For each miscompare message and each side, check the following parameters before and after the reversion:

- Engine: N1, N2, ITT.
- System: Battery voltage and temperature, takeoff temperature, hydraulic pressure, oxygen pressure.
- Warning: all warning messages, if any.

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DAU REVERSION

EICAS ADVISORY: DAU 1 (2) REVERSION

If the reversionary condition is not required, press the associated DAU Reversionary Button to remove it.

DISPLAY FAILURE

EICAS CAUTION: CHECK PFD 1 (2) message is presented if PFD is the failed display.

LIGHT: Master Caution

Confirm the failed display.

If PFD failed:

Associated MFD Selector Knob ..... PFD

If EICAS failed:

MFD Selector Knob (as required) ..... EICAS

If all main panel displays failed:

Exit or avoid icing conditions.

RMU ..... AS REQUIRED

Use RMU to access power plant or navigation data.

Land at the nearest suitable airport.

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DISPLAY FAN FAILURE

EICAS ADVISORY: DU 1 (2, 3, 4, 5) FAN FAIL

An overheat condition may arise in the associated display. In this case, it will be shut down automatically. Use reversionary capabilities.

DISPLAY OVERHEAT

EICAS ADVISORY: DU 1 (2, 3, 4, 5) OVHT

An overheat condition may arise in the associated display. In this case, it will be shut down automatically. Use reversionary capabilities.

FDAU FAIL

EICAS ADVISORY: FDAU FAIL

Crew awareness.

FLIGHT DATA RECORDER FAILURE

EICAS CAUTION: DFDR FAIL
LIGHT: Master Caution

Crew awareness.

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FMS NAVIGATION PERFORMANCE DEGRADED / FMS IN DEAD RECKONING MODE

Verify airplane position by using VOR/DME information (enroute and terminal operations) or other sources as appropriate (oceanic).

If conducting an instrument approach, discontinue use of FMS for approach guidance and select an alternate source of navigation, if available.

In case of one FMS (single FMS) or both FMS (dual FMS) entering in Dead Reckoning Mode and EGPWS is installed:

EGPWS TERRAIN SYS OVRD Button..... PRESS

The Terrain Awareness Alerting and Display functions on MFD will be inhibited. This will not affect the basic GPWS functions (modes 1 to 7).

If the FMS is restored after a period of inadequacy:

EGPWS TERRAIN SYS OVRD Button ..... PRESS

The Terrain Awareness will be enabled.

NOTE: For the FMZ 2000 FMS and the FMZ 2010 FMS, the DGRAD annunciator indicates that the FMS cannot guarantee that the accuracy of the system meets the requirements for the current phase of flight.

- Except in the case of conducting an instrument approach procedure, the FMS may still be accurate and may be used for navigation, provided the crew can confirm the position through other means, such as cross checking the VOR/DME raw data.
- For the FMZ 2010 FMS, the best estimate of the airplane position will be provided by the FMS based on airspeed and heading inputs, but it cannot guarantee the required accuracy for any of the flight phases. The pilot should cross check position with other navaids, station overfly, or visually.

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LPV UNAVAILABLE (AIRPLANES POST-MOD. SB145-34-0125)

If on approach:

MISSED APPROACH Procedure ..... ACCOMPLISH

Consider the possibility of continuing and performing the landing if under visual conditions and the airplane position and attitude assure a safe landing.

Perform an approach with non-LPV minima.

GPS FAILED

In case of GPS fail (GPS FAILED Scratchpad Message for single GPS or GPS 1 FAILED and GPS 2 FAILED Scratchpad Messages for dual GPS) associated with FMS Navigation Performance Degraded:

FMS NAVIGATION PERFORMANCE DEGRADED /
FMS IN DEAD RECKONING MODE
Abnormal Procedure ..... Accomplish

In case of GPS fail (GPS FAILED Scratchpad Message for single GPS or GPS 1 FAILED and GPS 2 FAILED Scratchpad Messages for dual GPS) and EGPWS is installed:

EGPWS TERRAIN SYS OVRD Button ..... PRESS

The Terrain Awareness Alerting and Display functions on MFD will be inhibited. This will not affect the basic GPWS functions (modes 1 to 7).

IC AIR/GROUND CONDITION SIGNAL INOPERATIVE

EICAS CAUTION: IC 1 (2) WOW INOP
LIGHT: Master Caution
Do not take off.

IC CONFIGURATION FAILURE

EICAS ADVISORY: IC 1 (2) CONFIG FAIL

Crew awareness.

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IC FAILURE/IC BUS FAILURE

EICAS CAUTION: IC BUS FAIL may be presented
LIGHT: Master Caution if IC BUS FAIL message is presented
CONDITION: Associated Display Units blank and with a red X drawn over them.

The following features will be inoperative:

- EICAS messages miscompare monitoring,
- Takeoff speeds synchronization,
- Check List Display synchronization, and
- Flight Director mode synchronization.

If IC 1 failed (loss of PFD 1, MFD 1 and EICAS):
SG 1 Button ..... PRESS

NOTE: - In case of IC 1 failure, the PTRIM MAIN (BACKUP) INOP or PIT TRIM 1 (2) INOP messages may not be available, and
- The autopilot is not available.

If IC 2 failed (loss of MFD 2 and PFD 2):
SG 2 Button ..... PRESS

IC FAN FAILURE

EICAS ADVISORY: IC 1 (2) FAN FAIL

An overheat condition may arise in the associated IC. In this case, turn the IC off by pulling its respective circuit breaker (C3 or D31 or D32).

IC OVERHEAT

EICAS CAUTION: IC 1(2) OVERHEAT

If there is smoke associated to IC 1 OVERHEAT message:
IC 1 Circuit Breaker (C3) ..... PULL
Backup Battery..... OFF
SG 1 Button ..... PRESS
If smoke persists:
ELECTRICAL SYSTEM
FAILURE OR SMOKE Procedure..... ACCOMPLISH

If there is smoke associated to IC 2 OVERHEAT message:

IC 2 Circuit Breaker (D31 or D32) ..... PULL

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SG 2 Button ..... PRESS

If smoke persists:

ELECTRICAL SYSTEM

FAILURE OR SMOKE Procedure ..... ACCOMPLISH

IC'S CONFIGURATION MISMATCH

EICAS CAUTION: CHK IC CONFIG with Master Caution Light or
EICAS ADVISORY: CONFIG MISMATCH

Do not take off.

INTEG ANNUNCIATOR ON (UNS-1K)

Discontinue the use of FMS whenever using the GPS source solely. If possible and feasible, select an alternate source of navigation for approach guidance.

IRS ALIGNMENT

EICAS ADVISORY: IRS 1 (2) ALN

IRU Mode Select Switch ..... CHECK NAV

This message is only presented during alignment phase or while the IRU mode select switch is set at ALIGN position.

IRS ALIGNMENT FAULT

EICAS CAUTION: IRS 1 (2) ALN FAULT

Check and reenter present position. If necessary, reenter present position once again.

IRS ATTITUDE MODE

EICAS ADVISORY: IRS 1 (2) ATT MODE

On ground:

IRU Mode Select Switch ..... OFF

Wait until POWER-OFF phase is finished (MSU annunciator lights extinguished).

IRU Mode Select Switch ..... NAV

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IRS EXCESSIVE MOTION

EICAS ADVISORY: IRS 1 (2) EXC MOTION

Make sure the airplane is completely stationary.

The IRU will restart a full alignment 30 seconds after the motion is stopped.

IRS FAIL

EICAS CAUTION: IRS 1 (2) FAIL

During power on or alignment phases:

IRU Mode Select Switch ..... OFF
Wait until POWER-OFF phase is finished (MSU annunciator lights extinguished).

IRU Mode Select Switch ..... NAV

In flight:

Reversionary Panel IRS Button ..... PRESS

If cross-side IRU is not available:

IRU Mode Select Switch ..... ATT
Maintain wings level and constant airspeed until attitude display recovers (approximately 20 seconds).

Magnetic Heading ..... ENTER

CAUTION: FOR IRS IN ATTITUDE MODE, NAVIGATION AND ATTITUDE OUTPUTS ARE NOT AS ACCURATE AS IN THE NAV MODE. MAGNETIC HEADING MUST BE ENTERED AND UPDATED PERIODICALLY FROM THE BEST AVAILABLE ALTERNATIVE SOURCE, THROUGH THE FMS CDU.

NOTE: Autopilot is available if the IRS 1(2) ATT MODE message is displayed and the IRS 1(2) ALN message is extinguished.

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IRS ON BATTERY

EICAS ADVISORY: IRS 1 (2) ON BATT

Associated IRU will operate for 40 minutes.

IRS OVERHEAT

EICAS CAUTION: IRS 1 (2) OVERHEAT

Operate affected IRU until completion of the flight.

If MSU FAULT annunciator is lighted, IRS 1 (2) FAIL message is presented or inertial data ceases to be transmitted by IRU:

Associated IRS Reversionary Button ..... PRESS
Affected IRU Mode Select Switch ..... OFF

NOTE: The Autopilot is not available.

If IRU is OFF, the airplane is near the end of the flight and additional attitude reference is necessary:

IRU Mode Select Switch..... ATT

CAUTION: FOR IRS IN ATTITUDE MODE, NAVIGATION AND ATTITUDE OUTPUTS ARE NOT AS ACCURATE AS IN THE NAV MODE. MAGNETIC HEADING MUST BE ENTERED AND UPDATED PERIODICALLY FROM THE BEST AVAILABLE ALTERNATIVE SOURCE, THROUGH THE FMS CDU.

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IRS/MSU FAILURE ANNUNCIATION

LIGHT	OPERATION PHASE		
	POWER ON	ALIGNMENT	IN FLIGHT
ALIGN	– No light: – Check IRS CB's. – Set mode select switch to ALIGN or NAV. – Press MSU Test switch. Annunciator bulb must be replaced if the other MSU annunciators do light.	– Flashes immediately after entry: – Check and reenter latitude or longitude. – Reenter same latitude or longitude. – Flashes at the end of alignment: – Enter latitude. – Check and reenter latitude. – Allow additional time for alignment.	– Flashes: – Select the remaining IRU by pressing the IRS Button on the associated reversionary panel. – If necessary set mode select switch to ATT.
FAULT	– Set mode select switch to OFF for at least 3 sec. Then set mode select switch back to ALIGN or NAV.	– Associated with ALIGN annunciation: – Recheck coordinates and reenter latitude. – Allow additional time for alignment. – Try new alignment. Set mode select switch to OFF for at least 3 sec, then to ALIGN, and enter present position.	– Select the remaining IRU by pressing the IRS Button on the associated reversionary panel. – If necessary set mode select switch to ATT.

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IRS/MSU FAILURE ANNUNCIATION (Continued)

LIGHT	OPERATION PHASE		
	POWER ON	ALIGNMENT	IN FLIGHT
ON BATT	–Check IRS CB's. –If the annunciator remains lighted, do not takeoff.	*******	– The IRU operates on backup DC power and will operate for 30 minutes.
BATT FAIL	– Do not takeoff.	*******	*******
NO AIR	–Do not takeoff.	*******	– Operate IRU until completion of flight. – If fault annunciator is ON or inertial data ceases to be transmitted by IRU, select the remaining IRU and set mode select switch for affected IRU to OFF. If IRU is OFF, the airplane is near the end of the flight and additional attitude reference is needed, set mode select switch to ATT.

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MESSAGE MISCOMPARISON

INDICATION: CAS MSG indication on PFD.

Pilot's MFD Selector Knob ..... EICAS
Copilot's MFD Selector Knob ..... EICAS

Compare the messages displayed on the copilot's MFD with the messages presented on the pilot's MFD to check which is the discrepant message. Analyze the situation to check whether the discrepant message is spurious or not, and take the appropriate corrective action.

NAV/FLIGHT INSTRUMENTS FAILURE

CAUTION: IN THE EVENT OF TOTAL LOSS OF DISPLAY INFORMATION, EXIT OR AVOID ICING CONDITIONS.

NOTE: For EMB-145 XR model if one ADC fails, indicated by a "X" (red) over the IAS and altitude tapes and a VS (red) annunciation displayed in the PFD, the maximum airspeed allowed is Mach 0.78.

ANNUNCIATOR /FAILURE	LOCATION	ACTION
ATT FAIL (red)	PFD	Use cross-side attitude by pressing the AHRS (IRS) button on associated reversionary panel or use standby attitude indicator.
"X" (red) over IAS tape		Use cross-side airspeed by pressing the ADC button on associated reversionary panel or use standby airspeed indicator.
"X" (red) over altitude tape		Use cross-side altitude by pressing the ADC button on associated reversionary panel or use standby altimeter.
"X" (red) over course scale		Select another sensor.

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NAV/FLIGHT INSTRUMENTS FAILURE (Continued)

ANNUNCIATOR /FAILURE	LOCATION	ACTION
VS (red)	PFD	Use cross-side vertical speed by pressing the ADC button on associated reversionary panel.
ROL, PIT, ATT, IAS or ALT (amber)		Compare data with Standby Indicator. For altitude compare the PFD altimeters setting also. If required, use cross-side data by pressing the appropriate button on associated reversionary panel.
PFD or EICAS Blank or "X" (red)		Use the MFD Knob to present the required information on MFD.
RA (amber)		Compare both Radio Altimeter indications. If required, consider only the lower altitude indication. Otherwise, disregard Radio Altitude. If RA displayed in the center, the RA is failed.
RA1 (2) (amber)	PFD MFD	Radio altimeter automatic reversion has occurred. No action is required.
HDG FAIL (red)		Use cross-side heading by pressing the AHRS (IRS) button on associated reversionary panel or use RMU or standby attitude indicator.
HDG (amber)		Compare data with the Magnetic Compass. After identifying the failed side, use cross-side data by pressing the AHRS (IRS) button on associated reversionary panel.

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NAV/FLIGHT INSTRUMENTS FAILURE (Continued)

ANNUNCIATOR /FAILURE	LOCATION	ACTION
MENU INOP (amber)	MFD	Crew awareness.
ATT:CAGE (amber)	ISIS	Press the CAGE push button in order to recover attitude indication. Caging the ISIS in flight will result in loss of attitude indication for up to 10 seconds and the amber message ATT 10s will be presented during this time. Until attitude indication is available again use the primary indication source.
ATT, ALT, SPD, M, HDG (red)		Use the primary indication source.
Errors in attitude indication	Standby Attitude Instrument	Maintain a straight and leveled flight using the primary indication source. Wait 3 minutes. If error persists, cage the instrument and monitor for 5 min after uncaging.

RADIO ALTIMETER FAIL

EICAS ADVISORY: RAD ALT 1 (2) FAIL or RAD ALT FAIL

If one Radio altimeter is lost (RAD ALT 1 (2) FAIL is presented):

Automatic reversion ..... CONFIRM

Automatic reversion may be confirmed through the RA1 (2) amber annunciator presented on both PFDs. In this case the CAT II logic is assured.

If both Radio Altimeters are lost (RAD ALT FAIL is presented):

Do not perform CAT II approaches.

If already performing a CAT II approach procedure:

MISSED APPROACH Procedure ..... PERFORM

Perform a normal MISSED APPROACH Procedure, unless the approach is continued under visual conditions and the airplane position and attitude assure a safe landing.

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AUTOPILOT

AUTOPILOT TRIM FAILED

EICAS CAUTION: AUTO TRIM FAIL
LIGHT: Master Caution

Control Column ..... HOLD FIRMLY
Quick Disconnect Button..... PRESS
Pitch Trim ..... AS REQUIRED
Trim the airplane.
Autopilot ..... AS REQUIRED

STABILIZER OUT OF TRIM

EICAS CAUTION: AP ELEV MISTRIM
LIGHT: Master Caution
CONDITION: Autopilot is engaged and pitch servo is holding force.

Control Column ..... HOLD FIRMLY
Quick Disconnect Button..... PRESS
Pitch Trim ..... AS REQUIRED
Trim the airplane.
Autopilot ..... AS REQUIRED

FD LATERAL MODE FAILURE

EICAS CAUTION: LATERAL MODE OFF
LIGHT: Master Caution

The Flight Director has been reverted to the basic roll mode.
At crew discretion, re-select the Flight Director affected mode or select another mode.

NOTE: - 5 seconds after pressing the Master Caution, the message will be removed. If the lost mode or any other mode is not selected again, the Flight Director will continue in the basic mode.

- For some EICAS versions this message will be presented if the crew turns the Flight Director off. In this case the message must be disregarded.

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FD VERTICAL MODE FAILURE

EICAS CAUTION: VERTICAL MODE OFF
LIGHT: Master Caution

The Flight Director has been reverted to the basic pitch mode.
At crew discretion, re-select the Flight Director affected mode or select another mode.

NOTE: - 5 seconds after pressing the Master Caution, the message will be removed. If the lost mode or any other mode is not selected again, the Flight Director will continue in the basic mode.

- For some EICAS versions this message will be presented if the crew turns the Flight Director off. In this case the message must be disregarded.

AILERON OUT OF TRIM

EICAS CAUTION: AP AIL MISTRIM
LIGHT: Master Caution

CONDITION: Autopilot is engaged and aileron servo is holding force.
If the message is displayed more than 10 seconds, proceed:
Control Wheel.....HOLD FIRMLY
Quick Disconnect Button.....PRESS
Roll Trim.....AS REQUIRED
Return the airplane to an in-trim condition, by trimming in the direction as requested by the EICAS indication.
Autopilot.....AS REQUIRED

YAW DAMPER FAILURE

EICAS CAUTION: YAW DAMPER FAIL
LIGHT: Master Caution

Yaw Damper.....DISENGAGE
Autopilot may be reengaged at pilot's discretion. If after reengagement the failure persists, continue the flight with autopilot disengaged.

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CAT II OPERATION

HARDOVER

If any unusual acceleration or motion is noticed on the airplane flight path the approach must be discontinued, and:

Autopilot ..... DISENGAGE
MISSED APPROACH Procedure ..... PERFORM AS REQUIRED

- Consider the possibility of continuing and performing the landing if adequate visual reference has been established to assure the airplane position and approach path.
- For EMB-135 and EMB-145XR models, consider the possibility of continuing the approach using the Flight Director for guidance.

SLOWOVER

The Slowover consists in a smooth and slow airplane attitude change due to an autopilot system malfunction. It may be recognized if one of the following symptoms occurs during approach:

- Unusual glide slope small deviation.
- Change in the rate of descent (small or large).
- Excessive glide slope deviation and the GS indications becoming amber.
- Flight Director command bar diverging from the airplane symbol.
- Autopilot self disconnection.

If a Slowover tendency is confirmed:

Autopilot ..... DISENGAGE
MISSED APPROACH Procedure ..... PERFORM AS REQUIRED

- Consider the possibility of continuing and performing the landing if adequate visual reference has been established to assure the airplane position and approach path.
- For EMB-135 and EMB-145XR models, consider the possibility of continuing the approach using the Flight Director for guidance.

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ENGINE FAILURE ON FINAL APPROACH OR DURING GO-AROUND

ONE ENGINE INOPERATIVE
GO-AROUND Procedure.....APPLY

AUTOPILOT MALFUNCTION

BEFORE REACHING OUTER MARKER

If the autopilot disengages or has to be disengaged, transfer autopilot and reengage it. The pilot on-side of the engaged autopilot may continue the approach. Check no failure light illuminated on the PFD and no EICAS message related to the autopilot system.
If the autopilot disengages again:

MISSED APPROACH Procedure.....PERFORM AS REQUIRED

- Consider the possibility of continuing and performing the landing if under visual conditions and the airplane position and attitude assure a safe landing.
- For EMB-135 and EMB-145XR models, consider the possibility of continuing the approach using the Flight Director for guidance.

AFTER REACHING OUTER MARKER

If the autopilot disengages or has to be disengaged, do not reengage the autopilot.

MISSED APPROACH Procedure.....PERFORM AS REQUIRED

- Consider the possibility of continuing and performing the landing if under visual conditions and the airplane position and attitude assure a safe landing.
- For EMB-135 and EMB-145XR models, consider the possibility of continuing the approach using the Flight Director for guidance.

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DISPLAY WARNINGS DURING FINAL APPROACH

Discontinue the approach if any of the following warnings occur:
- CAT 2 (not displayed or amber)
- AURAL WARN FAIL (amber)
- RAD ALT FAIL (cyan) (for airplanes Post-Mod. SB 145-31-0020 or with an equivalent modification factory incorporated)
- RA (amber)
- GS (red or amber)
- LOC (red or amber)
- ILS (amber)
- ATT FAIL (red)
- ATT (amber)
- PIT (amber)
- ROL (amber)
- HDG FAIL (red)
- HDG (amber)
- FD (red)

Perform a normal MISSED APPROACH Procedure, unless the approach is continued under visual conditions and the airplane position and attitude assure a safe landing.

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EXCESSIVE DEVIATION WARNING

If warning occurs above 200 ft Radio Altitude:
Monitor the ILS deviation to ensure that the airplane returns to the center beam. If not recovered up to 200 ft radio altitude:
Discontinue the approach.

If warning occurs below 200 ft Radio Altitude:
Discontinue the approach.

On both cases, perform a normal MISSED APPROACH Procedure, unless the approach is continued under visual conditions and the airplane position and attitude assure a safe landing.

ABNORMALITIES

The following abnormalities are deviation from CAT II normal range and must be called out:

- Excessive LOC or GS deviations.
- Airspeed 10 kt higher or 5 kt lower than the Landing Reference Speed ($V_{REF\ 22}$).
- Roll angle in excess of 15°.
- Pitch angle below - 5° or above 5°.

Rate of descent in excess of 1200 ft/min.

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HGS OPERATION

For AIII mode operations, the approach must be discontinued in the event of engine failure above DH. A new approach may be attempted with one engine inoperative. In this case, the normal procedure AIII approach contained in HGS Operation must be used.

APPROACH WARNING

COMBINER Message: APCH WARN

MISSED APPROACH Procedure ..... PERFORM

A MISSED APPROACH procedure must be performed, unless the approach is continued under visual conditions and the airplane position and attitude assure a safe landing. In this case, the AIII guidance must not be followed.

HGS FAIL

EICAS CAUTION: HGS FAIL

Do not use HGS system.

AIII NOT AVAILABLE

EICAS ADVISORY: AIII NOT AVAIL

Do not perform AIII mode approaches.

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INTENTIONALLY BLANK

MISCELLANEOUS

IMPAIRED OR CRACKED WINDSHIELD

Associated Windshield Heating ..... OFF

If only the outer layer (glass) is cracked, no action is required.
If not, proceed as follows:

Cockpit Door ..... CLOSE
Altitude ..... MEA OR BELOW 10000 ft, WHICHEVER IS HIGHER
Cabin ΔP = 1 psi ..... SET

NOTE: Pressurization Manual Controller must be used to reach and maintain cabin altitude steady while descending.

Airspeed ..... MAXIMUM 250 KIAS
Smoke Goggle ..... DON

In case both windshields are impaired:

Cabin (below 10000 ft) ..... DEPRESSURIZE
Airspeed ..... MAX 140 KIAS MINIMUM V_{REF}
Make sure there are no loose objects in the cockpit.
Direct Vision Window ..... REMOVE
Landing must be made by looking through Direct Vision Window.

NOTE: Intercommunication will be impossible with window removed.

LIGHTNING STRIKE REPORT

In case of lightning strike, report the incident to the maintenance personnel, by filling the LIGHTNING STRIKE INCIDENT REPORT form, part I (see model on the next page).

The part II of the LIGHTNING STRIKE INCIDENT REPORT form is reserved to the ground personnel, and is presented in the Aircraft Maintenance Manual.

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EMB-145 LIGHTNING STRIKE INCIDENT REPORT

Part I (to be completed by flight crew)

Conditions at time of strike:

- Operator: _____ Date of incident: _____
- ACFT S/N: _____ Flight no.: _____
- Route: From _____ To: _____
- Altitude: _____ ft Airspeed: _____ kt
- Flight phase: Approach ☐ Climb ☐ Level Flight ☐
  Other: _____
- Weather: Cloud type % Cover Ceiling (ft) Top at (ft) OAT (°C)
  _____ _____ _____ _____ _____
  Rain ☐ Sleet ☐ Hail ☐ Snow ☐ None ☐
- Was St. Elmo's fire visible before strike? Yes ☐ No ☐
- Any effects on:

DC power system: _____

Flight controls: _____

Engine: _____

Avionics: _____

Other (describe): _____

- Any effects on personnel, such as: Flash blindness: _____
  Electrical shock: _____

Part I completed by: _____

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BIRD IMPACT

Against windshield:

CRACKED WINDSHIELD Procedure..... APPLY

Against leading edge (wing or tail) or fuselage:

Maneuverability may be reduced. Refer to the associated leading edge deicer failure procedure, if necessary.

At a safe altitude, perform a controllability check step by step up to the landing configuration. Define a safe configuration and V_{REF} for approach and landing.

The use of a greater V_{REF} will cause the landing distance to increase.

Against engine:

PRECAUTIONARY ENGINE SHUTDOWN Procedure (if necessary)..... APPLY

Land at the nearest suitable airport.

STRUCTURAL DAMAGE

On evidence of structural damage:

Airspeed under turbulence ..... BELOW 200 KIAS

Load Factor ..... BELOW 2.0

Refer to Buffet Onset Envelope to obtain altitude and airspeed for the desired load factor.

Aileron and Rudder Deflection ..... BELOW 30%

If fuselage is damaged:

Altitude..... MEA OR BELOW 10000 ft, WHICHEVER IS HIGHER

Cabin ..... DEPRESSURIZE

When landing:

Rate of descent ..... LESS THAN 300 ft/MIN

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LANDING BELOW -40°C

Before touchdown:

Rate of descent..... LESS THAN
300 ft/MIN

OVERWEIGHT LANDING

Before touchdown:

Rate of Descent ..... MAXIMUM
300 FT/MIN

Touch smoothly the runway surface. Reduce the engine thrust only after the touchdown.

CAUTION: TO DETERMINE THE MINIMUM SUITABLE LANDING DISTANCE, MULTIPLY THE UNFACTORED LANDING DISTANCE FOR FLAPS 45° BY 1.10.

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UNRELIABLE AIRSPEED

CONDITION: Airspeed indications are erroneous or unreliable.

Autopilot/Yaw Damper ..... DISENGAGE
Both Flight Directors ..... OFF
If speed indication on both PFD is below 135 kt:
    Rudder Shutoff Sys 1 ..... PUSH OUT
Avoid using the speed brake.
Attitude/Thrust ..... ADJUST
    Maintain airplane control. Refer to Unreliable Airspeed tables. Altitude and/or Vertical Speed indications may also be unreliable.
Ground Speed indication is available in the FMS for reference.

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A3	Anti-Ice: OFF

CLB THRUST MODE					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (240 KIAS)	Pitch (deg)	11	10	9	8
	V/S (ft/min)	4100	3400	2900	2400
10000 (240 KIAS)	Pitch (deg)	8	7	6	6
	V/S (ft/min)	3100	2500	2100	1700
20000 (0.56 M)	Pitch (deg)	5	5	5	4
	V/S (ft/min)	2600	2000	1600	1200
30000 (0.56 M)	Pitch (deg)	6	5	5	5
	V/S (ft/min)	2000	1400	1100	700
34000 (0.56 M)	Pitch (deg)	6	6	6	6
	V/S (ft/min)	1700	1200	900	400

CRUISE					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	69.5	70.8	72.1	73.5
20000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	73.4	74.7	75.9	77.2
25000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	76.9	78.1	79.5	80.9
30000 (0.63 M)	Pitch (deg)	2	2	2	3
	N1 (%)	78.6	80.1	81.3	82.7
37000 (0.63 M)	Pitch (deg)	2	3	4	4
	N1 (%)	79.6	81.6	84.1	86.4

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A3	Anti-Ice: OFF

FLIGHT IDLE DESCENT					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1
	V/S (ft/min)	-1800	-1700	-1600	-1600
10000 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1
	V/S (ft/min)	-2200	-2000	-1900	-1800
20000 (240 KIAS)	Pitch (deg)	-3	-2	-1	-1
	V/S (ft/min)	-2300	-2200	-2100	-2000
30000 (240 KIAS)	Pitch (deg)	-2	-2	-1	0
	V/S (ft/min)	-2600	-2400	-2300	-2200
37000 (240 KIAS)	Pitch (deg)	-2	-1	0	0
	V/S (ft/min)	-2500	-2300	-2200	-2100

HOLDING					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
5000 (200 KIAS)	Pitch (deg)	3	3	4	5
	N1 (%)	54.2	56.2	58.2	60.5
10000 (200 KIAS)	Pitch (deg)	3	3	4	5
	N1 (%)	58.0	60.1	62.2	64.1

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A3	Anti-Ice: OFF

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	7
	N1 (%)	48.5	52.3	55.8	59.1
9 (V_{REF45} + 15)	Pitch (deg)	7	8	8	8
	N1 (%)	51.0	54.9	58.5	61.6

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	4	4
	N1 (%)	47.1	50.3	53.1	55.8
45 (V_{REF45} + 10)	Pitch (deg)	0	0	0	0
	N1 (%)	59.7	63.3	66.4	69.2

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A3	Anti-Ice: ON

CLB THRUST MODE					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (240 KIAS)	Pitch (deg)	11	10	9	8
	V/S (ft/min)	4000	3300	2800	2300
10000 (240 KIAS)	Pitch (deg)	7	6	6	5
	V/S (ft/min)	2600	2100	1700	1300
20000 (0.56 M)	Pitch (deg)	4	3	3	3
	V/S (ft/min)	1600	1100	800	600
30000 (0.56 M)	Pitch (deg)	4	4	4	4
	V/S (ft/min)	900	500	300	100
34000 (0.56 M)	Pitch (deg)	4	4	5	-
	V/S (ft/min)	800	400	200	-

CRUISE					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	69.5	70.8	72.1	73.4
20000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	73.4	74.7	75.9	77.1
25000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	76.9	78.1	79.5	80.8
30000 (0.63 M)	Pitch (deg)	2	2	2	3
	N1 (%)	78.4	79.9	81.2	82.5
37000 (0.63 M)	Pitch (deg)	3	3	4	4
	N1 (%)	79.5	81.7	84.1	86.4

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A3	Anti-Ice: ON

FLIGHT IDLE DESCENT					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (240 KIAS)	Pitch (deg)	-1	0	0	0
	V/S (ft/min)	-1000	-1000	-1000	-1000
10000 (240 KIAS)	Pitch (deg)	-1	-1	0	0
	V/S (ft/min)	-1300	-1200	-1200	-1200
20000 (240 KIAS)	Pitch (deg)	-1	-1	0	0
	V/S (ft/min)	-1400	-1400	-1400	-1400
30000 (240 KIAS)	Pitch (deg)	-1	0	0	1
	V/S (ft/min)	-1600	-1600	-1500	-1500
37000 (240 KIAS)	Pitch (deg)	-1	0	0	1
	V/S (ft/min)	-1800	-1706	-1700	-1700

HOLDING					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
5000 (200 KIAS)	Pitch (deg)	3	3	4	6
	N1 (%)	54.3	56.2	58.2	62.4
10000 (200 KIAS)	Pitch (deg)	3	3	4	6
	N1 (%)	58.0	60.1	62.2	65.7

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A3	Anti-Ice: ON

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	7
	N1 (%)	48.6	52.3	55.7	61.9
9 (V_{REF45} + 15)	Pitch (deg)	7	8	8	8
	N1 (%)	51.7	54.9	58.5	64.1

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	4	4
	N1 (%)	48.6	52.3	55.7	61.9
45 (V_{REF45} + 10)	Pitch (deg)	0	0	0	0
	N1 (%)	59.7	63.2	66.4	71.4

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A1/3	Anti-Ice: OFF

CLB THRUST MODE					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (240 KIAS)	Pitch (deg)	13	11	10	9
	V/S (ft/min)	4800	4000	3400	2900
10000 (240 KIAS)	Pitch (deg)	9	8	8	7
	V/S (ft/min)	3800	3100	2700	2200
20000 (0.56 M)	Pitch (deg)	7	6	6	5
	V/S (ft/min)	3500	2800	2300	1800
30000 (0.56 M)	Pitch (deg)	7	6	6	6
	V/S (ft/min)	2700	2000	1600	1200
37000 (0.56 M)	Pitch (deg)	7	7	7	7
	V/S (ft/min)	1800	1300	900	400

CRUISE					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	68.9	70.0	71.2	72.5
20000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	72.1	73.5	74.9	76.5
25000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	76.3	77.8	79.4	80.9
30000 (0.63 M)	Pitch (deg)	2	2	2	3
	N1 (%)	78.5	80.0	81.2	82.5
37000 (0.63 M)	Pitch (deg)	2	3	4	4
	N1 (%)	79.8	81.7	83.8	86.2

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A1/3	Anti-Ice: OFF

FLIGHT IDLE DESCENT					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1
	V/S (ft/min)	-1800	-1700	-1600	-1600
10000 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1
	V/S (ft/min)	-2100	-1900	-1800	-1800
20000 (240 KIAS)	Pitch (deg)	-2	-2	-1	-1
	V/S (ft/min)	-2200	-2100	-2000	-1900
30000 (240 KIAS)	Pitch (deg)	-2	-2	-1	0
	V/S (ft/min)	-2500	-2400	-2200	-2100
37000 (240 KIAS)	Pitch (deg)	-2	-1	0	0
	V/S (ft/min)	-2400	-2200	-2100	-2100

HOLDING					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
5000 (200 KIAS)	Pitch (deg)	3	3	4	5
	N1 (%)	54.1	55.9	57.9	59.9
10000 (200 KIAS)	Pitch (deg)	3	3	4	5
	N1 (%)	57.6	59.6	61.8	63.9

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A1/3	Anti-Ice: OFF

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0	Pitch (deg)	7	7	7	7
(V_{REF45} + 30)	N1 (%)	48.9	52.5	55.7	58.8
9	Pitch (deg)	7	8	8	8
(V_{REF45} + 15)	N1 (%)	51.4	55.1	58.2	61.3

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22	Pitch (deg)	3	3	4	4
(V_{REF22} + 10)	N1 (%)	47.5	50.8	53.5	56.0
45	Pitch (deg)	0	0	0	0
(V_{REF45} + 10)	N1 (%)	59.5	63.4	66.7	69.6

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A1/3	Anti-Ice: ON

CLB THRUST MODE					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (240 KIAS)	Pitch (deg)	12	11	10	9
	V/S (ft/min)	4700	3900	3400	2800
10000 (240 KIAS)	Pitch (deg)	8	8	7	7
	V/S (ft/min)	3500	2800	2400	1900
20000 (0.56 M)	Pitch (deg)	6	5	5	5
	V/S (ft/min)	3000	2300	1900	1500
30000 (0.56 M)	Pitch (deg)	6	5	5	5
	V/S (ft/min)	2000	1400	1100	700
37000 (0.56 M)	Pitch (deg)	6	6	6	6
	V/S (ft/min)	1200	700	400	0

CRUISE					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	68.9	70.0	71.2	72.4
20000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	72.2	73.5	74.9	76.5
25000 (250 KIAS)	Pitch (deg)	1	2	2	2
	N1 (%)	76.2	77.8	79.4	80.9
30000 (0.63 M)	Pitch (deg)	2	2	2	3
	N1 (%)	78.4	79.9	81.2	82.5
37000 (0.63 M)	Pitch (deg)	3	3	4	4
	N1 (%)	79.8	81.7	83.8	86.3

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A1/3	Anti-Ice: ON

FLIGHT IDLE DESCENT					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (240 KIAS)	Pitch (deg)	-1	0	0	0
	V/S (ft/min)	-900	-900	-900	-900
10000 (240 KIAS)	Pitch (deg)	-1	-1	0	0
	V/S (ft/min)	-1200	-1200	-1200	-1200
20000 (240 KIAS)	Pitch (deg)	-1	0	0	0
	V/S (ft/min)	-1300	-1300	-1300	-1300
30000 (240 KIAS)	Pitch (deg)	-1	0	0	1
	V/S (ft/min)	-1400	-1400	-1400	-1400
37000 (240 KIAS)	Pitch (deg)	-1	0	0	1
	V/S (ft/min)	-1700	-1600	-1600	-1500

HOLDING					
PRESSURE ALTITUDE (ft)		WEIGHT (lb)			
		30000	35000	40000	45000
5000 (200 KIAS)	Pitch (deg)	3	3	4	6
	N1 (%)	54.1	55.9	57.8	61.8
10000 (200 KIAS)	Pitch (deg)	3	3	4	6
	N1 (%)	57.5	59.6	61.8	65.8

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-135	Engine: AE3007A1/3	Anti-Ice: ON

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	7
	N1 (%)	48.9	52.5	55.7	61.3
9 (V_{REF45} + 15)	Pitch (deg)	7	8	8	8
	N1 (%)	51.5	55.1	58.3	63.9

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	4	4
	N1 (%)	47.6	50.7	53.5	58.0
45 (V_{REF45} + 10)	Pitch (deg)	0	0	0	0
	N1 (%)	59.5	63.4	66.7	72.0

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-140	Engine: AE3007A1/3	Anti-Ice: OFF

CLB THRUST MODE						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	13	11	10	10	9
	V/S (ft/min)	4800	4000	3400	2900	2500
10000 (240 KIAS)	Pitch (deg)	9	8	8	7	7
	V/S (ft/min)	3800	3200	2700	2200	1900
20000 (0.56 M)	Pitch (deg)	7	6	6	5	5
	V/S (ft/min)	3500	2800	2300	1800	1500
30000 (0.56 M)	Pitch (deg)	7	7	7	7	7
	V/S (ft/min)	2700	2000	1600	1200	900
37000 (0.56 M)	Pitch (deg)	7	7	7	8	8
	V/S (ft/min)	1800	1300	900	400	100

CRUISE						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	68.5	69.7	70.9	72.2	73.6
20000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	71.8	73.2	74.6	76.2	77.8
25000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	75.9	77.4	79.1	80.6	81.7
30000 (0.63 M)	Pitch (deg)	2	2	2	3	3
	N1 (%)	78.5	80.0	81.2	82.5	83.9
37000 (0.63 M)	Pitch (deg)	3	3	4	4	5
	N1 (%)	79.8	81.7	83.8	86.4	90.0

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-140	Engine: AE3007A1/3	Anti-Ice: OFF

FLIGHT IDLE DESCENT						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	-3	-2	-1	-1	-1
	V/S (ft/min)	-1800	-1700	-1600	-1500	-1500
10000 (240 KIAS)	Pitch (deg)	-3	-2	-1	-1	0
	V/S (ft/min)	-2000	-1900	-1800	-1700	-1700
20000 (240 KIAS)	Pitch (deg)	-2	-2	-1	-1	0
	V/S (ft/min)	-2200	-2000	-2000	-1900	-1900
30000 (240 KIAS)	Pitch (deg)	-2	-1	-1	0	0
	V/S (ft/min)	-2500	-2300	-2200	-2100	-2100
37000 (240 KIAS)	Pitch (deg)	-1	-1	0	0	1
	V/S (ft/min)	-2300	-2200	-2100	-2000	-2000

HOLDING						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
5000 (200 KIAS)	Pitch (deg)	3	4	4	5	5
	N1 (%)	53.8	55.8	57.7	59.9	62.1
10000 (200 KIAS)	Pitch (deg)	3	4	5	-	-
	N1 (%)	59.1	61.4	63.6	-	-

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-140	Engine: AE3007A1/3	Anti-Ice: OFF

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	8
	N1 (%)	48.9	52.5	55.7	58.8
9 (V_{REF45} + 15)	Pitch (deg)	7	7	7	8
	N1 (%)	51.5	55.2	58.4	61.6

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	3	3
	N1 (%)	47.6	50.9	53.6	56.2
45 (V_{REF45} + 10)	Pitch (deg)	-1	-1	0	0
	N1 (%)	59.7	63.5	66.7	69.5

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-140	Engine: AE3007A1/3	Anti-Ice: ON

CLB THRUST MODE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	13	11	10	10	9
	V/S (ft/min)	4700	3900	3400	2900	2500
10000 (240 KIAS)	Pitch (deg)	8	8	7	7	7
	V/S (ft/min)	3500	2800	2400	1900	1600
20000 (0.56 M)	Pitch (deg)	6	5	5	5	5
	V/S (ft/min)	3000	2300	1900	1500	1200
30000 (0.56 M)	Pitch (deg)	6	6	6	6	6
	V/S (ft/min)	2000	1400	1100	700	400
37000 (0.56 M)	Pitch (deg)	6	6	7	7	-
	V/S (ft/min)	1200	700	400	40	-

CRUISE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2	2
	N1 (%)	68.5	69.6	70.9	72.2	73.6
20000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	71.8	73.1	74.6	76.2	77.8
25000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	75.9	77.4	79.1	80.6	81.7
30000 (0.63 M)	Pitch (deg)	2	2	2	3	3
	N1 (%)	78.4	79.9	81.2	82.5	83.9
37000 (0.63 M)	Pitch (deg)	3	3	4	4	5
	N1 (%)	79.8	81.7	83.8	86.5	90.1

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-140	Engine: AE3007A1/3	Anti-Ice: ON

FLIGHT IDLE DESCENT						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	-1	0	0	0	1
	V/S (ft/min)	-900	-900	-900	-900	-900
10000 (240 KIAS)	Pitch (deg)	-1	0	0	0	1
	V/S (ft/min)	-1100	-1100	-1100	-1100	-1200
20000 (240 KIAS)	Pitch (deg)	-1	0	0	0	1
	V/S (ft/min)	-1300	-1300	-1300	-1300	-1300
30000 (240 KIAS)	Pitch (deg)	0	0	0	1	1
	V/S (ft/min)	-1400	-1400	-1300	-1300	-1400
37000 (240 KIAS)	Pitch (deg)	0	0	1	1	1
	V/S (ft/min)	-1600	-1600	-1500	-1500	-1500

HOLDING						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
5000 (200 KIAS)	Pitch (deg)	3	4	4	5	5
	N1 (%)	53.8	55.8	57.7	59.9	63.7
10000 (200 KIAS)	Pitch (deg)	4	4	5	5	-
	N1 (%)	59.1	61.4	63.6	67.7	-

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-140	Engine: AE3007A1/3	Anti-Ice: ON

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	7
	N1 (%)	48.9	52.5	55.7	61.3
9 (V_{REF45} + 15)	Pitch (deg)	7	8	8	8
	N1 (%)	52.1	55.2	58.4	64.2

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	3	3
	N1 (%)	48.9	52.5	55.7	61.3
45 (V_{REF45} + 10)	Pitch (deg)	-1	0	0	0
	N1 (%)	59.7	63.5	66.7	71.9

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A	Anti-Ice: OFF

CLB THRUST MODE						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	10	9	8	8	8
	V/S (ft/min)	3800	3100	2700	2200	1900
10000 (240 KIAS)	Pitch (deg)	8	7	7	6	6
	V/S (ft/min)	3100	2500	2100	1700	1400
20000 (0.56 M)	Pitch (deg)	6	5	5	5	5
	V/S (ft/min)	2900	2300	1800	1400	1100
30000 (0.56 M)	Pitch (deg)	6	6	6	6	6
	V/S (ft/min)	2200	1600	1200	800	500
37000 (0.56 M)	Pitch (deg)	7	7	7	7	-
	V/S (ft/min)	1400	900	600	200	-

CRUISE						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	69.2	70.7	71.9	73.2	74.6
20000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	72.9	74.3	75.9	77.1	78.4
25000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	76.8	78.0	79.4	80.8	82.0
30000 (0.63 M)	Pitch (deg)	2	2	2	3	3
	N1 (%)	78.5	80.1	81.4	82.9	84.5
37000 (0.63 M)	Pitch (deg)	3	3	4	4	-
	N1 (%)	79.9	82.0	84.3	86.8	-

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A	Anti-Ice: OFF

FLIGHT IDLE DESCENT

PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1	-1
	V/S (ft/min)	-1800	-1700	-1600	-1500	-1500
10000 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1	-1
	V/S (ft/min)	-2100	-2000	-1900	-1800	-1800
20000 (240 KIAS)	Pitch (deg)	-2	-2	-1	-1	0
	V/S (ft/min)	-2300	-2200	-2100	-2000	-2000
30000 (240 KIAS)	Pitch (deg)	-2	-2	-1	-1	0
	V/S (ft/min)	-2600	-2400	-2300	-2200	-2100
37000 (240 KIAS)	Pitch (deg)	-1	-1	0	0	1
	V/S (ft/min)	-2400	-2300	-2200	-2100	-2000

HOLDING

PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
5000 (200 KIAS)	Pitch (deg)	3	3	4	5	5
	N1 (%)	54.0	56.2	58.5	60.4	62.4
10000 (200 KIAS)	Pitch (deg)	3	4	5	5	-
	N1 (%)	59.8	61.8	64.0	65.9	-

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A	Anti-Ice: OFF

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	7
	N1 (%)	48.2	52.2	56.0	59.0
9 (V_{REF45} + 15)	Pitch (deg)	7	7	7	8
	N1 (%)	51.2	55.2	58.7	61.7

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	3	3
	N1 (%)	46.9	50.5	53.6	56.5
45 (V_{REF45} + 10)	Pitch (deg)	-1	0	0	0
	N1 (%)	58.5	62.2	65.3	68.1

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A	Anti-Ice: ON

CLB THRUST MODE						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	10	9	9	8	8
	V/S (ft/min)	3800	3100	2700	2200	1900
10000 (240 KIAS)	Pitch (deg)	7	7	6	6	6
	V/S (ft/min)	2800	2300	1900	1500	1200
20000 (0.56 M)	Pitch (deg)	4	3	3	3	3
	V/S (ft/min)	1600	1100	800	600	300
30000 (0.56 M)	Pitch (deg)	4	4	4	-	-
	V/S (ft/min)	700	300	100	-	-
37000 (0.56 M)	Pitch (deg)	5	5	-	-	-
	V/S (ft/min)	400	0	-	-	-

CRUISE						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	69.2	70.6	71.9	73.2	74.6
20000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	72.9	74.3	75.9	77.1	78.4
25000 (250 KIAS)	Pitch (deg)	1	2	2	-	-
	N1 (%)	76.8	78.0	79.4	-	-
30000 (0.63 M)	Pitch (deg)	-	-	-	-	-
	N1 (%)	-	-	-	-	-
37000 (0.63 M)	Pitch (deg)	-	-	-	-	-
	N1 (%)	-	-	-	-	-

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A	Anti-Ice: ON

FLIGHT IDLE DESCENT						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1	-1
	V/S (ft/min)	-1800	-1700	-1600	-1500	-1500
10000 (240 KIAS)	Pitch (deg)	-1	-1	0	0	0
	V/S (ft/min)	-1300	-1300	-1200	-1200	-1200
20000 (240 KIAS)	Pitch (deg)	-1	0	0	0	1
	V/S (ft/min)	-1400	-1400	-1400	-1400	-1400
30000 (240 KIAS)	Pitch (deg)	-1	0	0	1	1
	V/S (ft/min)	-1600	-1600	-1600	-1500	-1500
37000 (240 KIAS)	Pitch (deg)	0	0	1	1	1
	V/S (ft/min)	-1600	-1600	-1500	-1500	-1500

HOLDING						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
5000 (200 KIAS)	Pitch (deg)	3	3	4	5	6
	N1 (%)	54.0	56.2	58.5	60.4	63.8
10000 (200 KIAS)	Pitch (deg)	3	4	5	6	-
	N1 (%)	59.8	61.8	64.0	67.5	-

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A	Anti-Ice: ON

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	8
	N1 (%)	48.2	52.2	56.0	61.5
9 (V_{REF45} + 15)	Pitch (deg)	7	7	7	8
	N1 (%)	51.9	55.1	58.7	64.1

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	3	3
	N1 (%)	48.2	52.2	56.0	61.5
45 (V_{REF45} + 10)	Pitch (deg)	-1	0	0	0
	N1 (%)	58.5	62.1	65.3	70.4

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1/1	Anti-Ice: OFF

CLB THRUST MODE						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	12	11	10	9	9
	V/S (ft/min)	4600	3800	3300	2700	2400
10000 (240 KIAS)	Pitch (deg)	9	8	7	7	7
	V/S (ft/min)	3500	2800	2400	1900	1600
20000 (0.56 M)	Pitch (deg)	6	5	5	5	5
	V/S (ft/min)	3000	2400	2000	1500	1200
30000 (0.56 M)	Pitch (deg)	6	6	6	6	6
	V/S (ft/min)	2300	1700	1300	900	600
37000 (0.56 M)	Pitch (deg)	7	7	7	7	-
	V/S (ft/min)	1500	1000	700	300	-

CRUISE						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	68.7	70.0	71.4	72.8	74.2
20000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	72.6	74.0	75.3	76.7	78.1
25000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	76.4	77.7	79.1	80.4	81.5
30000 (0.63 M)	Pitch (deg)	2	2	2	3	3
	N1 (%)	78.2	79.6	80.8	82.2	83.8
37000 (0.63 M)	Pitch (deg)	3	3	4	4	5
	N1 (%)	79.0	81.1	83.5	85.9	88.3

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1/1	Anti-Ice: OFF

FLIGHT IDLE DESCENT						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1	-1
	V/S (ft/min)	-1800	-1700	-1600	-1500	-1500
10000 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1	-1
	V/S (ft/min)	-2100	-2000	-1900	-1800	-1800
20000 (240 KIAS)	Pitch (deg)	-2	-2	-1	-1	0
	V/S (ft/min)	-2300	-2100	-2000	-2000	-1900
30000 (240 KIAS)	Pitch (deg)	-2	-2	-1	0	0
	V/S (ft/min)	-2500	-2400	-2300	-2200	-2100
37000 (240 KIAS)	Pitch (deg)	-2	-1	0	0	1
	V/S (ft/min)	-2400	-2200	-2100	-2100	-2000

HOLDING						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
5000 (200 KIAS)	Pitch (deg)	3	3	4	5	5
	N1 (%)	53.5	55.6	57.7	59.9	62.1
10000 (200 KIAS)	Pitch (deg)	3	4	5	5	-
	N1 (%)	59.3	61.5	63.5	65.6	-

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1/1	Anti-Ice: OFF

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	7
	N1 (%)	48.0	51.8	55.4	58.7
9 (V_{REF45} + 15)	Pitch (deg)	7	7	7	8
	N1 (%)	50.9	55.0	58.4	61.6

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	3	3
	N1 (%)	46.8	50.3	53.4	56.3
45 (V_{REF45} + 10)	Pitch (deg)	-1	0	0	0
	N1 (%)	58.6	62.2	65.3	68.0

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1/1	Anti-Ice: ON

CLB THRUST MODE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	12	11	10	9	9
	V/S (ft/min)	4600	3800	3300	2700	2400
10000 (240 KIAS)	Pitch (deg)	8	7	7	6	6
	V/S (ft/min)	3200	2600	2200	1800	1500
20000 (0.56 M)	Pitch (deg)	4	4	3	3	3
	V/S (ft/min)	1700	1200	900	700	400
30000 (0.56 M)	Pitch (deg)	4	4	4	4	-
	V/S (ft/min)	2000	1400	1100	700	-
37000 (0.56 M)	Pitch (deg)	5	5	-	-	-
	V/S (ft/min)	500	100	-	-	-

CRUISE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	68.7	70.0	71.4	72.8	74.2
20000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	72.6	74.0	75.3	76.7	78.1
25000 (250 KIAS)	Pitch (deg)	1	2	2	2	3
	N1 (%)	76.4	77.7	79.1	80.4	81.5
30000 (0.63 M)	Pitch (deg)	2	2	2	3	3
	N1 (%)	78.2	79.6	80.8	82.2	83.8
37000 (0.63 M)	Pitch (deg)	3	3	4	4	5
	N1 (%)	79.0	81.1	83.5	85.9	88.3

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1/1	Anti-Ice: ON

FLIGHT IDLE DESCENT						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
0 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1	-1
	V/S (ft/min)	-1800	-1700	-1600	-1500	-1500
10000 (240 KIAS)	Pitch (deg)	-1	-1	0	0	1
	V/S (ft/min)	-1200	-1200	-1200	-1200	-1200
20000 (240 KIAS)	Pitch (deg)	-1	0	0	0	1
	V/S (ft/min)	-1400	-1400	-1400	-1400	-1400
30000 (240 KIAS)	Pitch (deg)	-1	0	0	1	1
	V/S (ft/min)	-1600	-1600	-1500	-1500	-1500
37000 (240 KIAS)	Pitch (deg)	-1	0	0	1	1
	V/S (ft/min)	-1800	-1700	-1700	-1700	-1600

HOLDING						
PRESSURE ALTITUDE (ft)		WEIGHT (lb)				
		30000	35000	40000	45000	50000
5000 (200 KIAS)	Pitch (deg)	3	3	4	5	6
	N1 (%)	53.5	55.6	57.7	59.9	63.6
10000 (200 KIAS)	Pitch (deg)	4	4	5	6	-
	N1 (%)	59.3	61.5	63.5	67.3	-

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1/1	Anti-Ice: ON

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	8
	N1 (%)	48.0	51.8	55.4	61.5
9 (V_{REF45} + 15)	Pitch (deg)	7	7	7	8
	N1 (%)	51.6	55.0	58.4	64.2

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	3	3
	N1 (%)	48.0	51.8	55.4	61.5
45 (V_{REF45} + 10)	Pitch (deg)	-1	0	0	0
	N1 (%)	58.6	62.2	65.3	70.2

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1&A1P	Anti-Ice: OFF

CLB THRUST MODE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
0	Pitch (deg)	13	12	11	10	10	9
(240 KIAS)	V/S (ft/min)	4800	4000	3400	2900	2500	2200
10000	Pitch (deg)	10	9	8	8	8	7
(240 KIAS)	V/S (ft/min)	3800	3100	2700	2200	1900	1600
20000	Pitch (deg)	7	6	6	5	5	5
(0.56 M)	V/S (ft/min)	3500	2800	2300	1800	1500	1200
30000	Pitch (deg)	7	7	7	8	7	7
(0.56 M)	V/S (ft/min)	2700	2000	1600	1200	900	600
37000	Pitch (deg)	7	7	8	8	8	-
(0.56 M)	V/S (ft/min)	1800	1300	900	400	100	-

CRUISE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
15000	Pitch (deg)	1	1	2	2	2	3
(250 KIAS)	N1 (%)	68.7	69.9	71.1	72.4	73.8	75.3
20000	Pitch (deg)	1	1	2	2	2	3
(250 KIAS)	N1 (%)	72.0	73.3	74.8	76.4	78.0	79.6
25000	Pitch (deg)	1	1	2	2	2	3
(250 KIAS)	N1 (%)	76.1	77.6	79.3	80.7	81.9	83.1
30000	Pitch (deg)	1	1	2	2	2	3
(0.63 M)	N1 (%)	78.5	80.0	81.2	82.5	84.0	85.5
37000	Pitch (deg)	2	2	2	3	3	4
(0.63 M)	N1 (%)	79.8	81.7	83.8	86.4	89.8	92.8

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1&A1P	Anti-Ice: OFF

FLIGHT IDLE DESCENT

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
0 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1	-1	0
	V/S (ft/min)	-1800	-1700	-1600	-1500	-1500	-1500
10000 (240 KIAS)	Pitch (deg)	-3	-2	-1	-1	0	0
	V/S (ft/min)	-2000	-1900	-1800	-1800	-1700	-1700
20000 (240 KIAS)	Pitch (deg)	-2	-2	-1	-1	0	0
	V/S (ft/min)	-2200	-2100	-2000	-1900	-1900	-1900
30000 (240 KIAS)	Pitch (deg)	-2	-2	-1	0	0	1
	V/S (ft/min)	-2500	-2400	-2200	-2100	-2100	-2000
37000 (240 KIAS)	Pitch (deg)	-1	-1	0	0	1	1
	V/S (ft/min)	-2400	-2200	-2100	-2100	-2000	-2000

HOLDING

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
5000 (200 KIAS)	Pitch (deg)	3	3	4	5	5	6
	N1 (%)	54.0	55.9	57.8	59.9	62.2	64.4
10000 (200 KIAS)	Pitch (deg)	3	3	4	5	5	6
	N1 (%)	57.5	59.5	61.8	63.9	66.2	68.4

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1&A1P	Anti-Ice: OFF

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	8
	N1 (%)	48.9	52.5	55.7	58.8
9 (V_{REF45} + 15)	Pitch (deg)	7	7	7	8
	N1 (%)	51.6	55.3	58.6	61.7

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	3	3
	N1 (%)	47.7	51.1	53.9	56.6
45 (V_{REF45} + 10)	Pitch (deg)	-1	0	0	0
	N1 (%)	58.6	62.4	65.7	68.6

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1&A1P	Anti-Ice: ON

CLB THRUST MODE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
0 (240 KIAS)	Pitch (deg)	13	11	10	10	9	9
	V/S (ft/min)	4700	3900	3400	2900	2500	2200
10000 (240 KIAS)	Pitch (deg)	8	8	7	7	7	6
	V/S (ft/min)	3500	2800	2400	1900	1600	1400
20000 (0.56 M)	Pitch (deg)	6	5	5	5	5	5
	V/S (ft/min)	3000	2300	1900	1500	1200	900
30000 (0.56 M)	Pitch (deg)	6	6	6	6	6	6
	V/S (ft/min)	2000	1400	1100	700	400	200
37000 (0.56 M)	Pitch (deg)	6	6	7	7	-	-
	V/S (ft/min)	1200	700	400	0	-	-

CRUISE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
15000 (250 KIAS)	Pitch (deg)	1	1	2	2	2	3
	N1 (%)	68.7	69.9	71.1	72.4	73.8	75.3
20000 (250 KIAS)	Pitch (deg)	1	1	2	2	2	3
	N1 (%)	72.0	73.4	74.8	76.4	78.0	79.6
25000 (250 KIAS)	Pitch (deg)	1	1	2	2	2	3
	N1 (%)	76.1	77.6	79.3	80.7	81.9	83.1
30000 (0.63 M)	Pitch (deg)	1	1	2	2	2	3
	N1 (%)	78.5	79.9	81.2	82.5	84.0	85.5
37000 (0.63 M)	Pitch (deg)	2	2	2	3	3	4
	N1 (%)	79.8	81.7	83.8	86.4	89.8	92.8

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1&A1P	Anti-Ice: ON

FLIGHT IDLE DESCENT

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
0 (240 KIAS)	Pitch (deg)	-1	0	0	0	1	1
	V/S (ft/min)	-900	-900	-900	-900	-900	-1000
10000 (240 KIAS)	Pitch (deg)	-1	0	0	0	1	1
	V/S (ft/min)	-1200	-1200	-1200	-1200	-1200	-1200
20000 (240 KIAS)	Pitch (deg)	-1	0	0	0	1	1
	V/S (ft/min)	-1300	-1300	-1300	-1300	-1300	-1400
30000 (240 KIAS)	Pitch (deg)	0	0	0	1	1	2
	V/S (ft/min)	-1400	-1400	-1400	-1400	-1400	-1400
37000 (240 KIAS)	Pitch (deg)	0	0	0	1	1	2
	V/S (ft/min)	-1700	-1600	-1600	-1500	-1500	-1500

HOLDING

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
5000 (200 KIAS)	Pitch (deg)	3	3	4	5	5	6
	N1 (%)	54.0	55.9	57.8	59.9	62.2	65.7
10000 (200 KIAS)	Pitch (deg)	3	3	4	5	5	6
	N1 (%)	57.5	59.5	61.8	65.7	66.2	69.7

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145	Engine: AE3007A1&A1P	Anti-Ice: ON

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	8
	N1 (%)	48.9	52.5	55.7	61.3
9 (V_{REF45} + 15)	Pitch (deg)	7	7	7	8
	N1 (%)	52.3	55.3	58.6	64.3

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	3	3
	N1 (%)	48.9	52.5	55.7	61.3
45 (V_{REF45} + 10)	Pitch (deg)	-1	0	0	0
	N1 (%)	58.6	62.4	65.7	70.9

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145XR	Engine: AE3007A1E	Anti-Ice: OFF

CLB THRUST MODE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
0 (240 KIAS)	Pitch (deg)	11	10	9	9	9	8
	V/S (ft/min)	4000	3400	3000	2600	2300	2000
10000 (240 KIAS)	Pitch (deg)	8	7	7	7	7	7
	V/S (ft/min)	3200	2700	2400	2000	1700	1500
20000 (0.56 M)	Pitch (deg)	4	4	4	4	4	4
	V/S (ft/min)	1800	1400	1200	1100	900	800
30000 (0.56 M)	Pitch (deg)	6	6	6	6	6	6
	V/S (ft/min)	1900	1400	1200	900	600	300
37000 (0.56 M)	Pitch (deg)	6	7	7	7	-	-
	V/S (ft/min)	1400	900	500	100	-	-

CRUISE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2	3	3
	N1 (%)	79.1	79.2	79.5	79.9	80.4	81.0
20000 (250 KIAS)	Pitch (deg)	1	2	2	2	3	3
	N1 (%)	82.7	82.8	83.1	83.5	84.0	84.6
25000 (250 KIAS)	Pitch (deg)	1	2	2	2	3	3
	N1 (%)	86.0	86.2	86.5	86.9	87.5	88.2
30000 (0.63 M)	Pitch (deg)	2	2	2	3	3	-
	N1 (%)	86.6	86.9	87.5	88.4	89.8	-
37000 (0.63 M)	Pitch (deg)	3	3	4	4	-	-
	N1 (%)	85.7	87.4	89.9	92.0	-	-

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145XR	Engine: AE3007A1E	Anti-Ice: OFF

FLIGHT IDLE DESCENT

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
0 (240 KIAS)	Pitch (deg)	-6	-5	-4	-3	-2	-1
	V/S (ft/min)	-3000	-2800	-2500	-2300	-2100	-2000
10000 (240 KIAS)	Pitch (deg)	-5	-4	-3	-2	-2	-1
	V/S (ft/min)	-3000	-3000	-2800	-2500	-2300	-2100
20000 (240 KIAS)	Pitch (deg)	-4	-3	-3	-2	-1	-1
	V/S (ft/min)	-3000	-3000	-2900	-2700	-2500	-2400
30000 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1	-1	0
	V/S (ft/min)	-3000	-3000	-3000	-2900	-2700	-2600
37000 (240 KIAS)	Pitch (deg)	-2	-2	-1	-1	0	1
	V/S (ft/min)	-3000	-3000	-3000	-2800	-2600	-2400

HOLDING

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
5000 (200 KIAS)	Pitch (deg)	3	3	4	5	5	6
	N1 (%)	61.4	62.2	63.3	64.6	66.0	67.5
10000 (200 KIAS)	Pitch (deg)	3	3	4	5	5	6
	N1 (%)	65.1	66.0	67.0	68.2	69.6	71.1

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145XR	Engine: AE3007A1E	Anti-Ice: OFF

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	8
	N1 (%)	51.4	54.8	57.9	60.9
9 (V_{REF45} + 15)	Pitch (deg)	7	7	8	8
	N1 (%)	49.3	52.8	56.0	58.8

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	3	3
	N1 (%)	43.9	46.9	49.6	52.0
45 (V_{REF45} + 10)	Pitch (deg)	-1	0	0	0
	N1 (%)	57.1	60.8	63.9	66.7

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145XR	Engine: AE3007A1E	Anti-Ice: ON

CLB THRUST MODE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
0 (240 KIAS)	Pitch (deg)	10	10	9	9	8	8
	V/S (ft/min)	3800	3300	2900	2500	2200	1900
10000 (240 KIAS)	Pitch (deg)	7	7	6	6	6	6
	V/S (ft/min)	2700	2200	2000	1700	1400	1200
20000 (0.56 M)	Pitch (deg)	3	3	3	3	3	4
	V/S (ft/min)	900	800	700	600	400	300
30000 (0.56 M)	Pitch (deg)	4	4	5	5	5	0
	V/S (ft/min)	900	700	500	300	0	0
37000 (0.56 M)	Pitch (deg)	5	5	0	0	-	-
	V/S (ft/min)	500	100	0	0	-	-

CRUISE

PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
15000 (250 KIAS)	Pitch (deg)	1	2	2	2	3	3
	N1 (%)	79.1	79.2	79.5	79.9	80.4	81.0
20000 (250 KIAS)	Pitch (deg)	1	2	2	2	3	3
	N1 (%)	82.7	82.8	83.1	83.5	84.0	84.6
25000 (250 KIAS)	Pitch (deg)	1	2	2	2	3	3
	N1 (%)	86.0	86.2	86.5	86.9	87.5	88.2
30000 (0.63 M)	Pitch (deg)	2	2	2	3	3	-
	N1 (%)	86.6	86.9	87.5	88.4	89.8	-
37000 (0.63 M)	Pitch (deg)	3	3	4	4	-	-
	N1 (%)	85.7	87.5	89.9	92.0	-	-

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145XR	Engine: AE3007A1E	Anti-Ice: ON

FLIGHT IDLE DESCENT							
PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
0 (240 KIAS)	Pitch (deg)	-4	-3	-2	-1	-1	0
	V/S (ft/min)	-2400	-2000	-1800	-1700	-1600	-1500
10000 (240 KIAS)	Pitch (deg)	-4	-3	-2	-1	-1	0
	V/S (ft/min)	-2700	-2300	-2100	-1900	-1800	-1700
20000 (240 KIAS)	Pitch (deg)	-3	-2	-2	-1	0	0
	V/S (ft/min)	-2900	-2500	-2200	-2100	-2000	-1900
30000 (240 KIAS)	Pitch (deg)	-3	-2	-1	0	0	1
	V/S (ft/min)	-2900	-2500	-2300	-2100	-2000	-2000
37000 (240 KIAS)	Pitch (deg)	-2	-1	-1	0	0	1
	V/S (ft/min)	-3100	-2700	-2500	-2400	-2200	-2100

HOLDING							
PRESSURE ALTITUDE (ft)		WEIGHT (lb)					
		30000	35000	40000	45000	50000	55000
5000 (200 KIAS)	Pitch (deg)	3	3	4	5	5	6
	N1 (%)	61.4	62.2	63.3	64.6	66.0	68.4
10000 (200 KIAS)	Pitch (deg)	3	3	4	5	5	6
	N1 (%)	65.1	66.0	67.0	69.1	69.6	71.9

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UNRELIABLE AIRSPEED TABLES

Airplane: EMB-145XR	Engine: AE3007A1E	Anti-Ice: ON

Terminal Area (5000 ft) - %N1 for Level Flight					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
0 (V_{REF45} + 30)	Pitch (deg)	7	7	7	8
	N1 (%)	51.4	54.8	57.9	63.4
9 (V_{REF45} + 15)	Pitch (deg)	7	7	8	8
	N1 (%)	49.9	52.8	56.0	61.2

Final Approach (1500 ft) - %N1 for 3° Glideslope					
Flap position (V_{REF} + INCREMENT)		WEIGHT (lb)			
		30000	35000	40000	45000
22 (V_{REF22} + 10)	Pitch (deg)	3	3	3	4
	N1 (%)	51.4	54.8	57.9	63.4
45 (V_{REF45} + 10)	Pitch (deg)	-1	0	0	0
	N1 (%)	57.1	60.8	63.9	69.0

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TRANSPONDER FAIL

CONDITION: The transponder mode annunciation replaced with dashes on the RMU Radio page or by ATC notification.

Transponder..... SELECT
ANOTHER

ADS-B OUT FAIL OR DEGRADED

CONDITION: ADS-B FAIL or ADS-B DGR annunciation displayed on the RMU Radio page or by ATC notification.

Transponder..... SELECT
ANOTHER

NOTE: Only applicable to airplanes Post-Mod. SB 145-34-0118 or equipped with an equivalent modification factory incorporated.

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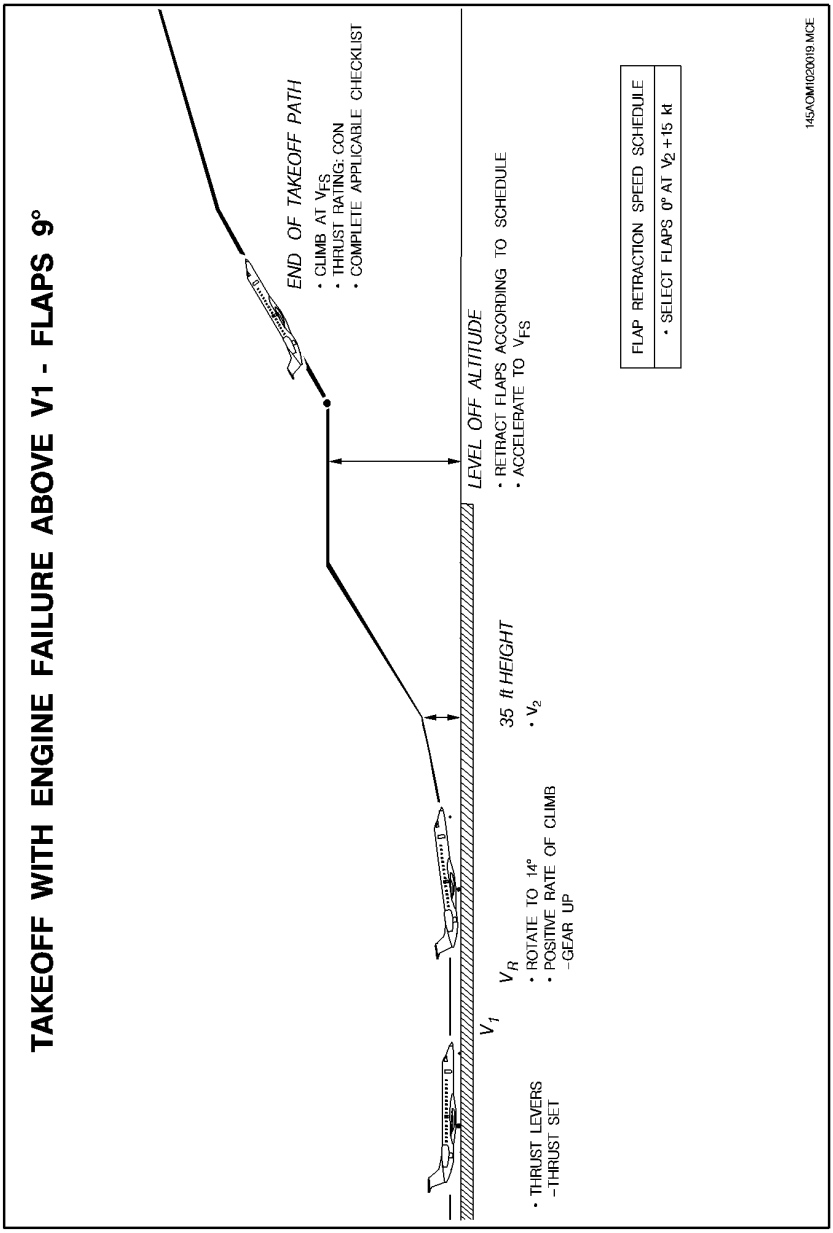
EMERGENCY PROFILES



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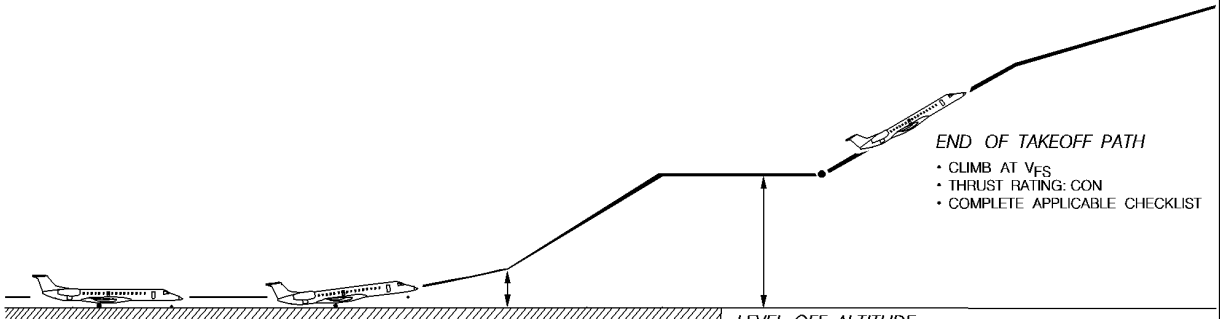
TAKEOFF WITH ENGINE FAILURE ABOVE V1 - FLAPS 18°



FLAP RETRACTION SPEED SCHEDULE
• SELECT FLAPS 9° AT V_2 + 10 kt
• SELECT FLAPS 0° AT V_2 + 30 kt

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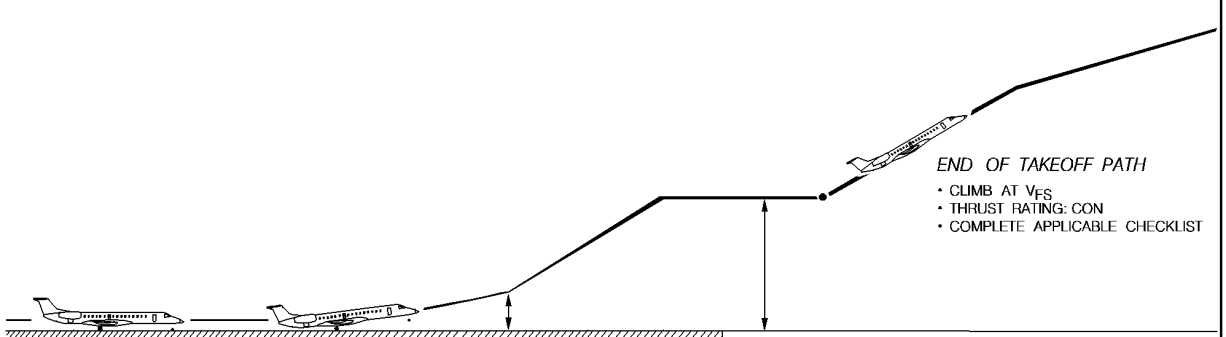
TAKEOFF WITH ENGINE FAILURE ABOVE V1 - FLAPS 22°



FLAP RETRACTION SPEED SCHEDULE	
ALL ENGINES EXCEPT AE3007A1P	AE3007A1P ENGINES
• SELECT FLAPS 9° AT V_2 + 5 kt	• SELECT FLAPS 9° AT V_2 + 10 kt
• SELECT FLAPS 0° AT V_2 + 25 kt	• SELECT FLAPS 0° AT V_2 + 30 kt

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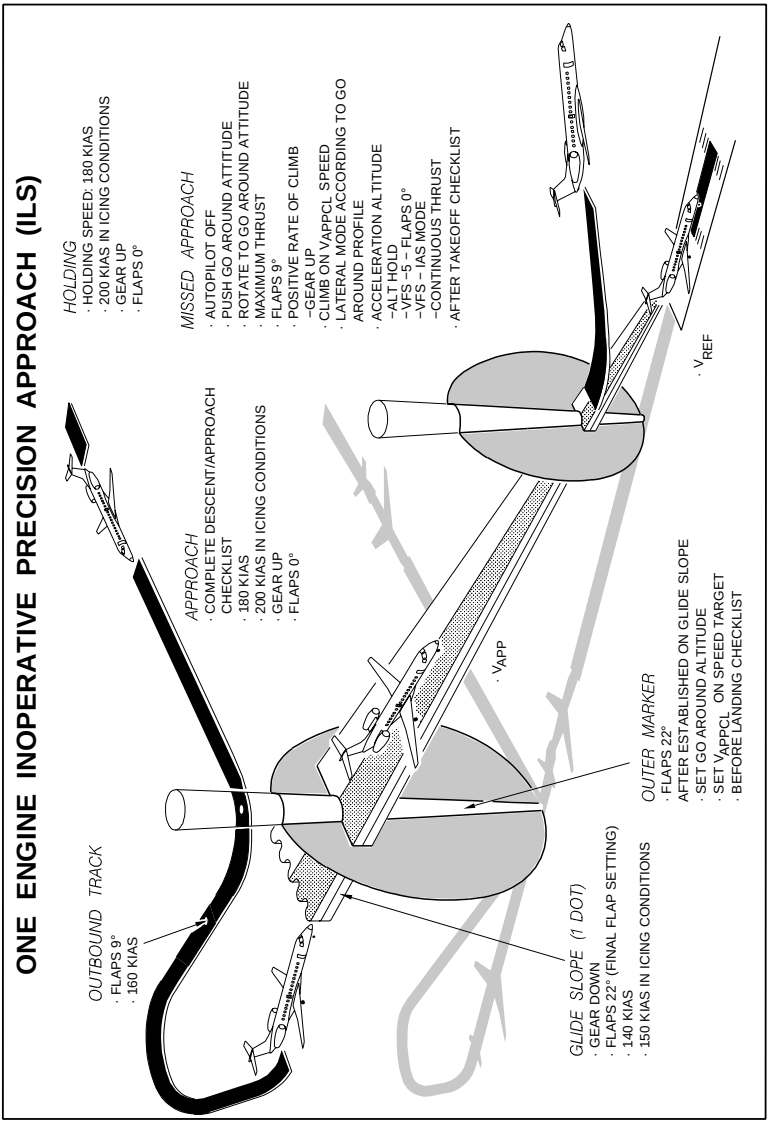
ABNORMAL PROFILES



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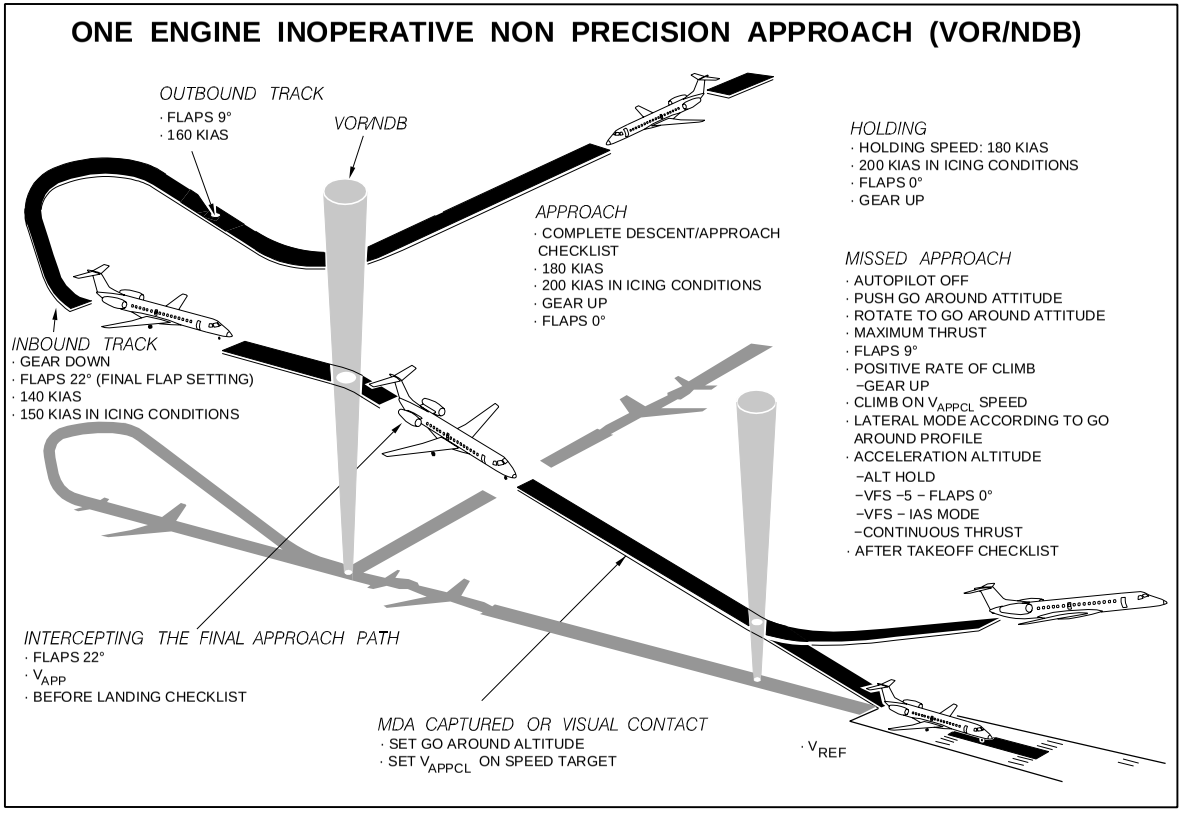
ONE ENGINE INOPERATIVE NON PRECISION APPROACH (VOR/NDB)



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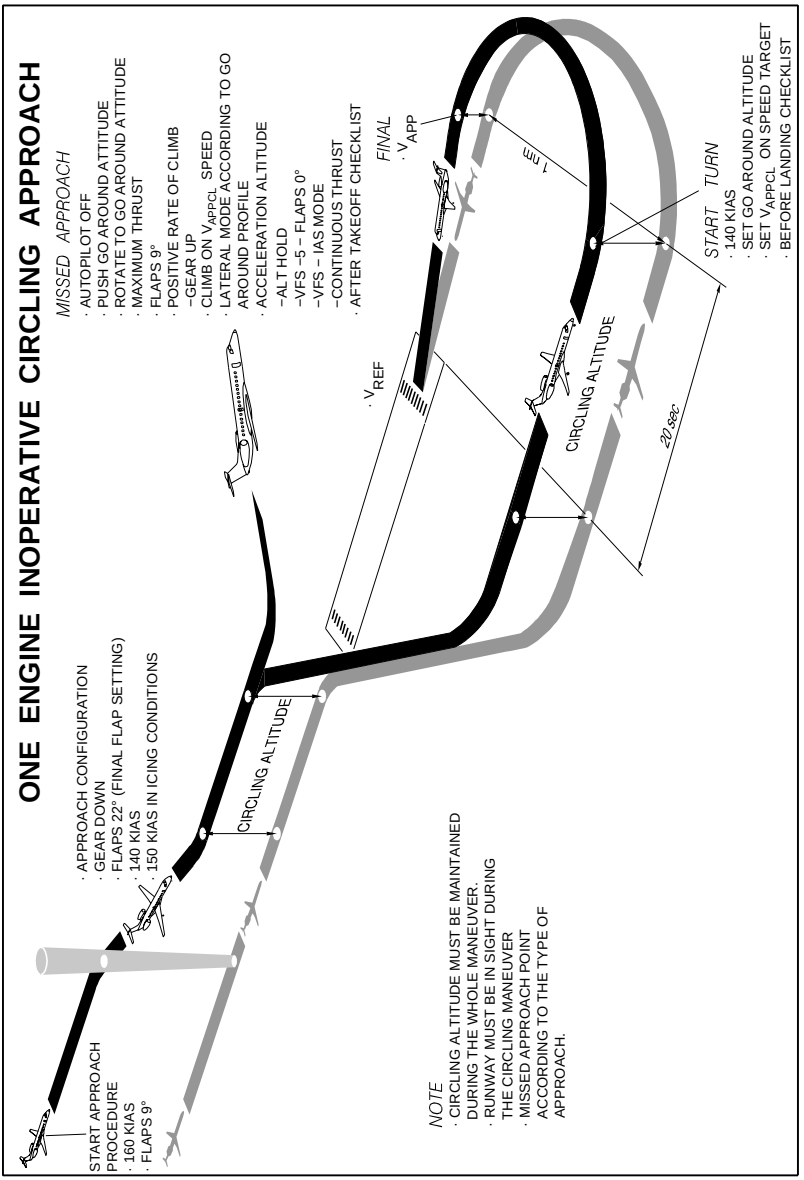

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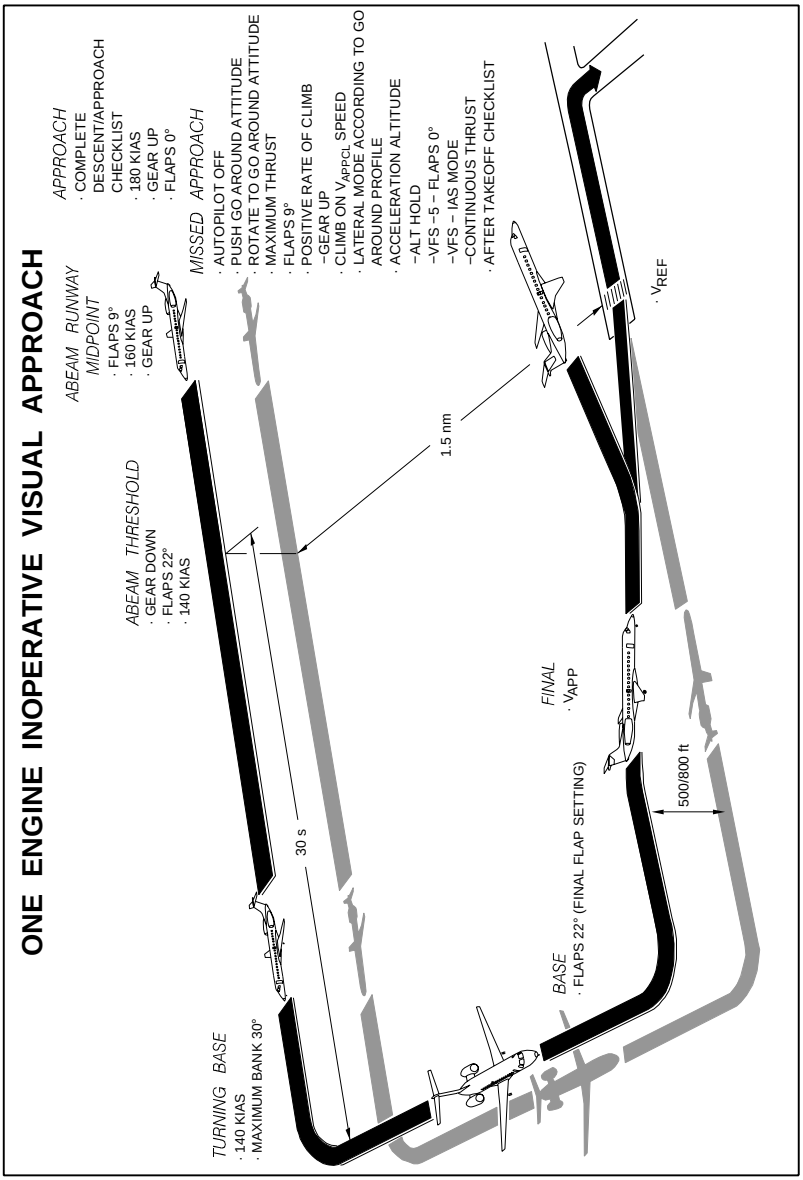
ONE ENGINE INOPERATIVE VISUAL APPROACH



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SECTION 1-04
PERFORMANCE

TABLE OF CONTENTS

Page Block

Introduction 1-04-00
Noise Levels 1-04-03
Wind and Altitude Conversion 1-04-05
Thrust Setting Tables 1-04-10
Takeoff 1-04-15
Supplementary Takeoff Information 1-04-20
Approach 1-04-25
Landing 1-04-30
Landing Information for Stockholm-Bromma (ESSB) Airport (*) 1-04-35

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NOTE: Items marked with an asterisk (*) may not be present in this manual.

INTRODUCTION

This section presents takeoff, approach and landing performance information.
For determination of the takeoff and landing limiting weights, the performance data as presented in the approved Airplane Flight Manual (AFM) or Runway Analysis Software must be used.

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NOISE LEVELS

The following Effective Perceived Noise Levels comply with RBHA 36, 14 CFR Part 36, and ICAO Annex 16 Volume I, Chapter 3.

The values below are stated for reference conditions of standard atmosphere pressure at sea level, 25°C ambient temperature, 70% relative humidity, and zero wind.

Takeoff and sideline noise levels were established for the EMB-145 equipped with two Rolls-Royce AE3007A, AE3007A1, AE3007A1/1, AE3007A1P or AE3007A1E engines or EMB-135 equipped with two Rolls-Royce AE3007A3 or AE3007A1/3 engines, at the MTOW (Maximum Takeoff Weight) related to each model, V_2 climb speed, flaps 9°, and all engines with maximum takeoff power setting. The takeoff power cutback procedure was used.

Approach noise levels were established from a 3° glide slope at the MLW (Maximum Landing Weight) associated to each airplane model, V_{REF45}, and flaps 45°.

No determination has been made by the Airworthiness Authority that the noise levels in this manual are or should be acceptable or unacceptable for operation at, into, or out of any airport.

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NOISE LEVEL IN EPNdB				
Airplane	Noise Level	CONDITION		
		Sideline	Takeoff	Approach
All	Maximum Allowable	94.0	89.0	98.0
EMB-145 EP model	Actual	85.0	80.1	92.6
EMB-145 ER model	Actual	85.1	79.8	92.6
EMB-145 EU model	Actual	85.1	79.2	92.6
EMB-145 MK model	Actual	85.1	79.2	92.5
EMB-145 LU model	Actual	84.9 (5)(6)	81.0	92.5
EMB-145 LR model (1)	Actual	84.9 (2)(5)(6)	81.0 (2) (3)	92.5
EMB-145 MP model	Actual	85.0	80.1	92.5
EMB-145 XR model	Actual	86.9	81.2	91.6
ERJ-140 ER (EMB-135 KE model)	Actual	84.3	79.7	92.4
ERJ-140 LR (EMB-135 KL model)	Actual	84.2	80.4	92.4
EMB-135 ER model	Actual	84.4 (4)	78.6 (4)	92.3
EMB-135 LR model	Actual	84.3	79.4	92.3

NOTE: 1) Noise levels applicable to airplanes with MTOW of 22000 kg.

2) For airplanes with MTOW of 21450 kg, the actual noise level for takeoff condition is 80.5 EPNdB and for sideline condition is 85.0 EPNdB.

3) For airplanes with MTOW of 22600 kg the actual noise level for takeoff condition is 81.6 EPNdB.

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4) For airplanes Post-Mod. SB 145-00-0028 or equipped with an equivalent modification factory incorporated, the actual noise level for Sideline condition is 84.3 EPNdB, and for Takeoff is 79.1 EPNdB.

5) For airplanes Post-Mod. SB 145-53-0065 or equipped with an equivalent modification factory incorporated, the actual noise level for Sideline condition is 85.0 EPNdB and for Takeoff condition is 80.5 EPNdB.

6) For airplanes Post-Mod. SB 145-53-0066 or equipped with an equivalent modification factory incorporated, the actual noise level for Sideline condition is 84.9 EPNdB.

The following table contains the noise levels in dBA for the same takeoff and approach conditions described above and should be used as general guidance.

NOISE LEVEL IN dBA		
Airplane	CONDITION	
	Takeoff	Approach
EMB-145 EP model	68.8	82.9
EMB-145 ER model	68.4	82.9
EMB-145 EU model	67.6	82.9
EMB-145 MK model	67.6	82.6
EMB-145 LU model	70.1 (4)	82.6
EMB-145 LR model (1)	70.1 (2) (3) (4)	82.6
EMB-145 MP model	68.8	82.6
EMB-145 XR model	70.2	81.3
ERJ-140 ER (EMB-135 KE model)	67.9	82.4
ERJ-140 LR (EMB-135 KL model)	69.0	82.4

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NOISE LEVEL IN dBA		
Airplane	CONDITION	
	Takeoff	Approach
EMB-135 ER model	66.5	82.2
EMB-135 LR model	67.7	82.2

NOTE: 1) Noise levels applicable to airplanes with MTOW of 22000 kg.

2) For airplanes with MTOW of 21450 kg, the actual noise level for takeoff condition is 69.4 dBA.

3) For airplanes with MTOW of 22600 kg the actual noise level for takeoff condition is 70.9 dBA.

4) For airplanes Post-Mod. SB 145-53-0065 or equipped with an equivalent modification factory incorporated, the actual noise level takeoff condition is 69.4 dBA.

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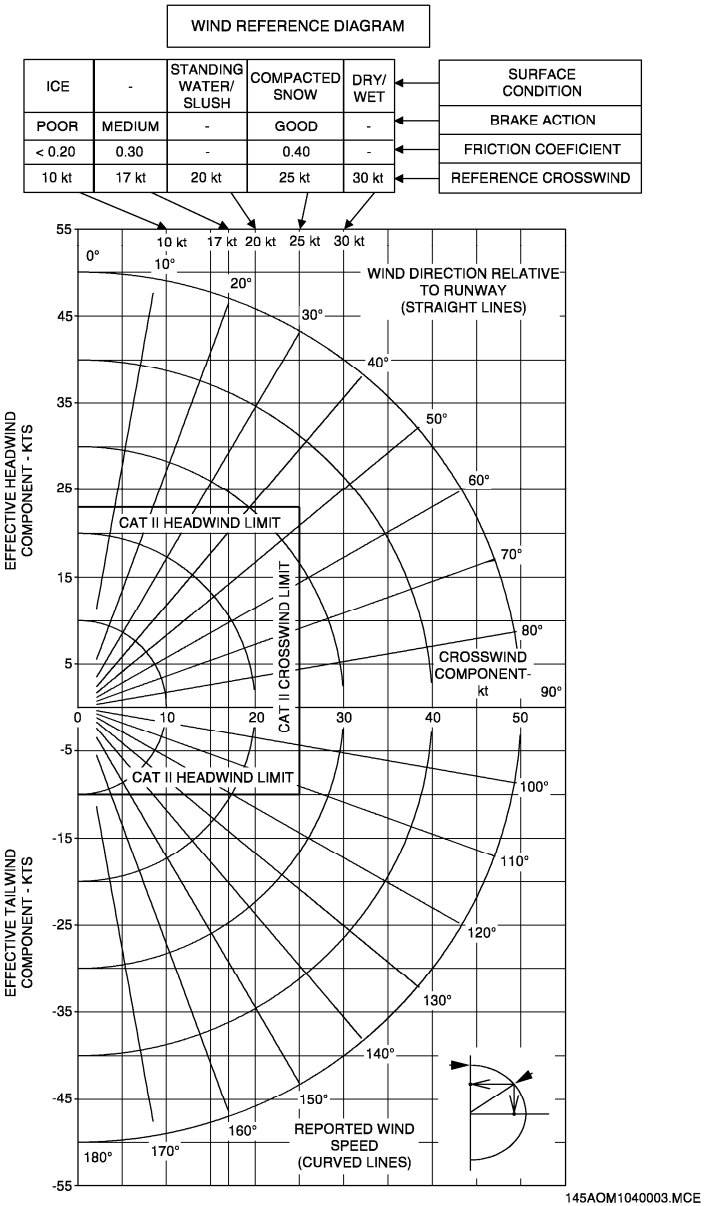
WIND AND ALTITUDE CONVERSION



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USE

Enter the chart with the reported wind velocity and the relative angle to the runway, to read the wind component parallel to the runway and the crosswind.

EXAMPLE

Given:

Wind velocity ..... 20 kt
Wind direction ..... 60°

Determine:

Wind component parallel to the runway ..... 10 kt
Crosswind ..... 17.5 kt

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ALTIMETER SETTING TO STATION PRESSURE

QNH TO PRESSURE ALTITUDE

QNH		CORRECTION TO ELEVATION FOR PRES. ALT. (FT)
in Hg	hPa	
28.81 to 28.91	976 to 979	1000
28.92 to 29.02	980 to 983	900
29.03 to 29.12	984 to 986	800
29.13 to 29.23	987 to 990	700
29.24 to 29.34	991 to 994	600
29.35 to 29.44	995 to 997	500
29.45 to 29.55	998 to 1001	400
29.56 to 29.66	1002 to 1004	300
29.67 to 29.76	1005 to 1008	200
29.77 to 29.87	1009 to 1012	100
29.88 to 29.97	1013 to 1015	0
29.98 to 30.08	1016 to 1019	-100
30.09 to 30.19	1020 to 1022	-200
30.20 to 30.30	1023 to 1026	-300
30.31 to 30.41	1027 to 1030	-400
30.42 to 30.52	1031 to 1034	-500
30.53 to 30.63	1035 to 1037	-600
30.64 to 30.74	1038 to 1041	-700
30.75 to 30.85	1042 to 1045	-800
30.86 to 30.96	1046 to 1048	-900
30.97 to 31.07	1049 to 1052	-1000

Example: Elevation = 2000 ft
QNH = 29.60 in Hg
Correction = 300 ft
Pressure Altitude = 2300 ft

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QFE TO STATION PRESSURE

QFE		PRESSURE ALTITUDE (ft)
in Hg	hPa	
31.01	1050	-989
30.86	1045	-856
30.71	1040	-723
30.57	1035	-589
30.42	1030	-454
30.27	1025	-319
30.12	1020	-184
29.98	1015	-48
29.83	1010	89
29.68	1005	227
29.53	1000	364
29.38	995	503
29.23	990	641
29.09	985	781
28.94	980	921
28.79	975	1062
28.64	970	1202
28.50	965	1344
28.35	960	1486
28.20	955	1630
28.05	950	1773
27.91	945	1918
27.76	940	2062
27.61	935	2208
27.46	930	2353
27.32	925	2500
27.17	920	2647
27.02	915	2796
26.87	910	2944
26.73	905	3094
26.58	900	3243
26.43	895	3394
26.28	890	3545
26.14	885	3698
25.99	880	3850
25.84	875	4004
25.69	870	4157

QFE		PRESSURE ALTITUDE (ft)
in Hg	hPa	
25.55	865	4313
25.40	860	4468
25.25	855	4625
25.10	850	4781
24.96	845	4939
24.81	840	5097
24.66	835	5257
24.51	830	5417
24.36	825	5579
24.21	820	5740
24.07	815	5903
23.92	810	6065
23.77	805	6230
23.62	800	6394
23.48	795	6561
23.33	790	6727
23.18	785	6895
23.03	780	7063
22.89	775	7233
22.74	770	7402
22.59	765	7574
22.44	760	7745
22.30	755	7920
22.15	750	8095
22.00	745	8269
21.85	740	8442
21.71	735	8619
21.56	730	8796
21.41	725	8975
21.26	720	9154
21.12	715	9335
20.97	710	9516
20.82	705	9699
20.67	700	9882
20.53	695	10068
20.38	690	10253
20.19	685	10439

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GEOMETRIC HEIGHT TO PRESSURE HEIGHT

Pressure altimeters are calibrated to indicate true altitude under International Standard Atmosphere (ISA) conditions. Any deviation from ISA will therefore result in an erroneous reading on the altimeter. In the case when the temperature is higher than ISA the true altitude will be higher than the figure indicated by the altimeter, and the true altitude will be lower when the temperature is lower than ISA. The altimeter error may be significant under conditions of extremely cold temperature (ICAO PANS-OPS Vol I 3.5.4.5.2).

AERODROME TEMP. (°C)	HEIGHT ABOVE THE ELEVATION OF THE ALTIMETER SETTING SOURCE (feet)						
(ft)	200	300	400	500	600	700	800
0	0	20	20	20	20	20	40
-10	20	20	40	40	40	60	60
-20	20	40	40	60	80	80	100
-30	40	60	60	80	100	120	140
-40	40	60	80	100	140	160	180
-50	60	80	100	140	160	200	220

AERODROME TEMP. (°C)	HEIGHT ABOVE THE ELEVATION OF THE ALTIMETER SETTING SOURCE (feet)						
(ft)	900	1000	1500	2000	3000	4000	5000
0	40	40	60	80	120	160	200
-10	80	80	120	160	240	320	400
-20	100	120	180	240	360	500	620
-30	160	160	260	340	500	680	860
-40	200	220	320	440	660	880	1100
-50	240	280	400	540	820	1100	1380

NOTE: The tables above are based on aerodrome elevation of 2000 ft; however, they can be used operationally for any aerodrome at or above sea level.

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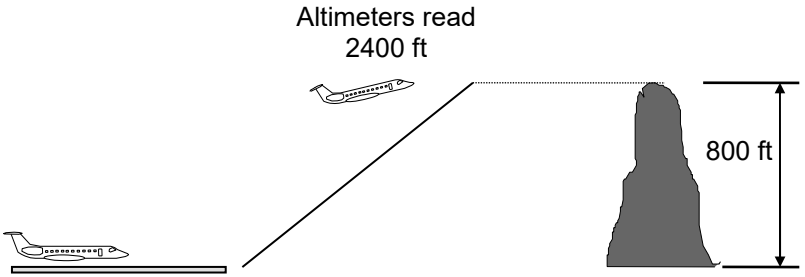
Example:

Airport elevation: ..... 1500 ft
Airport Temperature..... -20ºC
Obstacle Height above airport elevation..... 800 ft
Altimeter adjusted to airport QNH (on ground altimeter reads 1500 ft).

Enter table with 800 ft and -20ºC and read 100 ft.
So, when the airplane reaches the obstacle geometric height, the altimeter will read 1500 + 800 + 100 = 2400 ft



Elevation = 1500 ft
T = -20ºC
Altimeters reads 1500 ft

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THRUST SETTING TABLES

Thrust setting tables are presented for various Pressure Altitudes and Static Air Temperatures, with engine bleed closed or open, and anti-icing on or off.
The tables present the following data:

- N1 for T/O mode.
- N1 for ALT T/O-1 mode.
- N1 for go-around (T/O RSV mode).
- N1 for maximum continuous thrust (CON mode).

T/O: It is the maximum permissible thrust at takeoff for existing conditions of temperature and pressure altitude. This rating is time-limited to 5 minutes. In the case of an engine failure, the FADEC will command the operating engine to T/O RSV mode.

ALT T/O-1: It is an engine rating lower than the takeoff thrust, intended for engine life extension (due to lower turbine temperatures). It is also time-limited to 5 minutes. In the case of an engine failure, the FADEC will command the operating engine to T/O-1 mode.

GO AROUND (T/O RSV): It is the maximum permissible thrust during go around. The amount of thrust is the same as for takeoff with engine failure (T/O RSV mode), but the N1s are different because the effect of the airplane's airspeed during go around is taken into consideration.
Go-around thrust is also time-limited to 5 minutes.

MAXIMUM CONTINUOUS THRUST (CON): It is the maximum permissible thrust for continuous use.
Maximum Continuous Thrust is to be used whenever in the pilot's judgment it is deemed necessary for safety reasons (1 engine inoperative, severe icing, etc).

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N1 FOR T/O MODE

ANTI-ICE OFF
AIRSPEED: 0 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	-54	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5
-1000	74.8	75.5	76.4	77.2	78.0	78.8	79.6	80.4	81.2	82.0	82.8
0	75.5	76.1	77.0	77.8	78.7	79.5	80.3	81.1	81.9	82.7	83.5
1000	76.5	77.2	78.0	78.9	79.7	80.6	81.4	82.2	83.0	83.8	84.6
2000	77.5	78.2	79.1	80.0	80.8	81.7	82.5	83.3	84.1	84.9	85.7
3000	78.5	79.2	80.1	81.0	81.8	82.7	83.5	84.4	85.2	86.0	86.8
4000	79.5	80.2	81.1	82.0	82.8	83.7	84.6	85.4	86.2	87.1	87.9
5000	80.4	81.1	82.0	82.9	83.8	84.7	85.6	86.4	87.3	88.1	88.9
6000	80.9	81.7	82.6	83.5	84.4	85.2	86.1	87.0	87.8	88.7	89.5
7000	81.4	82.2	83.1	84.0	84.9	85.8	86.7	87.5	88.4	89.2	90.1
8000	82.0	82.7	83.6	84.6	85.5	86.3	87.2	88.1	89.0	89.8	90.7
9000	82.5	83.3	84.2	85.1	86.0	86.9	87.8	88.7	89.6	90.4	91.3
10000	83.1	83.9	84.8	85.7	86.6	87.5	88.4	89.3	90.2	91.1	91.9
11000	83.2	83.9	84.9	85.8	86.7	87.6	88.5	89.4	90.3	91.1	92.0
12000	83.3	84.0	84.9	85.9	86.8	87.7	88.6	89.5	90.4	91.2	92.1
13000	83.5	84.3	85.2	86.2	87.1	88.0	88.9	89.8	90.7	91.5	92.4
14000	84.0	84.8	85.8	86.7	87.6	88.5	89.4	90.3	91.2	92.1	93.0
15000	84.6	85.3	86.3	87.2	88.2	89.1	90.0	90.9	91.8	92.7	93.5
16000	84.6	85.3	86.3	87.2	88.2	89.1	90.0	90.9	91.8	92.7	93.5

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N1 FOR T/O MODE

ANTI-ICE OFF
AIRSPEED: 0 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	0	5	10	15	20	25	30	35	40	45	50
-1000	83.6	84.3	85.1	85.8	86.6	87.3	88.0	88.8	89.5	90.2	90.3
0	84.2	85.0	85.8	86.5	87.3	88.0	88.8	89.5	90.2	90.9	90.8
1000	85.4	86.2	86.9	87.7	88.5	89.2	90.0	90.7	91.4	91.4	90.1
2000	86.5	87.3	88.1	88.9	89.7	90.4	91.2	91.9	92.0	91.0	90.2
3000	87.7	88.5	89.2	90.0	90.8	91.6	92.3	92.7	91.8	91.0	90.4
4000	88.7	89.5	90.3	91.1	91.9	92.7	93.2	93.1	91.8	91.0	90.7
5000	89.8	90.6	91.4	92.2	93.0	93.8	93.7	92.7	91.9	91.0	-
6000	90.3	91.2	92.0	92.8	93.6	94.0	93.3	92.6	91.7	91.2	-
7000	90.9	91.7	92.6	93.4	94.2	94.3	93.2	92.4	91.6	91.4	-
8000	91.5	92.4	93.2	94.0	94.5	94.4	93.1	92.3	91.6	-	-
9000	92.2	93.0	93.8	94.6	94.9	93.7	92.9	92.2	91.8	-	-
10000	92.8	93.6	94.5	94.5	93.2	92.2	91.5	90.9	-	-	-
11000	92.9	93.7	94.5	94.5	93.0	92.1	91.4	91.0	-	-	-
12000	92.9	93.8	94.6	94.6	92.8	92.0	91.3	91.2	-	-	-
13000	93.3	94.1	94.7	94.5	92.6	91.9	91.3	-	-	-	-
14000	93.8	94.7	94.9	93.4	92.5	91.7	91.4	-	-	-	-
15000	94.4	95.2	95.1	93.2	92.4	91.5	-	-	-	-	-
16000	94.1	94.1	92.7	91.7	90.9	90.3	-	-	-	-	-

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N1 FOR T/O MODE

ANTI-ICE ON
AIRSPEED: 0 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
-1000	78.3	79.2	80.0	80.8	81.6	82.4	83.2	84.0	83.6	84.3	85.1
0	79.0	79.8	80.6	81.5	82.3	83.1	83.9	84.7	84.2	85.0	85.8
1000	80.0	80.9	81.7	82.6	83.4	84.2	85.0	85.8	85.4	86.2	86.9
2000	81.1	82.0	82.8	83.7	84.5	85.3	86.2	87.0	86.5	87.3	88.1
3000	82.1	83.0	83.9	84.7	85.6	86.4	87.2	88.1	87.6	88.4	89.2
4000	83.1	84.0	84.9	85.7	86.6	87.4	88.3	89.1	88.7	89.5	89.5
5000	84.1	85.0	85.9	86.7	87.6	88.5	89.3	90.2	89.8	90.5	89.5
6000	84.6	85.5	86.4	87.3	88.2	89.0	89.9	90.7	90.3	90.1	89.1
7000	85.1	86.0	86.9	87.8	88.7	89.6	90.4	91.3	90.6	89.8	88.8
8000	85.7	86.6	87.5	88.4	89.3	90.2	91.0	91.8	90.0	89.3	88.4
9000	86.3	87.2	88.1	89.0	89.9	90.8	91.6	91.1	89.3	88.7	88.0
10000	86.9	87.8	88.7	89.6	90.5	91.4	90.9	89.1	87.5	87.1	86.7
11000	86.9	87.9	88.8	89.7	90.6	90.9	90.4	88.8	87.3	87.0	86.6
12000	87.0	87.9	88.9	89.8	90.7	90.5	88.8	88.6	87.1	86.9	86.6
13000	87.3	88.2	89.2	90.1	90.5	90.1	88.6	88.4	87.0	86.8	86.5
14000	87.8	88.8	89.7	90.5	90.2	88.6	88.4	88.3	87.0	86.8	86.2
15000	88.4	89.3	90.2	90.2	89.9	88.4	88.3	88.3	87.0	86.9	85.9
16000	88.4	89.3	90.1	89.7	88.1	87.7	87.5	87.3	85.8	85.2	84.1

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N1 FOR ALT T/O-1 MODE

ANTI-ICE OFF

AIRSPEED: 0 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	-54	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5
-1000	72.3	72.9	73.7	74.6	75.3	76.1	76.9	77.7	78.4	79.2	79.9
0	72.9	73.5	74.3	75.1	75.9	76.7	77.5	78.3	79.1	79.8	80.6
1000	73.7	74.4	75.2	76.1	76.9	77.7	78.5	79.2	80.0	80.8	81.6
2000	74.6	75.3	76.1	77.0	77.8	78.6	79.4	80.2	81.0	81.8	82.5
3000	75.6	76.2	77.1	77.9	78.8	79.6	80.4	81.2	82.0	82.8	83.6
4000	76.6	77.2	78.1	79.0	79.8	80.6	81.5	82.3	83.1	83.9	84.7
5000	77.5	78.3	79.1	80.0	80.8	81.7	82.5	83.4	84.2	85.0	85.8
6000	78.0	78.7	79.6	80.5	81.3	82.2	83.0	83.9	84.7	85.5	86.3
7000	78.5	79.2	80.1	81.0	81.8	82.7	83.5	84.4	85.2	86.0	86.8
8000	78.9	79.6	80.5	81.4	82.2	83.1	84.0	84.8	85.6	86.5	87.3
9000	79.3	80.1	80.9	81.8	82.7	83.6	84.4	85.3	86.1	86.9	87.8
10000	79.7	80.5	81.4	82.2	83.1	84.0	84.8	85.7	86.5	87.4	88.2
11000	80.1	80.8	81.7	82.6	83.5	84.4	85.3	86.1	87.0	87.8	88.6
12000	80.5	81.2	82.1	83.0	83.9	84.8	85.7	86.5	87.4	88.2	89.0
13000	80.9	81.7	82.6	83.5	84.4	85.2	86.1	87.0	87.8	88.7	89.5
14000	81.4	82.1	83.1	84.0	84.9	85.7	86.6	87.5	88.3	89.2	90.0
15000	81.9	82.6	83.6	84.5	85.4	86.3	87.1	88.0	88.9	89.7	90.6
16000	82.6	83.3	84.3	85.2	86.1	87.0	87.9	88.8	89.6	90.5	91.4

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N1 FOR ALT T/O-1 MODE

ANTI-ICE OFF

AIRSPEED: 0 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	0	5	10	15	20	25	30	35	40	45	50
-1000	80.7	81.4	82.2	82.9	83.6	84.3	85.0	85.7	86.4	87.1	87.3
0	81.3	82.1	82.8	83.5	84.3	85.0	85.7	86.4	87.1	87.7	87.5
1000	82.3	83.1	83.8	84.5	85.3	86.0	86.7	87.4	88.1	88.1	86.9
2000	83.3	84.1	84.8	85.6	86.3	87.0	87.8	88.5	88.6	87.7	87.1
3000	84.3	85.1	85.9	86.6	87.4	88.1	88.9	89.2	88.4	87.8	87.3
4000	85.5	86.2	87.0	87.8	88.5	89.3	89.8	89.1	88.5	87.8	87.6
5000	86.6	87.4	88.2	88.9	89.7	90.3	90.2	89.1	88.5	87.9	-
6000	87.1	87.9	88.7	89.5	90.2	90.6	89.7	89.1	88.5	88.0	-
7000	87.6	88.4	89.2	90.0	90.8	90.8	89.7	89.0	88.3	88.2	-
8000	88.1	88.9	89.7	90.5	91.0	90.3	89.6	88.9	88.3	-	-
9000	88.6	89.4	90.2	91.0	91.2	90.2	89.5	88.8	88.5	-	-
10000	89.0	89.8	90.6	91.4	91.3	90.1	89.4	88.6	-	-	-
11000	89.4	90.3	91.1	91.5	90.6	90.0	89.3	88.8	-	-	-
12000	89.9	90.7	91.5	91.5	90.5	89.9	89.2	89.0	-	-	-
13000	90.4	91.2	91.8	91.1	90.5	89.8	89.1	-	-	-	-
14000	90.9	91.7	92.0	91.1	90.4	89.7	89.3	-	-	-	-
15000	91.4	92.2	92.1	91.0	90.3	89.5	-	-	-	-	-
16000	92.2	92.5	91.5	90.8	90.1	89.6	-	-	-	-	-

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N1 FOR ALT T/O-1 MODE

ANTI-ICE ON
AIRSPEED: 0 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
-1000	75.7	76.5	77.3	78.1	78.9	79.6	80.4	81.2	80.7	81.4	82.2
0	76.3	77.1	77.9	78.7	79.5	80.3	81.0	81.8	81.3	82.1	82.8
1000	77.2	78.0	78.8	79.6	80.4	81.2	82.0	82.8	82.3	83.1	83.8
2000	78.1	78.9	79.7	80.6	81.4	82.2	83.0	83.8	83.3	84.1	84.8
3000	79.1	79.9	80.7	81.6	82.4	83.2	84.0	84.8	84.3	85.1	85.9
4000	80.1	80.9	81.8	82.6	83.5	84.3	85.1	85.9	85.5	86.2	87.0
5000	81.1	82.0	82.9	83.7	84.5	85.4	86.2	87.0	86.6	87.4	88.1
6000	81.6	82.5	83.3	84.2	85.0	85.9	86.7	87.5	87.1	87.9	88.7
7000	82.1	83.0	83.8	84.7	85.5	86.4	87.2	88.0	87.6	88.4	89.2
8000	82.5	83.4	84.3	85.2	86.0	86.9	87.7	88.5	88.1	88.9	89.4
9000	83.0	83.8	84.7	85.6	86.5	87.3	88.1	89.0	88.6	89.4	89.3
10000	83.4	84.3	85.2	86.0	86.9	87.7	88.6	89.4	89.0	89.8	89.2
11000	83.8	84.7	85.6	86.4	87.3	88.2	89.0	89.8	89.4	89.7	88.8
12000	84.2	85.1	86.0	86.8	87.7	88.6	89.4	90.3	89.9	89.3	88.5
13000	84.6	85.5	86.4	87.3	88.2	89.0	89.9	90.7	89.8	89.0	88.3
14000	85.1	86.0	86.9	87.8	88.7	89.6	90.4	91.3	89.6	88.9	88.2
15000	85.6	86.5	87.4	88.3	89.2	90.1	90.9	91.3	89.4	88.7	88.1
16000	86.3	87.3	88.2	89.1	90.0	90.8	91.7	91.3	89.4	88.7	88.0

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N1 FOR GO-AROUND

ANTI-ICE OFF
AIRSPEED: 100 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	-54	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5
-1000	77.4	78.1	79.0	79.8	80.7	81.5	82.3	83.2	84.0	84.8	85.6
0	78.0	78.7	79.6	80.4	81.3	82.1	83.0	83.8	84.6	85.5	86.3
1000	78.5	79.2	80.1	81.0	81.8	82.7	83.5	84.4	85.2	86.0	86.8
2000	79.0	79.7	80.6	81.5	82.4	83.2	84.1	84.9	85.8	86.6	87.4
3000	79.5	80.2	81.1	82.0	82.9	83.7	84.6	85.4	86.3	87.1	87.9
4000	79.9	80.7	81.6	82.4	83.3	84.2	85.1	85.9	86.7	87.6	88.4
5000	80.4	81.1	82.0	82.9	83.8	84.6	85.5	86.4	87.2	88.1	88.9
6000	80.8	81.6	82.5	83.4	84.3	85.1	86.0	86.9	87.7	88.6	89.4
7000	81.3	82.0	82.9	83.8	84.7	85.6	86.5	87.4	88.2	89.1	89.9
8000	81.8	82.5	83.5	84.4	85.3	86.2	87.0	87.9	88.8	89.6	90.5
9000	82.3	83.1	84.0	84.9	85.8	86.7	87.6	88.5	89.4	90.2	91.1
10000	82.9	83.6	84.6	85.5	86.4	87.3	88.2	89.1	90.0	90.8	91.7

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N1 FOR GO-AROUND

ANTI-ICE OFF
AIRSPEED: 100 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	0	5	10	15	20	25	30	35	40	45	50
-1000	86.4	87.2	88.0	88.7	89.5	90.3	91.0	91.8	92.0	90.8	89.8
0	87.1	87.9	88.6	89.4	90.2	91.0	91.7	92.5	92.3	90.9	89.9
1000	87.6	88.4	89.2	90.0	90.8	91.6	92.3	92.6	91.7	90.9	89.9
2000	88.2	89.0	89.8	90.6	91.4	92.2	92.9	92.9	91.7	90.9	90.1
3000	88.8	89.6	90.4	91.2	92.0	92.7	93.2	92.5	91.7	90.9	90.3
4000	89.2	90.0	90.9	91.7	92.4	93.2	93.4	92.5	91.8	91.0	90.6
5000	89.7	90.5	91.3	92.1	92.9	93.7	93.6	92.6	91.8	91.0	-
6000	90.2	91.1	91.9	92.7	93.5	93.9	93.2	92.5	91.7	91.2	-
7000	90.7	91.6	92.4	93.2	94.0	94.1	93.2	92.4	91.6	91.4	-
8000	91.3	92.1	93.0	93.8	94.4	94.2	93.1	92.3	91.6	-	-
9000	91.9	92.8	93.6	94.4	94.7	93.6	92.9	92.1	91.8	-	-
10000	92.5	93.4	94.2	94.2	93.1	92.2	91.5	90.8	-	-	-

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N1 FOR GO-AROUND

ANTI-ICE ON
AIRSPEED: 100 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

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Pressure Altitude (ft)	Static Air Temperature - °C										
	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
-1000	81.0	81.8	82.7	83.5	84.4	85.2	86.0	86.8	86.4	87.2	88.0
0	81.6	82.5	83.3	84.2	85.0	85.8	86.7	87.5	87.1	87.9	88.6
1000	82.1	83.0	83.9	84.7	85.6	86.4	87.2	88.1	87.6	88.4	89.2
2000	82.7	83.5	84.4	85.3	86.1	87.0	87.8	88.6	88.2	89.0	89.6
3000	83.1	84.0	84.9	85.8	86.6	87.5	88.3	89.2	88.8	89.6	89.8
4000	83.6	84.5	85.4	86.2	87.1	87.9	88.8	89.6	89.2	90.0	89.8
5000	84.0	84.9	85.8	86.7	87.6	88.4	89.3	90.1	89.7	90.5	89.8
6000	84.5	85.4	86.3	87.2	88.1	88.9	89.8	90.6	90.2	90.5	89.5
7000	85.0	85.9	86.8	87.7	88.6	89.4	90.3	91.1	90.8	90.2	89.2
8000	85.5	86.4	87.3	88.2	89.1	90.0	90.8	91.7	90.6	89.7	88.8
9000	86.1	87.0	87.9	88.8	89.7	90.6	91.4	91.6	89.8	89.1	88.4
10000	86.6	87.6	88.5	89.4	90.3	91.2	91.5	89.7	88.0	87.5	86.9

N1 FOR GO-AROUND

ANTI-ICE OFF
AIRSPEED: 150 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	-54	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5
-1000	77.3	78.0	78.8	79.7	80.5	81.4	82.2	83.0	83.9	84.7	85.5
0	77.9	78.6	79.4	80.3	81.2	82.0	82.8	83.7	84.5	85.3	86.1
1000	78.4	79.1	80.0	80.9	81.7	82.6	83.4	84.3	85.1	85.9	86.7
2000	78.9	79.6	80.5	81.4	82.3	83.1	84.0	84.8	85.7	86.5	87.3
3000	79.4	80.1	81.0	81.9	82.8	83.7	84.5	85.4	86.2	87.0	87.9
4000	79.9	80.6	81.5	82.4	83.3	84.1	85.0	85.8	86.7	87.5	88.4
5000	80.3	81.1	82.0	82.9	83.7	84.6	85.5	86.3	87.2	88.0	88.9
6000	80.8	81.5	82.4	83.3	84.2	85.1	85.9	86.8	87.6	88.5	89.3
7000	81.2	81.9	82.8	83.7	84.6	85.5	86.4	87.2	88.1	88.9	89.8
8000	81.6	82.4	83.3	84.2	85.1	86.0	86.9	87.7	88.6	89.4	90.3
9000	82.1	82.9	83.8	84.7	85.6	86.5	87.4	88.3	89.1	90.0	90.8
10000	82.6	83.4	84.3	85.2	86.1	87.0	87.9	88.8	89.7	90.5	91.4

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N1 FOR GO-AROUND

ANTI-ICE OFF
AIRSPEED: 150 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	0	5	10	15	20	25	30	35	40	45	50
-1000	86.3	87.0	87.8	88.6	89.4	90.1	90.9	91.6	91.8	90.7	89.7
0	86.9	87.7	88.5	89.3	90.0	90.8	91.6	92.3	92.3	90.8	89.7
1000	87.5	88.3	89.1	89.9	90.7	91.4	92.2	92.6	91.6	90.7	89.7
2000	88.1	88.9	89.7	90.5	91.3	92.1	92.8	92.9	91.6	90.7	89.8
3000	88.7	89.5	90.3	91.1	91.9	92.6	93.1	93.0	91.6	90.8	90.1
4000	89.2	90.0	90.8	91.6	92.4	93.2	93.4	92.4	91.7	90.8	90.5
5000	89.7	90.5	91.3	92.1	92.9	93.7	93.6	92.5	91.7	90.9	-
6000	90.2	91.0	91.8	92.6	93.4	93.8	93.1	92.4	91.6	91.1	-
7000	90.6	91.4	92.3	93.1	93.9	94.0	93.1	92.3	91.5	91.3	-
8000	91.1	92.0	92.8	93.6	94.2	94.1	93.0	92.2	91.5	-	-
9000	91.7	92.5	93.3	94.2	94.4	93.5	92.8	92.0	91.7	-	-
10000	92.2	93.1	93.9	94.0	92.9	92.2	91.5	90.7	-	-	-

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N1 FOR GO-AROUND

ANTI-ICE ON
AIRSPEED: 150 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C											
	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
-1000	80.0	80.8	81.7	82.5	83.4	84.2	85.1	85.9	86.7	86.3	87.0	87.8
0	80.6	81.4	82.3	83.2	84.0	84.9	85.7	86.5	87.3	86.9	87.7	88.5
1000	81.1	82.0	82.9	83.7	84.6	85.4	86.3	87.1	87.9	87.5	88.3	89.1
2000	81.7	82.6	83.4	84.3	85.2	86.0	86.9	87.7	88.5	88.1	88.9	89.5
3000	82.2	83.1	84.0	84.8	85.7	86.6	87.4	88.2	89.1	88.7	89.5	89.7
4000	82.6	83.5	84.4	85.3	86.2	87.0	87.9	88.7	89.6	89.2	90.0	89.8
5000	83.1	84.0	84.9	85.8	86.7	87.5	88.4	89.2	90.1	89.7	90.5	89.9
6000	83.5	84.4	85.3	86.2	87.1	88.0	88.8	89.7	90.6	90.2	90.6	89.6
7000	84.0	84.9	85.8	86.7	87.6	88.4	89.3	90.2	91.0	90.6	90.4	89.3
8000	84.4	85.3	86.2	87.1	88.0	88.9	89.8	90.7	91.5	90.8	89.9	88.9
9000	84.9	85.9	86.8	87.7	88.6	89.5	90.3	91.2	91.9	90.0	89.2	88.4
10000	85.4	86.4	87.3	88.2	89.1	90.0	90.9	91.8	90.0	88.2	87.6	86.9

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N1 FOR GO-AROUND

ANTI-ICE OFF
AIRSPEED: 200 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	-54	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5
-1000	77.0	77.7	78.6	79.4	80.3	81.1	82.0	82.8	83.6	84.4	85.2
0	77.7	78.4	79.3	80.1	81.0	81.8	82.7	83.5	84.3	85.1	85.9
1000	78.2	79.0	79.8	80.7	81.6	82.4	83.3	84.1	84.9	85.7	86.6
2000	78.8	79.5	80.4	81.3	82.2	83.0	83.9	84.7	85.5	86.4	87.2
3000	79.4	80.1	81.0	81.9	82.7	83.6	84.4	85.3	86.1	87.0	87.8
4000	79.9	80.6	81.5	82.4	83.2	84.1	85.0	85.8	86.7	87.5	88.3
5000	80.4	81.1	82.0	82.9	83.8	84.6	85.5	86.4	87.2	88.1	88.9
6000	80.7	81.5	82.4	83.3	84.2	85.0	85.9	86.8	87.6	88.5	89.3
7000	81.1	81.8	82.8	83.7	84.6	85.4	86.3	87.2	88.0	88.9	89.7
8000	81.5	82.3	83.2	84.1	85.0	85.9	86.7	87.6	88.5	89.3	90.2
9000	82.0	82.7	83.6	84.5	85.4	86.3	87.2	88.1	89.0	89.8	90.7
10000	82.4	83.1	84.1	85.0	85.9	86.8	87.7	88.6	89.4	90.3	91.1

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N1 FOR GO-AROUND

ANTI-ICE OFF
AIRSPEED: 200 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	0	5	10	15	20	25	30	35	40	45	50
-1000	86.0	86.8	87.6	88.3	89.1	89.8	90.6	91.3	91.6	90.5	89.3
0	86.7	87.5	88.3	89.1	89.8	90.6	91.4	92.1	92.1	90.6	89.3
1000	87.4	88.2	88.9	89.7	90.5	91.3	92.0	92.4	91.5	90.5	89.3
2000	88.0	88.8	89.6	90.4	91.2	91.9	92.7	92.8	91.5	90.5	89.4
3000	88.6	89.4	90.2	91.0	91.8	92.6	93.1	92.9	91.5	90.5	89.7
4000	89.1	90.0	90.8	91.6	92.4	93.1	93.3	92.4	91.5	90.6	90.2
5000	89.7	90.5	91.3	92.1	92.9	93.7	93.6	92.4	91.6	90.7	-
6000	90.1	91.0	91.8	92.6	93.4	93.8	93.0	92.3	91.5	91.0	-
7000	90.6	91.4	92.2	93.0	93.8	93.9	93.0	92.3	91.5	91.3	-
8000	91.0	91.8	92.7	93.5	94.1	94.0	92.9	92.2	91.5	-	-
9000	91.5	92.3	93.2	94.0	94.3	93.5	92.8	92.0	91.7	-	-
10000	92.0	92.8	93.7	93.8	92.8	92.2	91.5	90.7	-	-	-

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N1 FOR GO-AROUND

ANTI-ICE ON
AIRSPEED: 200 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
-1000	80.6	81.5	82.3	83.1	84.0	84.8	85.6	86.4	86.0	86.8	87.6
0	81.3	82.1	83.0	83.8	84.7	85.5	86.3	87.2	86.7	87.5	88.3
1000	81.9	82.7	83.6	84.4	85.3	86.1	87.0	87.8	87.4	88.2	88.9
2000	82.4	83.3	84.2	85.1	85.9	86.8	87.6	88.4	88.0	88.8	89.4
3000	83.0	83.9	84.8	85.6	86.5	87.3	88.2	89.0	88.6	89.4	89.6
4000	83.5	84.4	85.3	86.2	87.0	87.9	88.7	89.6	89.1	90.0	89.8
5000	84.0	84.9	85.8	86.7	87.6	88.4	89.3	90.1	89.7	90.5	89.9
6000	84.4	85.3	86.2	87.1	88.0	88.8	89.7	90.5	90.1	90.7	89.7
7000	84.8	85.7	86.6	87.5	88.4	89.2	90.1	91.0	90.6	90.5	89.5
8000	85.2	86.1	87.0	87.9	88.8	89.7	90.6	91.4	91.0	90.1	89.1
9000	85.7	86.6	87.5	88.4	89.3	90.2	91.0	91.9	90.3	89.4	88.5
10000	86.1	87.1	88.0	88.9	89.8	90.6	91.5	90.4	88.5	87.7	87.0

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N1 FOR MAXIMUM CONTINUOUS MODE

ANTI-ICE OFF
AIRSPEED: 100 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C												
	-65	-60	-54	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5
0	71.2	72.1	73.1	73.7	74.6	75.4	76.2	77.0	77.8	78.5	79.3	80.1	80.8
2000	72.9	73.8	74.9	75.5	76.4	77.2	78.0	78.8	79.6	80.4	81.2	82.0	82.8
4000	74.8	75.7	76.8	77.5	78.4	79.2	80.1	80.9	81.7	82.5	83.4	84.2	85.0
6000	76.3	77.2	78.3	79.0	79.9	80.7	81.6	82.4	83.3	84.1	84.9	85.8	86.6
8000	77.1	78.0	79.1	79.9	80.8	81.6	82.5	83.4	84.2	85.1	85.9	86.7	87.6
10000	77.9	78.9	80.0	80.7	81.6	82.5	83.4	84.2	85.1	85.9	86.8	87.6	88.4
12000	78.7	79.7	80.8	81.5	82.4	83.3	84.2	85.1	86.0	86.8	87.7	88.5	89.4
14000	79.6	80.6	81.7	82.5	83.4	84.3	85.2	86.1	86.9	87.8	88.7	89.6	90.4
16000	80.6	81.5	82.7	83.4	84.4	85.3	86.2	87.1	88.0	88.9	89.7	90.6	91.5
18000	81.7	82.7	83.8	84.6	85.6	86.5	87.4	88.3	89.2	90.1	91.0	91.9	92.7
20000	83.5	84.5	85.7	86.4	87.4	88.4	89.3	90.2	91.2	92.1	93.0	93.9	94.3
22000	84.2	85.2	86.4	87.2	88.2	89.1	90.1	91.0	92.0	92.9	93.8	94.2	93.2
24000	85.0	86.0	87.2	88.0	89.0	89.9	90.9	91.9	92.8	93.7	94.3	93.4	92.6
26000	85.8	86.8	88.0	88.8	89.8	90.8	91.7	92.7	93.7	94.3	94.1	92.8	92.0
28000	86.6	87.6	88.8	89.7	90.7	91.6	92.6	93.6	94.3	94.2	93.0	92.2	91.5
30000	87.4	88.5	89.7	90.5	91.5	92.5	93.5	94.3	94.2	93.1	92.4	91.7	90.9
32000	88.3	89.3	90.6	91.4	92.4	93.4	94.2	94.1	93.2	92.6	91.9	91.0	90.7
34000	89.2	90.3	91.5	92.3	93.4	94.1	94.1	93.3	92.8	92.0	91.2	90.7	-
36000	90.1	91.2	92.5	93.3	94.0	93.8	93.4	92.9	92.2	91.3	90.6	-	-
37000	90.1	91.2	92.5	93.3	94.2	94.0	94.0	93.2	92.5	91.5	90.8	-	-

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N1 FOR MAXIMUM CONTINUOUS MODE

ANTI-ICE OFF
AIRSPEED: 100 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	0	5	10	15	20	25	30	35	40	45	50
0	81.6	82.3	83.1	83.8	84.5	85.2	85.9	86.6	87.3	88.0	87.8
2000	83.6	84.3	85.1	85.8	86.6	87.3	88.0	88.8	88.9	88.0	87.2
4000	85.7	86.5	87.3	88.1	88.8	89.6	90.1	89.4	88.8	88.1	87.9
6000	87.4	88.2	89.0	89.7	90.5	90.8	90.0	89.4	88.8	88.3	-
8000	88.4	89.2	90.0	90.8	91.3	90.6	90.0	89.3	88.7	-	-
10000	89.3	90.1	90.9	91.6	91.5	90.4	89.7	89.0	-	-	-
12000	90.2	91.0	91.8	91.9	90.9	90.2	89.5	89.3	-	-	-
14000	91.2	92.1	92.3	91.4	90.8	90.0	89.7	-	-	-	-
16000	92.3	92.7	91.9	91.2	90.5	90.0	-	-	-	-	-
18000	93.3	93.1	91.5	90.9	90.3	-	-	-	-	-	-
20000	93.0	92.0	91.4	90.8	-	-	-	-	-	-	-
22000	92.3	91.6	91.0	90.8	-	-	-	-	-	-	-
24000	91.8	91.1	90.8	-	-	-	-	-	-	-	-
26000	91.3	90.8	-	-	-	-	-	-	-	-	-
28000	90.8	-	-	-	-	-	-	-	-	-	-
30000	-	-	-	-	-	-	-	-	-	-	-
32000	-	-	-	-	-	-	-	-	-	-	-
34000	-	-	-	-	-	-	-	-	-	-	-
36000	-	-	-	-	-	-	-	-	-	-	-
37000	-	-	-	-	-	-	-	-	-	-	-

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N1 FOR MAXIMUM CONTINUOUS MODE

ANTI-ICE ON
AIRSPEED: 100 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
0	76.5	77.3	78.1	78.9	79.7	80.5	81.3	82.1	81.6	82.3	83.1
2000	78.3	79.2	80.0	80.8	81.6	82.4	83.2	84.0	83.6	84.3	85.1
4000	80.4	81.2	82.0	82.9	83.7	84.6	85.4	86.2	85.7	86.5	85.8
6000	81.9	82.7	83.6	84.5	85.3	86.1	87.0	87.8	87.1	86.4	85.6
8000	82.8	83.7	84.5	85.4	86.3	87.1	88.0	88.8	86.9	86.2	85.4
10000	83.6	84.5	85.4	86.3	87.1	88.0	88.8	89.0	86.9	86.0	85.0
12000	84.5	85.4	86.3	87.2	88.0	88.9	88.8	88.0	86.0	85.2	84.4
14000	85.4	86.3	87.3	88.1	89.0	88.8	88.1	87.5	85.5	84.8	83.9
16000	86.4	87.3	88.3	89.2	89.1	88.5	87.9	87.2	85.3	84.4	83.1
18000	87.6	88.6	89.5	89.9	89.3	88.5	87.7	86.9	84.7	83.4	82.1
20000	89.5	90.5	91.2	90.4	89.1	87.7	86.3	84.8	83.1	82.7	81.7
22000	90.3	90.8	90.1	89.1	87.8	86.5	85.2	84.5	82.8	82.1	81.3
24000	90.4	89.8	89.0	87.9	86.7	85.5	84.7	84.1	82.3	81.7	81.4
26000	89.5	88.8	87.9	87.0	86.0	85.0	84.3	83.7	82.0	81.6	-
28000	88.6	87.9	87.1	86.3	85.5	84.6	83.7	83.4	81.9	-	-
30000	87.7	87.1	86.4	85.8	84.9	84.1	83.5	82.9	-	-	-
32000	87.0	86.5	86.0	85.3	84.5	83.6	82.8	82.5	-	-	-
34000	86.4	86.0	85.4	84.7	83.9	82.9	82.4	-	-	-	-
36000	85.9	85.5	84.9	84.1	83.1	82.3	-	-	-	-	-
37000	85.7	85.2	84.5	83.6	82.6	81.9	-	-	-	-	-

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N1 FOR MAXIMUM CONTINUOUS MODE

ANTI-ICE OFF
AIRSPEED: 150 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C												
	-65	-60	-54	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5
0	71.2	72.1	73.1	73.8	74.6	75.4	76.2	77.0	77.8	78.6	79.3	80.1	80.9
2000	73.0	73.9	74.9	75.6	76.4	77.3	78.1	78.9	79.7	80.5	81.3	82.1	82.9
4000	74.9	75.8	76.9	77.6	78.5	79.3	80.2	81.0	81.8	82.6	83.5	84.3	85.1
6000	76.3	77.3	78.3	79.0	79.9	80.8	81.7	82.5	83.4	84.2	85.0	85.8	86.6
8000	77.2	78.1	79.2	79.9	80.8	81.7	82.6	83.4	84.3	85.1	86.0	86.8	87.6
10000	78.0	78.9	80.0	80.8	81.7	82.6	83.4	84.3	85.2	86.0	86.9	87.7	88.5
12000	78.8	79.7	80.8	81.6	82.5	83.4	84.3	85.1	86.0	86.9	87.7	88.6	89.4
14000	79.6	80.6	81.7	82.4	83.3	84.2	85.1	86.0	86.9	87.8	88.6	89.5	90.3
16000	80.4	81.3	82.5	83.2	84.2	85.1	86.0	86.9	87.8	88.6	89.5	90.4	91.2
18000	81.3	82.3	83.5	84.2	85.2	86.1	87.0	87.9	88.8	89.7	90.6	91.5	92.3
20000	83.1	84.1	85.2	86.0	87.0	87.9	88.9	89.8	90.7	91.6	92.5	93.4	93.9
22000	83.9	84.9	86.1	86.9	87.9	88.8	89.8	90.7	91.7	92.6	93.5	94.1	94.0
24000	84.8	85.8	87.0	87.8	88.8	89.8	90.7	91.7	92.6	93.5	94.2	94.1	92.6
26000	85.7	86.7	87.9	88.7	89.7	90.7	91.7	92.6	93.6	94.2	94.1	92.8	92.0
28000	86.6	87.7	88.9	89.7	90.7	91.7	92.7	93.6	94.2	93.7	93.0	92.3	91.4
30000	87.7	88.7	89.9	90.8	91.8	92.8	93.8	94.3	93.7	93.1	92.4	91.6	90.7
32000	88.7	89.8	91.1	91.9	92.9	93.9	94.3	93.8	93.2	92.6	91.7	90.7	90.4
34000	89.9	91.0	92.3	93.1	94.1	94.2	93.7	93.3	92.7	91.9	90.8	90.3	-
36000	91.2	92.3	93.6	94.0	93.9	93.8	93.4	92.9	92.1	91.0	90.1	-	-
37000	90.8	91.9	93.2	94.0	94.1	94.1	93.7	93.2	92.4	91.2	90.3	-	-

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N1 FOR MAXIMUM CONTINUOUS MODE

ANTI-ICE OFF
AIRSPEED: 150 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	0	5	10	15	20	25	30	35	40	45	50
-1000	81.0	81.7	82.4	83.1	83.9	84.6	85.3	86.0	86.7	87.3	87.6
0	81.6	82.4	83.1	83.8	84.5	85.3	86.0	86.7	87.4	88.0	87.8
1000	82.6	83.4	84.1	84.9	85.6	86.3	87.0	87.8	88.5	88.4	86.8
2000	83.6	84.4	85.2	85.9	86.7	87.4	88.1	88.8	89.0	87.9	87.0
3000	84.7	85.5	86.3	87.0	87.8	88.5	89.3	89.7	88.8	88.0	87.3
4000	85.8	86.6	87.4	88.2	88.9	89.7	90.2	89.5	88.8	88.1	87.7
5000	87.0	87.7	88.5	89.3	90.1	90.7	90.6	89.6	88.9	88.2	-
6000	87.4	88.2	89.0	89.8	90.6	90.9	90.1	89.5	88.9	88.4	-
8000	88.4	89.2	90.0	90.8	91.3	90.6	90.1	89.4	88.8	-	-
10000	89.4	90.2	91.0	91.7	91.6	90.6	89.9	89.1	-	-	-
12000	90.2	91.1	91.9	91.9	91.0	90.3	89.6	89.4	-	-	-
14000	91.2	92.0	92.2	91.4	90.8	90.1	89.8	-	-	-	-
16000	92.1	92.6	91.9	91.3	90.6	90.1	-	-	-	-	-
18000	93.2	93.1	91.6	91.0	90.4	-	-	-	-	-	-
20000	93.7	92.0	91.4	90.8	-	-	-	-	-	-	-
22000	92.3	91.6	91.0	90.8	-	-	-	-	-	-	-
24000	91.8	91.2	90.8	-	-	-	-	-	-	-	-
26000	91.3	90.8	-	-	-	-	-	-	-	-	-
28000	90.7	-	-	-	-	-	-	-	-	-	-
30000	-	-	-	-	-	-	-	-	-	-	-
32000	-	-	-	-	-	-	-	-	-	-	-
34000	-	-	-	-	-	-	-	-	-	-	-
36000	-	-	-	-	-	-	-	-	-	-	-
37000	-	-	-	-	-	-	-	-	-	-	-

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N1 FOR MAXIMUM CONTINUOUS MODE

ANTI-ICE ON
AIRSPEED: 150 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
0	76.5	77.4	78.2	79.0	79.8	80.5	81.3	82.1	81.6	82.4	83.1
2000	78.4	79.3	80.1	80.9	81.7	82.5	83.3	84.1	83.7	84.4	85.2
4000	80.4	81.3	82.1	83.0	83.8	84.7	85.5	86.3	85.8	86.6	86.1
6000	81.9	82.8	83.7	84.5	85.4	86.2	87.1	87.9	87.3	86.6	85.9
8000	82.8	83.7	84.6	85.5	86.3	87.2	88.0	88.8	87.2	86.4	85.6
10000	83.7	84.6	85.5	86.4	87.2	88.1	88.9	89.6	87.4	86.4	85.4
12000	84.5	85.4	86.3	87.2	88.1	88.9	89.4	88.6	86.5	85.6	84.6
14000	85.4	86.3	87.2	88.1	89.0	89.2	88.5	87.8	85.7	84.9	84.0
16000	86.2	87.1	88.1	89.0	89.3	88.7	88.0	87.4	85.4	84.5	83.2
18000	87.2	88.2	89.1	90.0	89.4	88.6	87.8	87.0	84.8	83.5	82.2
20000	89.1	90.0	91.0	90.5	89.2	87.9	86.5	85.1	83.3	82.8	81.7
22000	90.0	90.9	90.2	89.2	88.0	86.7	85.4	84.7	82.9	82.1	81.2
24000	90.5	89.9	89.1	88.0	86.8	85.5	84.7	84.3	82.5	81.7	81.4
26000	89.6	88.9	88.0	87.0	86.0	85.1	84.4	83.8	82.0	81.6	-
28000	88.7	87.9	87.2	86.3	85.5	84.6	83.8	83.5	82.0	-	-
30000	87.8	87.2	86.5	85.8	85.0	84.2	83.6	83.0	-	-	-
32000	87.1	86.6	86.1	85.3	84.5	83.7	82.9	82.6	-	-	-
34000	86.5	86.1	85.5	84.8	83.9	82.9	82.4	-	-	-	-
36000	86.1	85.7	85.0	84.2	83.0	82.1	-	-	-	-	-
37000	85.9	85.4	84.7	83.7	82.6	81.8	-	-	-	-	-

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N1 FOR MAXIMUM CONTINUOUS MODE

ANTI-ICE OFF
AIRSPEED: 200 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C												
	-65	-60	-54	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5
0	71.1	72.0	73.0	73.6	74.5	75.3	76.1	76.9	77.7	78.4	79.2	80.0	80.7
2000	73.1	74.0	75.0	75.7	76.5	77.4	78.2	79.0	79.8	80.6	81.4	82.2	83.0
4000	75.0	75.9	77.0	77.7	78.6	79.4	80.3	81.1	81.9	82.8	83.6	84.4	85.2
6000	76.4	77.3	78.4	79.1	80.0	80.9	81.8	82.6	83.5	84.3	85.1	85.9	86.8
8000	77.3	78.2	79.3	80.0	80.9	81.8	82.7	83.5	84.4	85.2	86.1	86.9	87.7
10000	78.1	79.1	80.2	80.9	81.8	82.7	83.6	84.4	85.3	86.2	87.0	87.8	88.7
12000	78.8	79.8	80.9	81.6	82.5	83.4	84.3	85.2	86.1	86.9	87.8	88.6	89.5
14000	79.6	80.5	81.7	82.4	83.3	84.2	85.1	86.0	86.9	87.8	88.6	89.5	90.3
16000	80.2	81.2	82.3	83.1	84.0	84.9	85.8	86.7	87.6	88.5	89.3	90.2	91.1
18000	80.9	81.9	83.0	83.8	84.7	85.7	86.6	87.5	88.4	89.3	90.1	91.0	91.8
20000	82.3	83.3	84.4	85.2	86.2	87.1	88.0	89.0	89.9	90.8	91.7	92.5	93.4
22000	83.3	84.3	85.5	86.2	87.2	88.1	89.1	90.0	90.9	91.8	92.8	93.6	93.5
24000	84.3	85.3	86.5	87.3	88.3	89.3	90.2	91.2	92.1	93.0	93.8	93.7	92.5
26000	85.5	86.5	87.7	88.5	89.5	90.5	91.4	92.4	93.3	93.9	93.8	92.7	92.0
28000	86.5	87.5	88.7	89.5	90.5	91.5	92.5	93.5	94.0	93.4	92.8	92.2	91.3
30000	87.7	88.7	90.0	90.8	91.8	92.8	93.8	94.2	93.5	92.9	92.3	91.4	90.4
32000	89.1	90.2	91.4	92.3	93.3	94.3	94.3	93.5	92.9	92.3	91.4	90.4	90.1
34000	89.6	90.6	91.9	92.7	93.8	94.1	93.5	93.0	92.3	91.5	90.5	89.9	-
36000	90.0	91.1	92.3	93.2	93.8	93.4	92.9	92.3	91.5	90.5	89.7	-	-
37000	90.0	91.1	92.3	93.2	94.1	94.0	93.1	92.4	91.6	90.6	89.9	-	-

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N1 FOR MAXIMUM CONTINUOUS MODE

ANTI-ICE OFF
AIRSPEED: 200 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	0	5	10	15	20	25	30	35	40	45	50
0	81.5	82.2	83.0	83.7	84.4	85.1	85.8	86.5	87.2	87.8	87.6
2000	83.7	84.5	85.2	86.0	86.7	87.5	88.2	88.9	89.1	87.8	86.6
4000	86.0	86.7	87.5	88.3	89.0	89.8	90.2	89.6	88.9	88.0	87.6
6000	87.6	88.4	89.1	89.9	90.7	91.0	90.2	89.7	88.9	88.5	-
8000	88.5	89.4	90.1	90.9	91.4	90.7	90.2	89.6	89.1	-	-
10000	89.5	90.3	91.1	91.8	91.7	90.7	90.1	89.4	-	-	-
12000	90.3	91.1	91.9	92.0	91.1	90.5	89.8	89.6	-	-	-
14000	91.2	92.0	92.2	91.5	90.9	90.2	89.9	-	-	-	-
16000	91.9	92.5	91.9	91.3	90.6	90.2	-	-	-	-	-
18000	92.7	92.8	91.6	91.0	90.4	-	-	-	-	-	-
20000	93.4	92.0	91.4	90.8	-	-	-	-	-	-	-
22000	92.3	91.6	90.9	90.7	-	-	-	-	-	-	-
24000	91.8	91.1	90.7	-	-	-	-	-	-	-	-
26000	91.2	90.6	-	-	-	-	-	-	-	-	-
28000	90.4	-	-	-	-	-	-	-	-	-	-
30000	-	-	-	-	-	-	-	-	-	-	-
32000	-	-	-	-	-	-	-	-	-	-	-
34000	-	-	-	-	-	-	-	-	-	-	-
36000	-	-	-	-	-	-	-	-	-	-	-
37000	-	-	-	-	-	-	-	-	-	-	-

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N1 FOR MAXIMUM CONTINUOUS MODE

ANTI-ICE ON
AIRSPEED: 200 KCAS

ROLLS-ROYCE AE3007A1P ENGINES

Pressure Altitude (ft)	Static Air Temperature - °C										
	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
0	76.4	77.2	78.0	78.8	79.6	80.4	81.2	82.0	81.5	82.2	82.9
2000	78.5	79.3	80.2	81.0	81.8	82.6	83.4	84.2	83.7	84.5	85.2
4000	80.6	81.4	82.3	83.1	83.9	84.8	85.6	86.4	86.0	86.7	86.4
6000	82.0	82.9	83.8	84.6	85.5	86.3	87.2	88.0	87.6	86.9	86.2
8000	83.0	83.8	84.7	85.6	86.4	87.3	88.1	89.0	87.4	86.7	85.9
10000	83.8	84.7	85.6	86.5	87.4	88.2	89.1	89.9	87.8	86.8	85.7
12000	84.6	85.5	86.4	87.3	88.1	89.0	89.9	89.1	86.9	85.9	84.9
14000	85.4	86.3	87.2	88.1	89.0	89.6	88.8	88.0	86.0	85.1	84.1
16000	86.1	87.0	87.9	88.8	89.4	88.8	88.1	87.4	85.5	84.5	83.3
18000	86.8	87.7	88.7	89.6	89.3	88.5	87.8	87.0	84.8	83.6	82.3
20000	88.3	89.2	90.1	90.3	89.1	87.9	86.7	85.4	83.4	82.5	81.5
22000	89.3	90.3	90.1	89.1	87.9	86.7	85.5	84.7	82.8	81.9	81.0
24000	90.4	89.9	89.0	87.9	86.7	85.5	84.7	84.2	82.3	81.5	81.1
26000	89.5	88.9	87.9	86.9	85.9	85.0	84.4	83.8	81.9	81.5	-
28000	88.7	87.9	87.1	86.2	85.3	84.6	83.9	83.5	81.9	-	-
30000	87.9	87.2	86.4	85.6	84.9	84.1	83.5	82.8	-	-	-
32000	87.2	86.6	85.9	85.2	84.4	83.6	82.7	82.4	-	-	-
34000	86.6	86.0	85.4	84.6	83.8	82.8	82.2	-	-	-	-
36000	86.1	85.5	84.7	83.9	82.8	82.0	-	-	-	-	-
37000	85.8	85.2	84.3	83.5	82.4	81.6	-	-	-	-	-

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TAKEOFF

TAKEOFF SPEEDS

Takeoff performance in the FAA approved EMB-145 AFM and ETOASG (First Principles) software is presented in two formats for airplanes equipped with A1P engines:

a) Balanced Field Length (fixed V1/VR ratio):
   - Flaps 9°, ALT T/O-1 thrust - AFM.

b) Unbalanced Field Length (variable V1/VR ratio):
   - Flaps 9°, ALT T/O-1 thrust - ETOASG (First Principles).
   - Flaps 9°, T/O thrust - ETOASG (First Principles) / AFM.
   - Flaps 18°, T/O thrust - ETOASG (First Principles) / AFM.
   - Flaps 22°, T/O thrust - ETOASG (First Principles) / AFM.

TAKEOFF SPEEDS FOR BALANCED PERFORMANCE

Takeoff speeds V1, VR and V2 for Balanced Performance are read from the tables using the procedure below:

a) Enter the appropriate table with Airport Pressure Altitude and move right as far as the appropriate Static Air Temperature Range.
b) Enter the table with Airplane Brake Release Gross Weight and move right as far as the appropriate temperature column. Read V1, VR and V2. If necessary, interpolate between two weights to obtain the corrected speed.

TAKEOFF SPEEDS FOR UNBALANCED PERFORMANCE

Takeoff speeds V1, VR and V2 for Unbalanced Performance are read from the tables using the procedure below:

a) Enter the appropriate table with Airport Pressure Altitude and move right as far as the appropriate Static Air Temperature Range.
b) Enter the table with Airplane Brake Release Gross Weight and move right as far as the appropriate temperature column. Read VR and V2. If necessary, interpolate between two weights to obtain the corrected speed.
c) For determining V1, enter the appropriate takeoff analysis with the Static Air Temperature and wind and read V1 for the Maximum Takeoff Weight. Use the lower between this V1 and VR obtained in step b as the V1 for the actual Takeoff Weight.

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VR/V2 SPEEDS
EMB-145 - AE3007A1P ENGINES - FAA CERTIFICATION
T/O MODE - NORMAL V2 - FLAPS 9°
ANTI-ICE ON OR OFF

PRESSURE ALTITUDE (ft)	STATIC AIR TEMPERATURE (° C)				
SL →	-40 to 39	40 to 44	45 to 48	49 to 50	
1000 →	-40 to 35	36 to 40	41 to 44	45 to 48	
2000 →	-40 to 30	31 to 36	37 to 41	42 to 46	
3000 →		-40 to 32	33 to 37	38 to 42	43 to 44
4000 →		-40 to 27	28 to 33	34 to 38	39 to 42
5000 →			-40 to 28	29 to 34	35 to 40
6000 →			-40 to 24	25 to 30	31 to 36
7000 →				-40 to 25	26 to 31
8000 →				-40 to 21	22 to 27
10000 →					-40 to 26
	↓	↓	↓	↓	↓
WEIGHT (lb)	**VR V2**	**VR V2**	**VR V2**	**VR V2**	**VR V2**
26500	109 128	106 124	103 120	99 116	96 112
27500	109 127	105 123	102 119	99 115	96 111
28500	108 126	105 122	102 118	99 114	96 111
29500	108 125	105 121	102 117	98 114	98 113
30500	107 124	104 121	101 117	100 114	101 114
31500	107 124	104 120	101 116	102 116	103 116
32500	107 123	104 119	103 118	104 118	105 118
33500	107 123	105 120	106 120	107 120	108 120
34500	106 122	107 122	108 122	109 122	110 122
35500	108 123	109 123	110 123	111 123	112 123
36500	110 125	111 125	112 125	113 125	114 125
37500	112 127	113 127	114 127	115 127	116 127
38500	114 128	115 128	116 128	117 128	118 129
39500	116 130	117 130	118 130	119 130	120 130
40500	118 132	119 132	120 132	121 132	122 132
41500	120 133	121 133	122 133	123 133	124 133
42500	122 135	123 135	124 135	125 135	126 135
43500	124 136	125 136	126 136	127 136	128 136
44500	126 138	127 138	128 138	129 138	129 138
45500	128 139	129 139	129 139	130 139	131 139
46500	130 141	130 141	131 141	132 141	133 141
47500	131 142	132 142	133 142	134 142	135 142
48500	133 144	134 144	135 144	135 144	136 144

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VR/V2 SPEEDS
EMB-145 - AE3007A1P ENGINES - FAA CERTIFICATION
T/O MODE - NORMAL V2 - FLAPS 18°
ANTI-ICE ON OR OFF

PRESSURE ALTITUDE (ft)	STATIC AIR TEMPERATURE (° C)				
SL →	-40 to 41	42 to 48	49 to 50		
1000 →	-40 to 38	39 to 45	46 to 48		
2000 →	-40 to 33	34 to 41	42 to 46		
3000 →	-40 to 29	30 to 37	38 to 44		
4000 →		-40 to 33	34 to 41	42 to 42	
5000 →		-40 to 29	30 to 37	38 to 40	
6000 →		-40 to 24	25 to 33	34 to 38	
7000 →			-40 to 28	29 to 36	
8000 →			-40 to 24	25 to 32	33 to 34
10000 →				-40 to 25	26 to 33
	↓	↓	↓	↓	↓
WEIGHT (lb)	**VR V2**	**VR V2**	**VR V2**	**VR V2**	**VR V2**
26500	109 123	104 118	100 112	99 110	98 108
27500	108 122	104 117	101 113	100 111	98 109
28500	108 122	104 116	102 114	100 112	99 109
29500	108 121	104 117	103 115	102 113	101 110
30500	108 120	106 118	105 116	104 114	103 111
31500	108 121	107 119	106 117	105 115	104 112
32500	109 121	108 119	107 117	106 116	106 114
33500	110 122	109 120	108 118	108 116	107 115
34500	111 123	110 121	109 119	109 117	108 116
35500	112 124	111 122	110 120	110 118	110 117
36500	113 124	112 122	112 121	111 119	111 118
37500	114 125	113 123	113 121	112 120	112 119
38500	115 126	114 124	114 122	113 121	114 120
39500	116 126	115 125	115 123	115 122	115 122
40500	117 127	116 125	116 124	116 123	117 123
41500	118 128	117 126	117 125	118 125	118 124
42500	119 128	118 127	118 126	119 126	120 126
43500	120 129	119 128	120 127	121 127	122 127
44500	121 130	120 128	121 128	122 128	123 128
45500	121 130	122 130	123 130	124 130	125 130
46500	122 131	123 131	124 131	125 131	126 131
47500	124 132	125 132	126 132	127 132	128 132
48500	125 133	126 133	127 133	128 133	130 134

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VR/V2 SPEEDS
EMB-145 - AE3007A1P ENGINES - FAA CERTIFICATION
T/O MODE - NORMAL V2 - FLAPS 22°
ANTI-ICE ON OR OFF

PRESSURE ALTITUDE (ft)	STATIC AIR TEMPERATURE (° C)			
SL →	-40 to 46	47 to 50		
1000 →	-40 to 43	44 to 48		
2000 →	-40 to 39	40 to 46		
3000 →	-40 to 35	36 to 42	43 to 44	
4000 →	-40 to 31	32 to 38	39 to 42	
5000 →	-40 to 26	27 to 34	35 to 40	
6000 →	-40 to 22	23 to 30	31 to 38	
7000 →	-40 to 18	19 to 25	26 to 33	34 to 36
8000 →		-40 to 20	21 to 29	30 to 34
10000 →			-40 to 24	25 to 33
	↓	↓	↓	↓
WEIGHT (lb)	**VR V2**	**VR V2**	**VR V2**	**VR V2**
26500	96 107	94 104	93 102	92 101
27500	96 107	96 105	95 103	94 102
28500	98 108	97 106	96 104	95 103
29500	99 108	98 107	97 105	96 103
30500	100 109	99 108	98 106	98 104
31500	101 110	101 109	100 107	99 105
32500	103 111	102 109	101 108	101 107
33500	104 112	103 110	102 109	103 109
34500	105 113	104 111	104 110	105 110
35500	106 114	105 112	106 112	106 112
36500	107 114	106 113	107 113	108 113
37500	108 115	108 115	109 115	109 115
38500	109 116	109 116	110 116	111 116
39500	110 118	111 118	112 118	112 118
40500	112 119	112 119	113 119	114 119
41500	113 120	114 120	115 120	115 120
42500	115 121	115 121	116 121	117 121
43500	116 122	117 122	117 122	118 122
44500	117 123	118 123	119 123	119 124
45500	119 125	119 125	120 125	121 125
46500	120 126	121 126	121 126	122 126
47500	121 127	122 127	123 127	123 127
48500	122 128	123 128	124 128	124 128

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V1/VR/V2 SPEEDS
EMB-145 - AE3007A1P ENGINES - FAA CERTIFICATION
ALT T/O-1 MODE - NORMAL V2 - FLAPS 9°
ANTI-ICE ON OR OFF

PRESSURE ALTITUDE (ft)	STATIC AIR TEMPERATURE (° C)			
SL →	-40 to 46	47 to 48	49 to 50	
1000 →	-40 to 43	44 to 45	46 to 48	
2000 →	-40 to 39	40 to 42	43 to 45	46 to 46
3000 →	-40 to 35	36 to 38	39 to 41	42 to 44
4000 →	-40 to 31	32 to 34	35 to 38	39 to 41
5000 →	-40 to 26	27 to 30	31 to 33	34 to 37
6000 →		-40 to 25	26 to 29	30 to 32
7000 →		-40 to 20	21 to 24	25 to 28
8000 →			-40 to 20	21 to 24
10000 →				-40 to 23
	↓	↓	↓	↓
WEIGHT (lb)	**V1 VR V2**	**V1 VR V2**	**V1 VR V2**	**V1 VR V2**
26500	100 104 122	98 102 119	97 100 117	95 98 114
27500	100 104 121	99 102 119	97 100 116	95 98 113
28500	100 104 120	99 102 118	97 100 115	95 98 113
29500	100 104 120	99 102 117	97 100 115	97 99 114
30500	100 103 119	98 101 117	98 101 115	99 101 115
31500	100 103 119	99 101 116	100 102 116	101 103 116
32500	101 103 118	102 104 118	103 104 118	103 105 118
33500	104 106 120	104 106 120	105 107 120	106 107 120
34500	106 108 122	107 108 122	108 109 122	108 109 122
35500	108 110 123	109 110 123	110 111 123	111 111 123
36500	111 112 125	111 112 125	112 113 125	113 114 125
37500	113 114 127	114 115 127	115 115 127	115 116 127
38500	115 116 128	116 117 128	117 117 128	117 118 128
39500	118 118 130	118 119 130	119 119 130	119 120 130
40500	120 120 132	120 121 132	121 121 132	121 122 132
41500	122 122 133	122 122 133	123 123 133	123 124 133
42500	124 124 135	124 124 135	125 125 135	125 125 135
43500	126 126 136	126 126 136	127 127 136	127 127 136
44500	128 128 138	128 128 138	129 129 138	129 129 138
45500	129 129 139	130 130 139	130 130 139	131 131 139
46500	131 131 141	132 132 141	132 132 141	133 133 141
47500	133 133 142	133 133 142	134 134 142	134 134 142
48500	134 134 144	135 135 144	135 135 144	136 136 144

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V1/VR/V2 SPEEDS
EMB-145 - AE3007A1P ENGINES - FAA CERTIFICATION
ALT T/O-1 MODE - NORMAL V2 - FLAPS 9°
ANTI-ICE ON OR OFF

PRESSURE ALTITUDE (ft)	STATIC AIR TEMPERATURE (° C)		
SL →			
1000 →			
2000 →			
3000 →			
4000 →	42 to 42		
5000 →	38 to 40		
6000 →	33 to 36	37 to 38	
7000 →	29 to 32	33 to 35	36 to 36
8000 →	25 to 27	28 to 31	32 to 34
10000 →		22 to 25	26 to 32
	↓	↓	↓
WEIGHT (lb)	**V1 VR V2**	**V1 VR V2**	**V1 VR V2**
26500	94 96 112	92 94 109	91 92 107
27500	93 96 111	92 94 109	94 95 109
28500	94 96 111	95 97 111	96 98 111
29500	97 99 112	98 99 112	99 100 112
30500	99 101 114	100 102 114	101 102 114
31500	102 103 116	103 104 116	104 105 116
32500	104 106 118	105 106 118	106 107 118
33500	107 108 120	108 109 120	109 109 120
34500	109 110 122	110 111 122	111 111 122
35500	112 112 123	112 113 123	113 113 123
36500	114 114 125	115 115 125	115 115 125
37500	116 116 127	117 117 127	117 117 127
38500	118 118 128	119 119 128	119 119 128
39500	120 120 130	121 121 130	121 121 130
40500	122 122 132	123 123 132	123 123 132
41500	124 124 133	125 125 133	125 125 133
42500	126 126 135	126 126 135	127 127 135
43500	128 128 136	128 128 136	129 129 136
44500	130 130 138	130 130 138	131 131 138
45500	131 131 139	132 132 139	132 132 139
46500	133 133 141	134 134 141	134 134 141
47500	135 135 142	135 135 142	136 136 142
48500	136 136 144	137 137 144	137 137 144

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FLAP RETRACTION SCHEDULE

Takeoff with Flap 9°:
Flap 9° to UP ..... V_2 + 15 KIAS

Takeoff with flap 18°:
Flap 18° to 9° ..... V_2 + 10 KIAS
Flap 9° to UP ..... V_2 + 30 KIAS

Takeoff with flap 22°:
Flap 22° to 9° ..... V_2 + 10 KIAS
Flap 9° to UP ..... V_2 + 30 KIAS

FINAL SEGMENT SPEED

WEIGHT (lb)	V_{FS} (KIAS)
26000	132
27000	134
28000	136
29000	139
30000	141
31000	142
32000	145
33000	147
34000	150
35000	152
36000	154
37000	156
38000	158
39000	160
40000	162
41000	164
42000	165
43000	167
44000	169
45000	171
46000	172
47000	173
48000	175
49000	177
50000	179

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PITCH TRIM SETTING FOR TAKEOFF

CG POSITION (%)	LESS THAN OR EQUAL TO 27.5	27.6 UP TO 32.5	32.6 UP TO 36.5	36.6 UP TO 41.5	ABOVE OR EQUAL TO 41.6
PITCH TRIM UNITS	8	7	6	5	4

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CLIMB GRADIENT

The climb gradient tables show the climb gradients for several weights, temperatures and altitudes. These tables are published in the following configurations:

GRADIENTS FOR TAKEOFF THRUST AND FLAPS 9

The gradients were obtained for a speed equal to V_2 + 10 KIAS and V_2/V_S ratio equal to 1.20. The thrust rating was T/O with Anti-Ice OFF. Corrections in the climb gradient for Anti-Ice ON and Flaps 18 are also provided below each table.

GRADIENTS FOR TAKEOFF THRUST AND FLAPS UP

The gradients were obtained for a speed equal to 200 KIAS. The thrust rating was T/O with Anti-Ice OFF. Below each table are provided corrections in the climb gradients for Anti-Ice ON and corrections for climb speed equal to V_{FS}.

GRADIENTS FOR CLIMB THRUST AND FLAPS UP

The gradients were obtained for the following climb schedule:

- 240 KIAS up to 10000 ft, increasing linearly to 300 KIAS at 12000 ft, maintaining this speed up to 20000 ft.
- The thrust rating was CLB with Anti-Ice OFF. Corrections in the climb gradient for Anti-Ice ON are provided after the tables.

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CLIMB GRADIENT - ALL ENGINES OPERATING

TAKEOFF RATING - FLAPS 9

AE3007A1P ENGINES

ANTI ICE: OFF
LANDING GEAR UP
T/O MODE
AIRSPEED: V2 + 10 KIAS
WINGS LEVELED

ALTITUDE: 0 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	33.72	31.01	28.54	26.27	24.20	22.31	20.61	19.08	17.70	16.45	15.30	14.26
-20	33.74	31.03	28.55	26.28	24.21	22.32	20.62	19.10	17.71	16.46	15.32	14.27
-10	33.69	30.98	28.51	26.24	24.17	22.28	20.58	19.06	17.68	16.43	15.28	14.24
0	33.57	30.87	28.40	26.14	24.07	22.18	20.50	18.98	17.60	16.35	15.21	14.17
10	33.43	30.74	28.28	26.02	23.96	22.08	20.40	18.88	17.51	16.26	15.13	14.09
20	33.31	30.63	28.17	25.92	23.86	21.99	20.31	18.80	17.43	16.19	15.06	14.02
30	32.36	29.61	27.09	24.77	22.74	20.93	19.31	17.85	16.53	15.33	14.24	13.25

ALTITUDE : 2000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	33.75	30.99	28.46	26.15	24.04	22.17	20.48	18.97	17.60	16.35	15.22	14.20
-20	33.76	30.99	28.47	26.16	24.05	22.17	20.49	18.98	17.60	16.36	15.23	14.20
-10	33.71	30.95	28.42	26.11	24.01	22.13	20.45	18.94	17.57	16.32	15.20	14.17
0	33.61	30.85	28.33	26.03	23.93	22.05	20.38	18.87	17.50	16.26	15.13	14.11
10	33.50	30.75	28.24	25.94	23.84	21.98	20.30	18.80	17.43	16.20	15.07	14.05
20	33.32	30.58	28.08	25.78	23.70	21.84	20.17	18.67	17.32	16.08	14.97	13.95
30	30.91	28.19	25.69	23.46	21.51	19.77	18.21	16.81	15.54	14.39	13.35	12.40

ALTITUDE: 4000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	33.51	30.71	28.16	25.80	23.71	21.85	20.19	18.69	17.33	16.10	14.99	13.98
-20	33.53	30.73	28.17	25.81	23.72	21.87	20.20	18.70	17.34	16.11	15.00	13.99
-10	33.47	30.67	28.11	25.76	23.68	21.82	20.16	18.67	17.31	16.08	14.97	13.96
0	33.39	30.59	28.04	25.69	23.61	21.76	20.10	18.61	17.26	16.03	14.92	13.91
10	33.28	30.49	27.94	25.60	23.53	21.68	20.02	18.54	17.19	15.96	14.86	13.85
20	32.76	30.00	27.48	25.16	23.11	21.29	19.66	18.19	16.86	15.65	14.56	13.57
30	29.42	26.73	24.30	22.16	20.28	18.62	17.12	15.78	14.56	13.46	12.46	11.56

FOR ANTI-ICE ON, REDUCE THE CLIMB GRADIENT BY 2.2%.

FOR FLAPS 18, REDUCE THE CLIMB GRADIENT BY 1.25%.

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CLIMB GRADIENT - ALL ENGINES OPERATING

TAKEOFF RATING - FLAPS 9

AE3007A1P ENGINES

ANTI ICE: OFF
LANDING GEAR UP
T/O MODE
AIRSPEED: V2 + 10 KIAS
WINGS LEVELED

ALTITUDE: 6000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	32.73	29.91	27.33	25.00	22.97	21.15	19.53	18.06	16.74	15.54	14.45	13.46
-20	32.75	29.94	27.36	25.03	22.99	21.17	19.55	18.08	16.76	15.55	14.47	13.48
-10	32.72	29.91	27.33	25.00	22.96	21.15	19.52	18.06	16.74	15.53	14.45	13.46
0	32.62	29.82	27.24	24.92	22.88	21.08	19.45	17.99	16.67	15.47	14.39	13.40
10	32.51	29.71	27.14	24.82	22.79	20.99	19.37	17.92	16.60	15.40	14.32	13.34
20	31.03	28.32	25.84	23.60	21.65	19.91	18.35	16.94	15.67	14.52	13.48	12.53
30	27.72	25.08	22.76	20.72	18.93	17.34	15.92	14.64	13.48	12.43	11.48	10.62

ALTITUDE: 8000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	30.86	28.08	25.56	23.35	21.40	19.68	18.13	16.74	15.48	14.33	13.30	12.36
-20	30.86	28.08	25.57	23.36	21.42	19.70	18.15	16.76	15.50	14.36	13.33	12.39
-10	30.86	28.08	25.57	23.35	21.41	19.69	18.14	16.75	15.49	14.35	13.31	12.38
0	30.78	28.01	25.50	23.29	21.35	19.63	18.08	16.70	15.44	14.30	13.27	12.33
10	30.68	27.92	25.41	23.20	21.27	19.55	18.01	16.63	15.37	14.23	13.21	12.27
20	29.30	26.62	24.19	22.05	20.18	18.52	17.03	15.69	14.47	13.37	12.38	11.48
30	25.82	23.30	21.10	19.16	17.47	15.97	14.62	13.41	12.32	11.32	10.43	9.62

ALTITUDE: 10000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	28.98	26.24	23.85	21.74	19.89	18.25	16.78	15.46	14.26	13.18	12.20	11.31
-20	29.02	26.28	23.88	21.77	19.92	18.28	16.81	15.48	14.29	13.20	12.22	11.33
-10	28.99	26.25	23.86	21.75	19.90	18.26	16.79	15.47	14.27	13.19	12.21	11.32
0	28.91	26.18	23.78	21.68	19.84	18.20	16.74	15.42	14.22	13.14	12.16	11.28
10	28.83	26.10	23.71	21.62	19.78	18.15	16.69	15.37	14.18	13.10	12.13	11.24
20	27.55	24.90	22.59	20.55	18.77	17.19	15.77	14.50	13.35	12.30	11.36	10.50
30	23.78	21.41	19.34	17.53	15.94	14.53	13.27	12.13	11.10	10.17	9.34	8.58

FOR ANTI-ICE ON, REDUCE THE CLIMB GRADIENT BY 2.2%.

FOR FLAPS 18, REDUCE THE CLIMB GRADIENT BY 1.25%.

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CLIMB GRADIENT - ALL ENGINES OPERATING

TAKEOFF RATING - FLAPS 9

AE3007A1P ENGINES

ANTI ICE: OFF
LANDING GEAR UP
T/O MODE
AIRSPEED: V2 + 10 KIAS
WINGS LEVELED

ALTITUDE: 12000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	26.14	23.60	21.38	19.42	17.72	16.20	14.84	13.62	12.51	11.51	10.61	9.79
-20	26.16	23.61	21.39	19.44	17.73	16.21	14.85	13.63	12.52	11.52	10.62	9.80
-10	26.15	23.60	21.38	19.43	17.72	16.21	14.85	13.63	12.52	11.52	10.61	9.79
0	26.08	23.54	21.32	19.37	17.67	16.15	14.80	13.58	12.47	11.47	10.57	9.75
10	25.98	23.44	21.23	19.28	17.58	16.07	14.72	13.50	12.40	11.40	10.50	9.69
20	25.53	23.03	20.84	18.92	17.25	15.76	14.42	13.22	12.13	11.15	10.26	9.45
30	22.01	19.75	17.78	16.06	14.55	13.21	12.01	10.93	9.96	9.08	-	-

FOR ANTI-ICE ON, REDUCE THE CLIMB GRADIENT BY 2.2%.

FOR FLAPS 18, REDUCE THE CLIMB GRADIENT BY 1.25%.

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CLIMB GRADIENT - ALL ENGINES OPERATING

TAKEOFF RATING - FLAPS UP

AE3007A1P ENGINES

ANTI ICE: OFF
LANDING GEAR UP
T/O MODE
AIRSPEED: 200 KIAS
WINGS LEVELED

ALTITUDE: 0 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	29.37	27.14	25.17	23.42	21.86	20.44	19.15	17.97	16.89	15.89	14.96	14.10
-20	29.38	27.15	25.19	23.44	21.87	20.45	19.16	17.98	16.90	15.90	14.97	14.11
-10	29.30	27.08	25.12	23.37	21.80	20.39	19.10	17.93	16.85	15.85	14.92	14.06
0	29.17	26.96	25.00	23.26	21.70	20.29	19.01	17.84	16.76	15.77	14.85	13.99
10	29.03	26.82	24.87	23.14	21.59	20.18	18.91	17.74	16.67	15.68	14.76	13.91
20	28.91	26.71	24.77	23.05	21.50	20.10	18.83	17.67	16.60	15.61	14.69	13.84
30	27.75	25.63	23.75	22.09	20.59	19.24	18.01	16.89	15.86	14.90	14.02	13.19

ALTITUDE: 2000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	29.52	27.28	25.31	23.55	21.97	20.55	19.26	18.07	16.99	15.98	15.05	14.18
-20	29.52	27.28	25.30	23.54	21.97	20.55	19.25	18.07	16.98	15.98	15.05	14.18
-10	29.47	27.23	25.26	23.51	21.93	20.51	19.22	18.04	16.95	15.95	15.02	14.15
0	29.36	27.13	25.16	23.41	21.84	20.43	19.14	17.96	16.88	15.88	14.95	14.09
10	29.25	27.03	25.07	23.33	21.76	20.35	19.07	17.89	16.82	15.82	14.89	14.03
20	29.08	26.87	24.92	23.19	21.63	20.23	18.95	17.78	16.71	15.72	14.80	13.94
30	26.39	24.36	22.57	20.97	19.54	18.24	17.06	15.99	14.99	14.08	13.22	12.43

ALTITUDE: 4000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	29.29	27.06	25.10	23.36	21.79	20.38	19.09	17.92	16.84	15.84	14.91	14.05
-20	29.28	27.06	25.10	23.35	21.79	20.37	19.09	17.91	16.83	15.83	14.91	14.05
-10	29.23	27.01	25.05	23.31	21.75	20.33	19.05	17.88	16.80	15.80	14.88	14.02
0	29.15	26.94	24.98	23.24	21.68	20.28	19.00	17.83	16.75	15.76	14.83	13.98
10	29.05	26.84	24.89	23.16	21.61	20.20	18.92	17.76	16.68	15.69	14.77	13.92
20	28.57	26.39	24.47	22.77	21.23	19.85	18.59	17.44	16.38	15.40	14.50	13.65
30	25.02	23.08	21.37	19.84	18.47	17.23	16.10	15.07	14.12	13.24	12.42	11.66

FOR ANTI-ICE ON, REDUCE THE CLIMB GRADIENT BY 3.66%.

CLIMBING IN VFS, INCREASE THE CLIMB GRADIENT BY 0.51%.

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CLIMB GRADIENT - ALL ENGINES OPERATING

TAKEOFF RATING - FLAPS UP

AE3007A1P ENGINES

ANTI ICE: OFF
LANDING GEAR UP
T/O MODE
AIRSPEED: 200 KIAS
WINGS LEVELED

ALTITUDE: 6000 FT

ISA+°C **WEIGHT (LB)**

	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	28.34	26.18	24.27	22.57	21.05	19.68	18.43	17.28	16.23	15.26	14.36	13.52
-20	28.33	26.17	24.26	22.56	21.04	19.67	18.42	17.28	16.22	15.25	14.35	13.51
-10	28.29	26.13	24.23	22.53	21.01	19.64	18.39	17.25	16.20	15.23	14.33	13.49
0	28.19	26.04	24.14	22.45	20.94	19.57	18.33	17.19	16.14	15.17	14.28	13.44
10	28.07	25.93	24.04	22.36	20.85	19.48	18.24	17.11	16.07	15.10	14.21	13.37
20	26.76	24.71	22.89	21.28	19.83	18.52	17.33	16.23	15.23	14.30	13.44	12.64
30	23.48	21.65	20.02	18.58	17.28	16.10	15.03	14.05	13.14	12.31	11.53	10.80

ALTITUDE: 8000 FT

ISA+°C **WEIGHT (LB)**

	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	26.43	24.39	22.60	21.00	19.57	18.27	17.09	16.01	15.02	14.10	13.25	12.45
-20	26.48	24.44	22.64	21.04	19.60	18.31	17.12	16.04	15.05	14.13	13.27	12.48
-10	26.44	24.41	22.61	21.01	19.58	18.28	17.10	16.02	15.03	14.11	13.25	12.46
0	26.35	24.32	22.53	20.94	19.50	18.21	17.03	15.96	14.97	14.05	13.20	12.41
10	26.22	24.20	22.41	20.83	19.40	18.11	16.94	15.87	14.88	13.97	13.12	12.33
20	24.79	22.87	21.17	19.66	18.30	17.07	15.95	14.92	13.98	13.10	12.29	11.54
30	21.82	20.09	18.56	17.20	15.98	14.87	13.86	12.94	12.08	11.29	10.56	9.87

ALTITUDE: 10000 FT

ISA+°C **WEIGHT (LB)**

	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	24.60	22.69	21.00	19.50	18.15	16.92	15.81	14.79	13.86	12.99	12.18	11.43
-20	24.64	22.73	21.04	19.53	18.18	16.95	15.84	14.82	13.88	13.01	12.21	11.45
-10	24.59	22.68	20.99	19.49	18.14	16.92	15.81	14.79	13.85	12.98	12.18	11.42
0	24.52	22.61	20.93	19.43	18.08	16.86	15.75	14.74	13.80	12.94	12.13	11.38
10	24.44	22.54	20.86	19.36	18.02	16.80	15.70	14.68	13.75	12.89	12.09	11.34
20	23.08	21.27	19.67	18.24	16.96	15.80	14.74	13.78	12.88	12.06	11.29	10.58
30	20.10	18.49	17.06	15.79	14.64	13.61	12.66	11.79	10.99	10.25	9.56	8.91

FOR ANTI-ICE ON, REDUCE THE CLIMB GRADIENT BY 3.66%.

CLIMBING IN VFS, INCREASE THE CLIMB GRADIENT BY 0.51%.

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CLIMB GRADIENT - ALL ENGINES OPERATING

TAKEOFF RATING - FLAPS UP

AE3007A1P ENGINES

ANTI ICE: OFF
LANDING GEAR UP
T/O MODE
AIRSPEED: 200 KIAS
WINGS LEVELED

ALTITUDE: 12000 FT

ISA+ºC	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	21.93	20.20	18.66	17.30	16.07	14.95	13.94	13.01	12.15	11.36	10.62	9.93
-20	21.94	20.20	18.67	17.30	16.07	14.96	13.95	13.02	12.16	11.36	10.63	9.94
-10	21.93	20.20	18.67	17.30	16.07	14.96	13.94	13.01	12.16	11.36	10.62	9.93
0	21.84	20.11	18.58	17.22	16.00	14.89	13.88	12.95	12.10	11.31	10.57	9.88
10	21.76	20.04	18.52	17.16	15.94	14.83	13.82	12.90	12.05	11.26	10.53	9.84
20	21.33	19.63	18.13	16.80	15.60	14.51	13.52	12.61	11.77	10.99	10.27	9.59
30	18.27	16.78	15.46	14.28	13.22	12.26	11.38	10.57	9.82	9.13	8.49	7.88

ALTITUDE: 13500 FT

ISA+ºC	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	20.52	18.88	17.43	16.13	14.97	13.91	12.95	12.07	11.25	10.50	9.80	9.14
-20	20.52	18.88	17.43	16.13	14.97	13.91	12.95	12.07	11.25	10.50	9.80	9.14
-10	20.52	18.88	17.43	16.14	14.97	13.92	12.95	12.07	11.26	10.50	9.80	9.14
0	20.45	18.81	17.37	16.07	14.91	13.86	12.90	12.02	11.21	10.46	9.76	9.10
10	20.36	18.73	17.29	16.00	14.85	13.80	12.84	11.96	11.16	10.41	9.71	9.05
20	20.03	18.42	17.00	15.73	14.59	13.55	12.61	11.74	10.94	10.20	9.51	8.87
30	17.09	15.67	14.42	13.31	12.30	11.38	10.55	9.78	9.07	8.41	7.80	7.22

FOR ANTI-ICE ON, REDUCE THE CLIMB GRADIENT BY 3.66%.

CLIMBING IN VFS, INCREASE THE CLIMB GRADIENT BY 0.51%.

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CLIMB GRADIENT - ALL ENGINES OPERATING

CLIMB RATING - FLAPS UP

AE3007A1P ENGINES

ANTI ICE: OFF
LANDING GEAR UP
CLB MODE
WINGS LEVELED
SPEED SCHEDULE: 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 300 KIAS AT 12000 FT, MAINTAINING 300 KIAS UP TO 20000 FT.

ALTITUDE: 0 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	21.01	19.41	18.00	16.75	15.62	14.61	13.68	12.84	12.07	11.36	10.70	9.94
-20	21.01	19.41	18.00	16.74	15.62	14.60	13.68	12.84	12.07	11.36	10.69	9.94
-10	20.97	19.37	17.96	16.71	15.58	14.57	13.65	12.81	12.04	11.33	10.67	9.91
0	20.87	19.28	17.88	16.63	15.51	14.50	13.59	12.75	11.98	11.27	10.61	9.86
10	20.57	18.99	17.61	16.38	15.27	14.28	13.37	12.54	11.79	11.08	10.44	9.70
20	17.27	15.92	14.72	13.66	12.71	11.85	11.06	10.35	9.69	9.08	8.51	7.86
30	14.26	13.11	12.09	11.19	10.37	9.63	8.96	8.34	7.77	7.25	6.76	6.18

ALTITUDE: 2000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	19.62	18.11	16.78	15.60	14.53	13.58	12.71	11.91	11.18	10.50	9.88	9.16
-20	19.63	18.12	16.79	15.61	14.55	13.59	12.72	11.92	11.19	10.51	9.89	9.17
-10	19.60	18.09	16.76	15.58	14.52	13.56	12.69	11.89	11.16	10.49	9.87	9.15
0	19.51	18.01	16.68	15.50	14.45	13.49	12.63	11.84	11.11	10.44	9.81	9.10
10	19.12	17.64	16.34	15.18	14.15	13.21	12.36	11.58	10.86	10.20	9.59	8.88
20	16.08	14.80	13.68	12.68	11.78	10.97	10.23	9.55	8.93	8.35	7.81	7.19
30	13.22	12.14	11.18	10.33	9.56	8.86	8.23	7.65	7.11	6.61	6.15	5.60

ALTITUDE: 4000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	18.25	16.83	15.58	14.46	13.46	12.56	11.74	10.99	10.30	9.67	9.08	8.39
-20	18.27	16.85	15.59	14.48	13.48	12.58	11.76	11.01	10.32	9.68	9.09	8.41
-10	18.24	16.83	15.57	14.46	13.46	12.56	11.74	10.99	10.30	9.67	9.07	8.39
0	18.17	16.76	15.51	14.40	13.41	12.51	11.69	10.94	10.26	9.62	9.03	8.35
10	17.78	16.40	15.17	14.08	13.10	12.22	11.42	10.68	10.01	9.39	8.81	8.14
20	14.87	13.67	12.62	11.68	10.83	10.07	9.38	8.74	8.15	7.61	7.10	6.51
30	12.15	11.14	10.25	9.45	8.73	8.07	7.48	6.93	6.43	5.96	5.52	5.00

FOR ANTI-ICE ON, REDUCE THE CLIMB GRADIENT BY 3.73%.

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CLIMB GRADIENT - ALL ENGINES OPERATING

CLIMB RATING - FLAPS UP

AE3007A1P ENGINES

ANTI ICE: OFF
LANDING GEAR UP
CLB MODE
WINGS LEVELED
SPEED SCHEDULE: 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 300 KIAS AT 12000 FT, MAINTAINING 300 KIAS UP TO 20000 FT.

ALTITUDE: 6000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	16.91	15.58	14.41	13.36	12.42	11.58	10.80	10.10	9.45	8.85	8.29	7.66
-20	16.93	15.60	14.42	13.37	12.44	11.59	10.82	10.11	9.46	8.86	8.30	7.67
-10	16.92	15.59	14.42	13.37	12.43	11.59	10.81	10.11	9.46	8.86	8.30	7.67
0	16.87	15.54	14.37	13.32	12.39	11.54	10.77	10.07	9.42	8.82	8.27	7.64
10	16.48	15.18	14.03	13.01	12.09	11.26	10.50	9.81	9.18	8.59	8.04	7.42
20	13.65	12.54	11.55	10.68	9.89	9.17	8.52	7.93	7.38	6.87	6.39	5.84
30	11.08	10.14	9.31	8.56	7.89	7.28	6.73	6.22	5.74	5.30	4.90	4.41

ALTITUDE: 8000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	15.68	14.43	13.33	12.35	11.47	10.67	9.94	9.28	8.67	8.10	7.57	6.97
-20	15.72	14.47	13.36	12.38	11.49	10.69	9.97	9.30	8.69	8.12	7.59	6.99
-10	15.71	14.46	13.36	12.37	11.49	10.69	9.97	9.30	8.69	8.12	7.59	6.99
0	15.65	14.40	13.30	12.32	11.44	10.64	9.92	9.26	8.65	8.08	7.56	6.96
10	15.32	14.10	13.01	12.05	11.18	10.40	9.69	9.04	8.44	7.88	7.36	6.77
20	12.52	11.48	10.57	9.75	9.01	8.34	7.73	7.17	6.66	6.18	5.73	5.21
30	10.08	9.21	8.43	7.74	7.11	6.54	6.02	5.55	5.10	4.69	4.31	3.85

ALTITUDE: 10000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	14.50	13.32	12.29	11.37	10.54	9.79	9.11	8.48	7.91	7.37	6.88	6.31
-20	14.52	13.35	12.31	11.39	10.56	9.81	9.13	8.50	7.92	7.39	6.89	6.32
-10	14.52	13.35	12.31	11.39	10.56	9.81	9.12	8.50	7.92	7.39	6.89	6.32
0	14.47	13.30	12.27	11.35	10.52	9.77	9.09	8.47	7.89	7.36	6.86	6.29
10	14.22	13.07	12.05	11.14	10.33	9.59	8.92	8.30	7.73	7.21	6.72	6.16
20	11.40	10.44	9.58	8.82	8.13	7.51	6.94	6.42	5.94	5.49	5.08	4.58
30	9.08	8.27	7.55	6.90	6.32	5.80	5.31	4.87	4.46	4.08	3.72	3.28

FOR ANTI-ICE ON, REDUCE THE CLIMB GRADIENT BY 3.73%.

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CLIMB GRADIENT - ALL ENGINES OPERATING

CLIMB RATING - FLAPS UP

AE3007A1P ENGINES

ANTI ICE: OFF
LANDING GEAR UP
CLB MODE
WINGS LEVELED
SPEED SCHEDULE: 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 300 KIAS AT 12000 FT, MAINTAINING 300 KIAS UP TO 20000 FT.

ALTITUDE: 12000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	7.74	7.06	6.45	5.92	5.44	5.00	4.61	4.24	3.91	3.60	3.32	2.83
-20	7.76	7.08	6.47	5.94	5.45	5.02	4.62	4.26	3.93	3.62	3.33	2.84
-10	7.77	7.08	6.48	5.94	5.46	5.02	4.63	4.26	3.93	3.62	3.34	2.85
0	7.73	7.04	6.44	5.91	5.43	4.99	4.60	4.23	3.90	3.60	3.31	2.82
10	7.36	6.70	6.12	5.60	5.14	4.72	4.34	3.99	3.67	3.37	3.10	2.62
20	5.03	4.53	4.08	3.69	3.33	3.01	2.71	2.44	2.19	1.96	1.74	1.32
30	2.98	2.62	2.29	2.00	1.74	1.50	1.28	1.07	0.88	0.71	0.54	0.18

ALTITUDE: 14000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	6.75	6.13	5.58	5.10	4.66	4.26	3.90	3.57	3.27	2.99	2.73	2.27
-20	6.77	6.15	5.60	5.11	4.67	4.28	3.92	3.59	3.28	3.00	2.74	2.28
-10	6.77	6.15	5.60	5.12	4.68	4.28	3.92	3.59	3.28	3.00	2.74	2.28
0	6.74	6.12	5.57	5.09	4.65	4.25	3.89	3.56	3.26	2.98	2.72	2.26
10	6.39	5.80	5.27	4.80	4.38	4.00	3.65	3.34	3.04	2.77	2.52	2.07
20	4.15	3.70	3.31	2.95	2.64	2.35	2.08	1.84	1.62	1.41	1.21	0.82
30	2.21	1.90	1.61	1.36	1.13	0.92	0.73	0.55	0.38	0.23	0.08	-0.26

ALTITUDE: 16000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	5.93	5.36	4.86	4.41	4.01	3.65	3.32	3.01	2.73	2.48	2.23	1.80
-20	5.95	5.38	4.88	4.43	4.03	3.66	3.33	3.03	2.75	2.49	2.25	1.82
-10	5.94	5.37	4.87	4.42	4.02	3.66	3.33	3.02	2.74	2.48	2.24	1.81
0	5.92	5.35	4.85	4.41	4.00	3.64	3.31	3.01	2.73	2.47	2.23	1.80
10	5.58	5.04	4.55	4.13	3.74	3.39	3.07	2.78	2.51	2.26	2.03	1.61
20	3.35	2.96	2.61	2.29	2.01	1.75	1.51	1.30	1.10	0.91	0.73	0.37
30	1.50	1.23	0.98	0.76	0.57	0.38	0.22	0.06	-0.08	-0.22	-0.35	-0.66

FOR ANTI-ICE ON, REDUCE THE CLIMB GRADIENT BY 3.73%.

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CLIMB GRADIENT - ALL ENGINES OPERATING

CLIMB RATING - FLAPS UP

AE3007A1P ENGINES

ANTI ICE: OFF
LANDING GEAR UP
CLB MODE
WINGS LEVELED
SPEED SCHEDULE: 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 300 KIAS AT 12000 FT, MAINTAINING 300 KIAS UP TO 20000 FT.

ALTITUDE: 18000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	5.38	4.85	4.38	3.96	3.58	3.23	2.92	2.64	2.37	2.13	1.90	1.49
-20	5.39	4.85	4.38	3.96	3.58	3.24	2.93	2.64	2.38	2.13	1.91	1.50
-10	5.39	4.86	4.39	3.96	3.59	3.24	2.93	2.64	2.38	2.14	1.91	1.50
0	5.37	4.83	4.36	3.94	3.57	3.22	2.91	2.63	2.36	2.12	1.89	1.48
10	4.93	4.42	3.98	3.58	3.22	2.90	2.60	2.33	2.08	1.85	1.64	1.24
20	2.80	2.44	2.12	1.83	1.57	1.33	1.12	0.92	0.73	0.56	0.40	0.05
30	0.97	0.73	0.51	0.32	0.14	-0.02	-0.17	-0.31	-0.44	-0.56	-0.67	-0.97

ALTITUDE: 20000 FT

ISA+°C	WEIGHT (LB)											
	28000	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000	50000
-30	-	-	-	-	-	-	-	-	-	-	-	-
-20	5.20	4.68	4.21	3.80	3.43	3.09	2.78	2.50	2.24	2.00	1.78	1.38
-10	5.20	4.68	4.21	3.80	3.43	3.09	2.78	2.50	2.24	2.00	1.78	1.38
0	5.19	4.66	4.20	3.79	3.42	3.08	2.78	2.50	2.24	2.00	1.77	1.37
10	4.76	4.26	3.82	3.43	3.08	2.76	2.47	2.21	1.96	1.73	1.52	1.13
20	2.83	2.46	2.14	1.84	1.58	1.34	1.12	0.92	0.73	0.56	0.40	0.06
30	0.85	0.61	0.40	0.21	0.04	-0.12	-0.26	-0.4	-0.52	-0.64	-0.76	-1.04

FOR ANTI-ICE ON, REDUCE THE CLIMB GRADIENT BY 3.73%.

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SUPPLEMENTARY TAKEOFF INFORMATION

TURN ANALYSIS

The method below presents the criteria for transforming a takeoff flight path with turns in an equivalent straight one to allow the use of the AFM charts or runway analysis software to determine obstacle clearance.

The method to be used herein converts an actual flight path with turns and wind effects to an equivalent straight flight path with still air.

The equivalent straight flight path with still air will be determined in terms of increments on the existing obstacles' height that should be taken into account to ensure obstacle clearance. With the equivalent straight flight path, the performance calculation must be done, as usual, as presented in the AFM.

OPERATIONAL LIMITATIONS

Maximum bank angle: All Engines Operative: 25° at V2 + 10

One Engine Inoperative: 15° at V2

EQUIVALENT STRAIGHT FLIGHT PATH DETERMINATION

The equivalent straight flight path (zero wind) to be used in the performance calculation should be determined as follows:

1) OBSTACLE INCREMENT IN A STEADY TURN

During a steady turn the climb gradient deteriorates. To compensate, an increment of the actual obstacle height must be obtained as a function of the gradient loss due to a steady turn and the turning distance flown to the obstacle by the following relation:

$$\Delta H = D_T \times G_L$$

Where:

- ΔH = height increment
- D_T = distance flown along the turning flight
- G_L = gradient loss (obtained from the gradient loss due to a steady turn chart)

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The equivalent obstacle height to be used in a obstacle clearance calculation is:

$$H_E = H_A + \Delta H_1 + \Delta H_2 + ... + \Delta H_n$$

where:

H_E = equivalent obstacle height
H_A = actual obstacle height
$\Delta H_{1, 2, n}$ = height increments for each distance portion flown in turn to the obstacle.

2) WIND EFFECT ON THE FLIGHT PATH

a) STRAIGHT FLIGHT PORTIONS
Considering the drift compensation, the straight portions of the flight path may be corrected to still air equivalent distance as follows:

$$SAD = \frac{GD \times TAS}{GS}$$

Where:

SAD = still air equivalent distance
GD = actual ground distance
TAS = airplane true airspeed (obtained from the radius of turns and speed conversion chart)
GS = airplane ground speed

For straight flight:

$GS = TAS + (V_W \times \cos\alpha)$

Where:

V_W = wind speed
α = angle between flight direction and wind direction

Remarks:

$V_W \times \cos\alpha$ is negative for a head wind component
$V_W \times \cos\alpha$ is positive for a tailwind component

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b) TURNING FLIGHT PORTIONS
Two effects must be taken into account:

b1) Trajectory Displacement:

The trajectory is displaced in the wind component direction proportionally to the time.

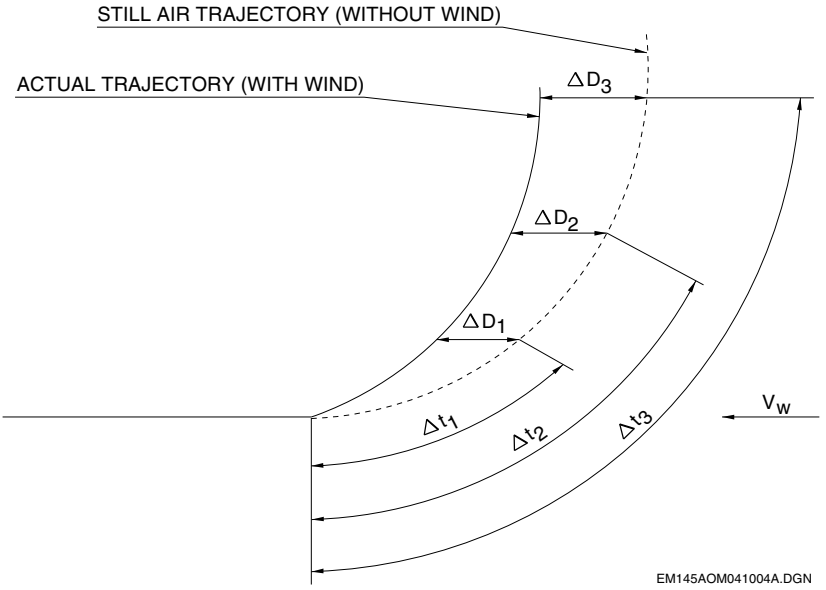
The displacement may be calculated by:

$\Delta D = \Delta t \times V_W$

ΔD = trajectory displacement in the wind component direction.

Δt = elapsed time in turning flight (obtained from the Horizontal Distance and Time to Complete chart)

V_W = wind speed



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b2) Distance Flown Compensation

The wind takes the same effect as mentioned in item 2a.

$$SAD = \frac{GD \times TAS}{GS}$$

For turning flight:

$$GS = \frac{Dm}{\Delta t}$$

Where:

Dm = distance flown along the actual trajectory

Δt = elapsed time in turning flight

PERFORMANCE CHARTS PRESENTATION

GRADIENT LOSS DUE TO A STEADY TURN

This chart shows the gradient loss due to a steady turn as a function of the bank angle.

RADIUS OF TURN AND SPEED CONVERSION

This chart shows the radius of turn and the true airspeed to be used on the turning flight path calculation as a function of the indicated airspeed (V_2), airport pressure altitude, outside air temperature and the bank angle.

HORIZONTAL DISTANCE AND TIME TO COMPLETE

This chart shows the horizontal distance and the elapsed time during a turning flight as a function of the radius of turn, heading change and the bank angle.

NOTE: If necessary, the heading change may be divided in segments and the elapsed time of each segment should be added.

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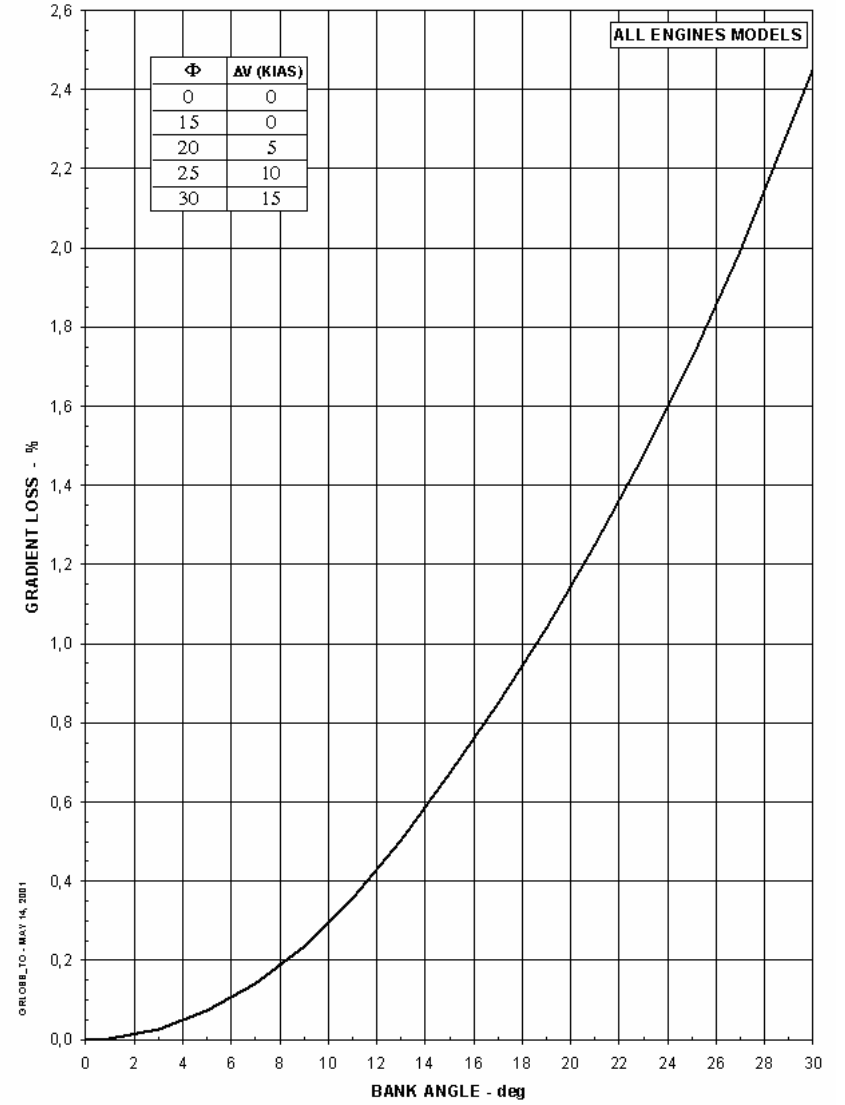
GRADIENT LOSS DUE TO A STEADY TURN
ONE ENGINE INOPERATIVE
TAKEOFF FLAPS 9°



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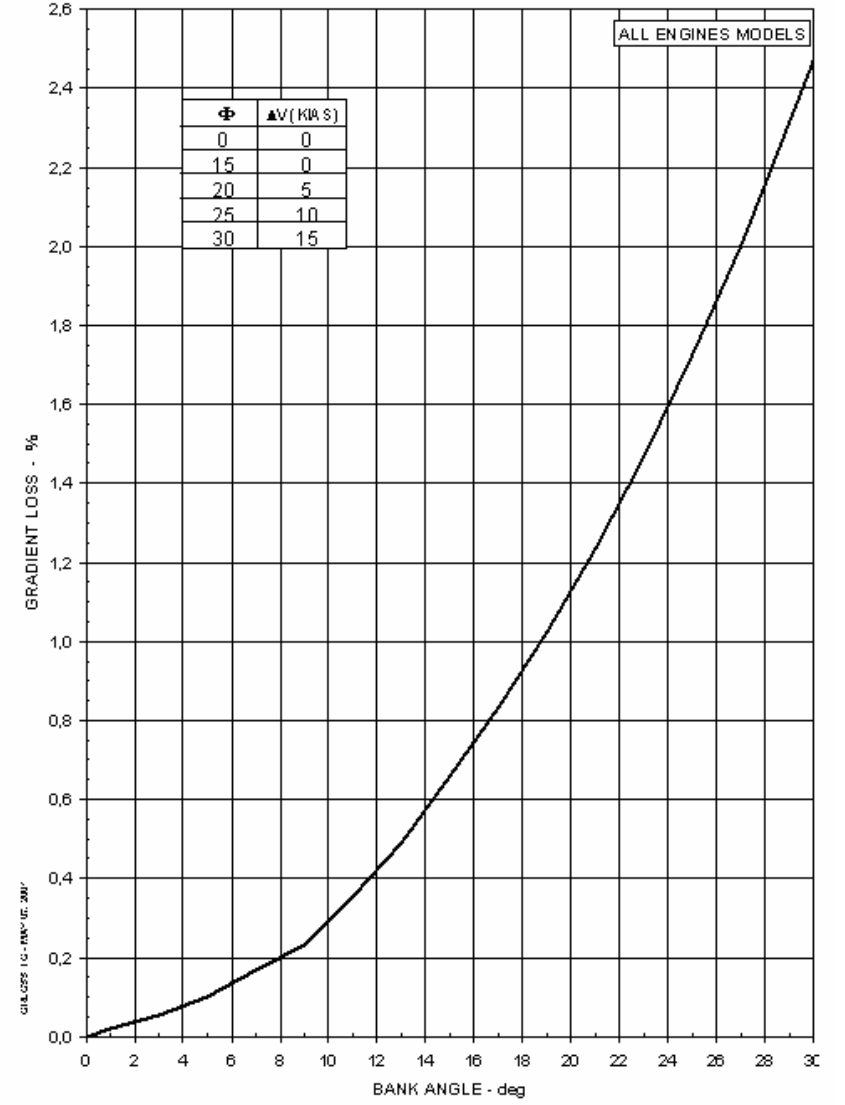
GRADIENT LOSS DUE TO A STEADY TURN

ONE ENGINE INOPERATIVE

TAKEOFF FLAPS 18°



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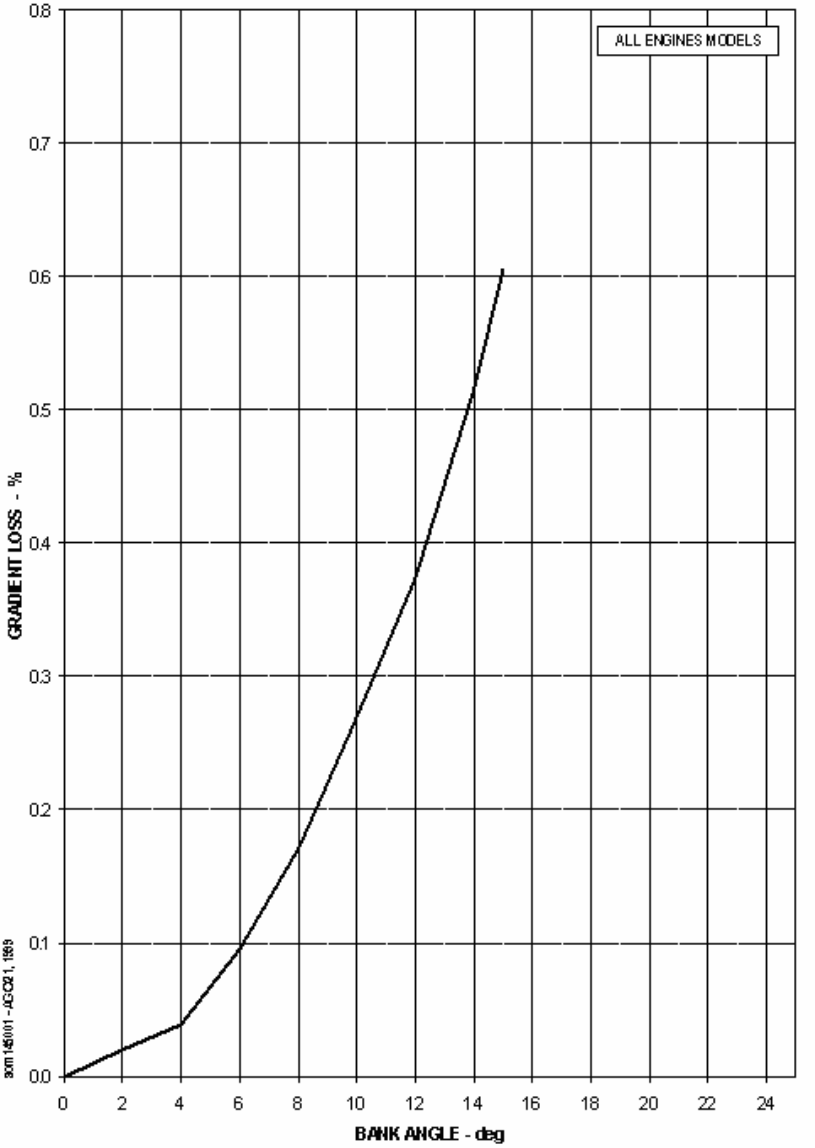
GRADIENT LOSS DUE TO A STEADY TURN
ONE ENGINE INOPERATIVE
TAKEOFF FLAPS 22°



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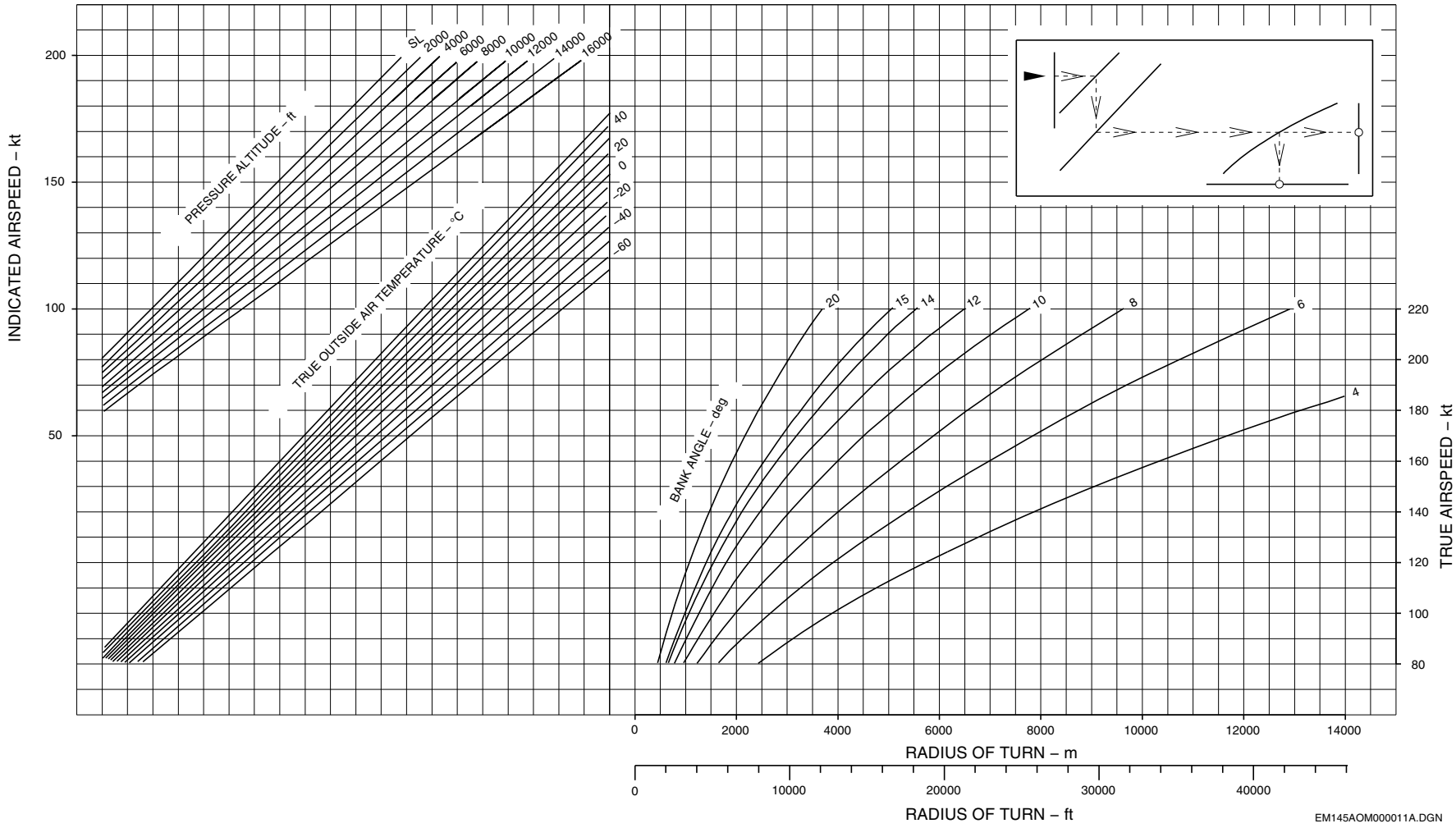
RADIUS OF TURN AND SPEED CONVERSION



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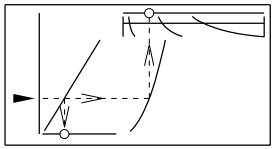
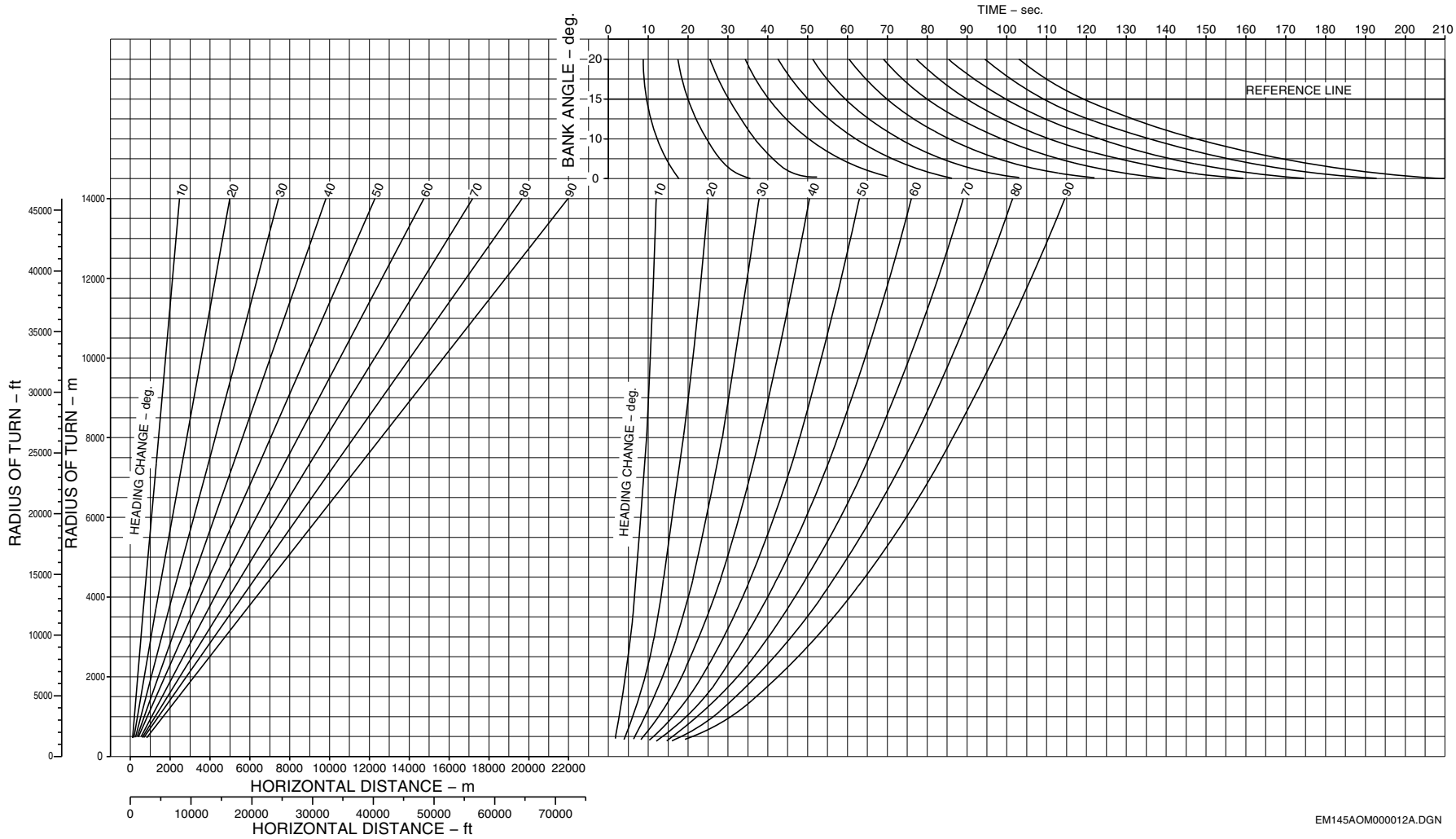
HORIZONTAL DISTANCE AND TIME TO COMPLETE





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AIRCRAFT CLASSIFICATION NUMBER - ACN

The Pavement Classification Number (PCN) reported shall indicate that an airplane with ACN equal to or less than the reported PCN can operate on that pavement.

PCN - PAVEMENT CLASSIFICATION NUMBER

Example: PCN 50 / F / A / X / T

1 2 3 4

1 - Type of pavement:

R = Rigid (concrete) F = Flexible (asphalt)

2 - Pavement sub-grade strength category:

A = High B = Medium,

C = Low D = Ultra-low.

3 - Maximum tire pressure authorized for the pavement:

W = Unlimited, no limit; X = High (up to 254 psi)

Y = Medium (up to 181 psi); Z = Low (up to 73 psi)

4 - Pavement evaluation method:

T = Technical evaluation;

U = By experience of airplane actually using the pavement.

OVERLOAD OPERATIONS

Individual airport authorities are free to decide on their own criteria for permitting overload operations as long as pavements remain safe for use by airplane. However, a 10% difference in ACN over PCN for flexible pavement and 5% for rigid pavements is generally accepted, provided that overload operations do not exceed 5% of the annual departures and are spread throughout the year.

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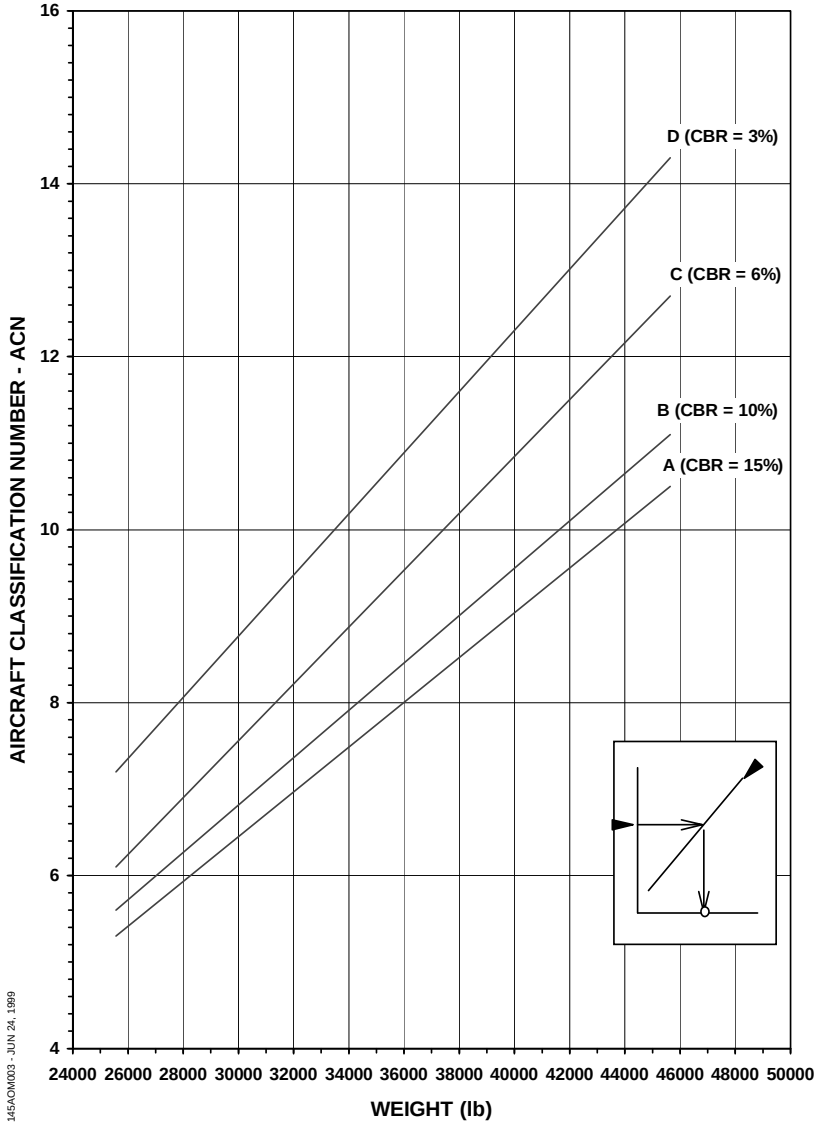
EMB-145ER - ACN FLEXIBLE PAVEMENT



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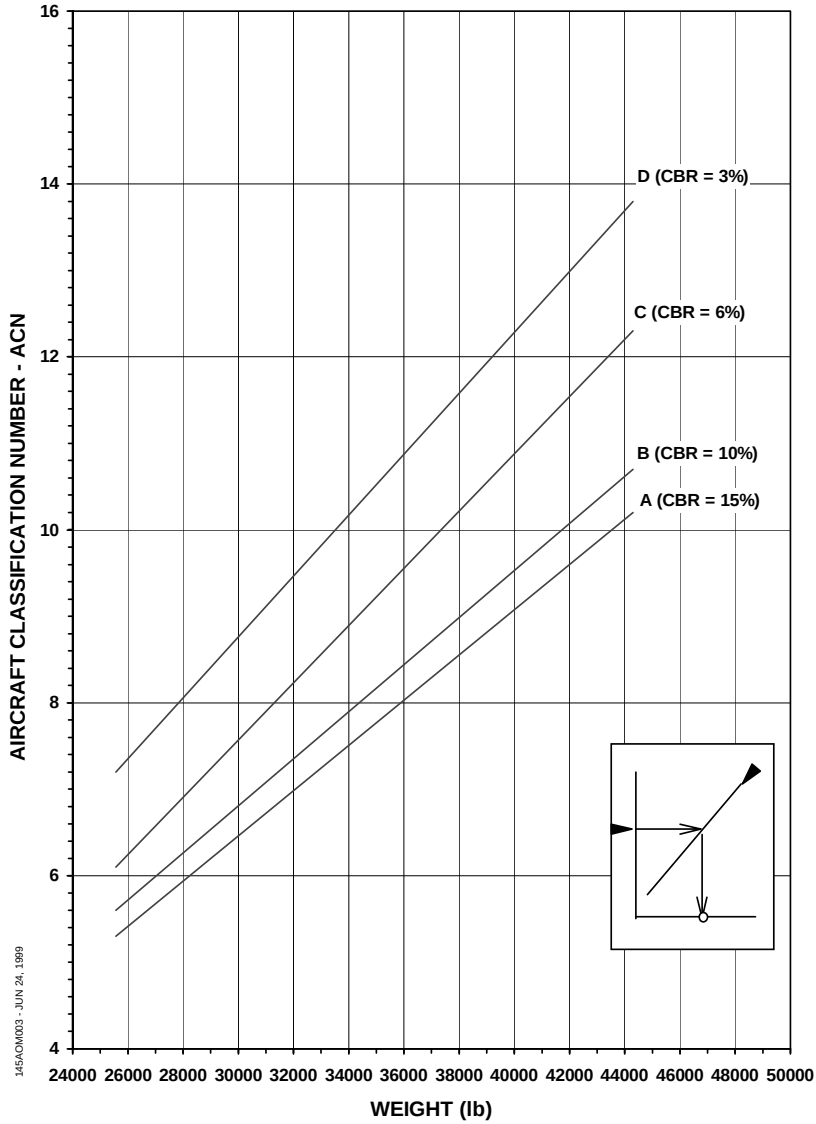
EMB-145EU - ACN FLEXIBLE PAVEMENT



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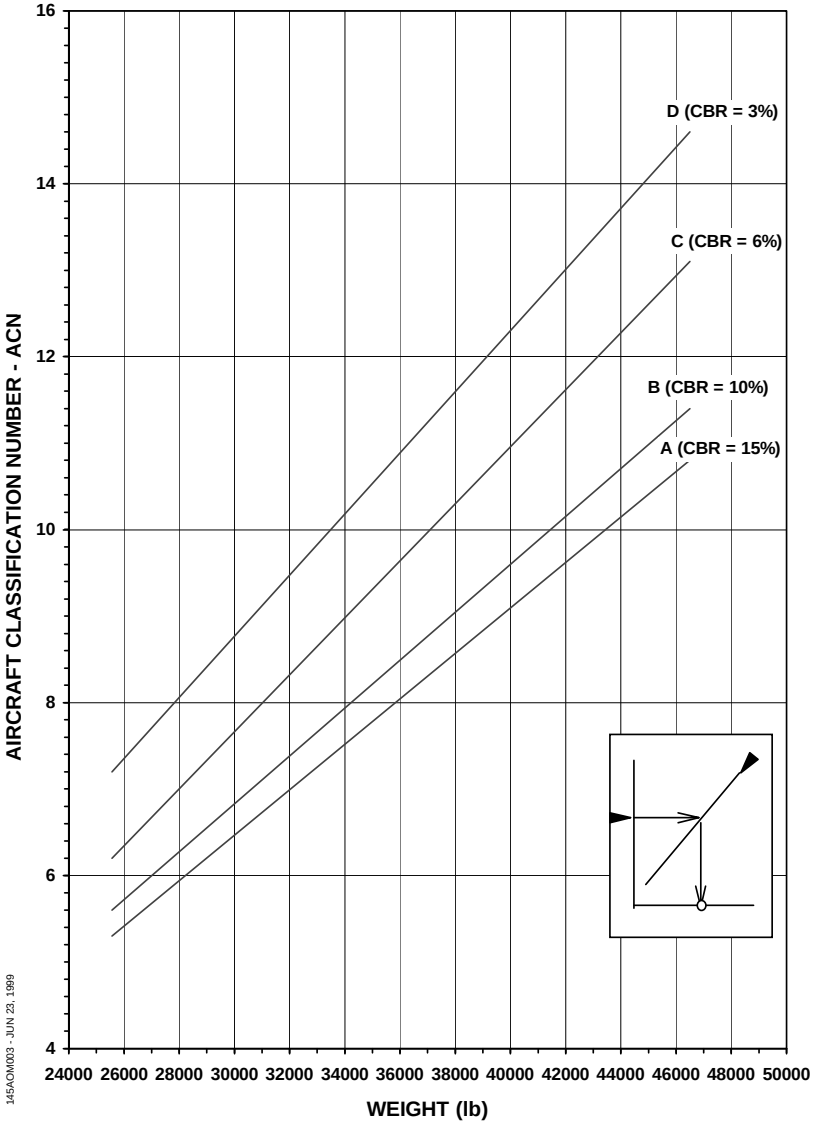
EMB-145EP/MP - ACN FLEXIBLE PAVEMENT



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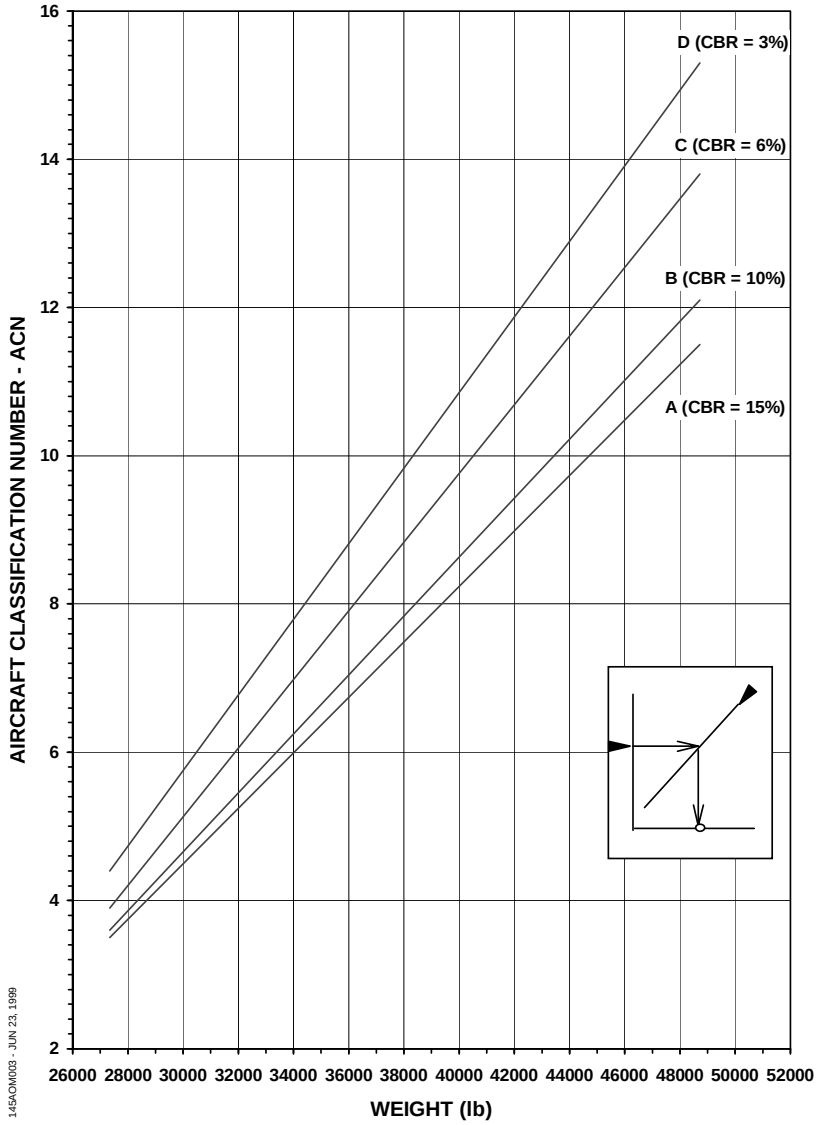
EMB-145LR/LU - ACN FLEXIBLE PAVEMENT



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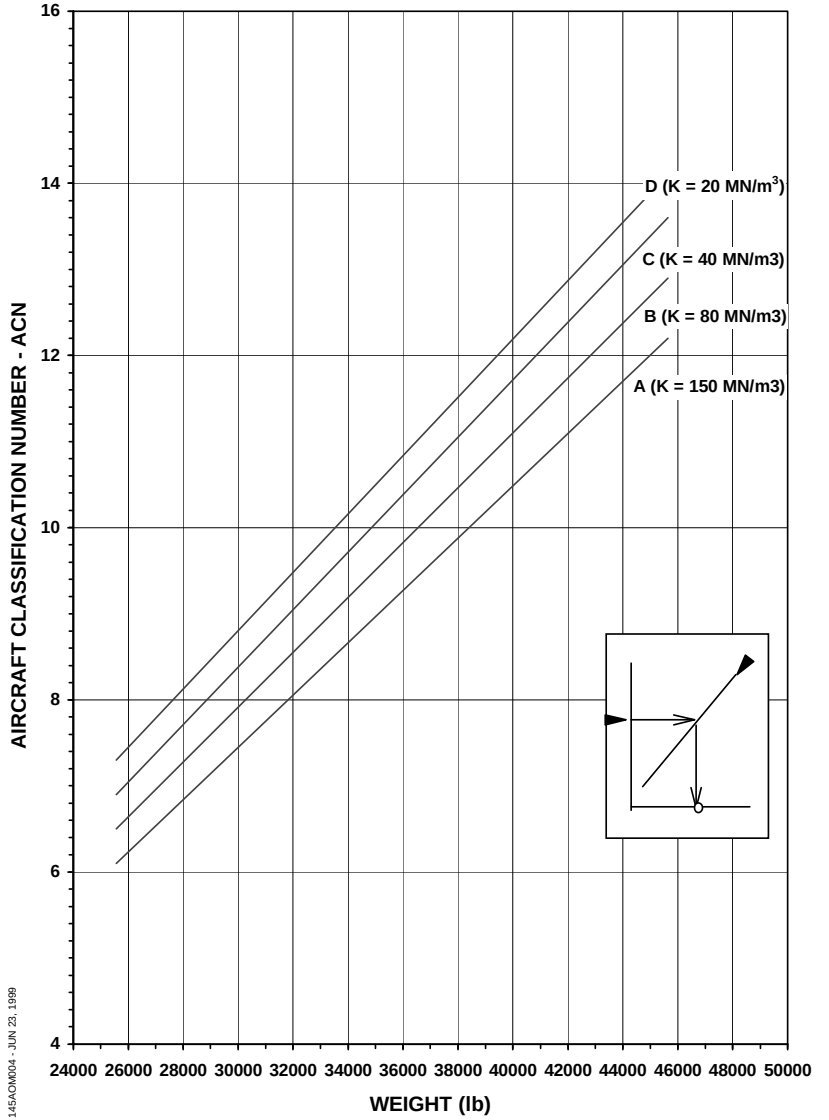
EMB-145ER - ACN RIGID PAVEMENT



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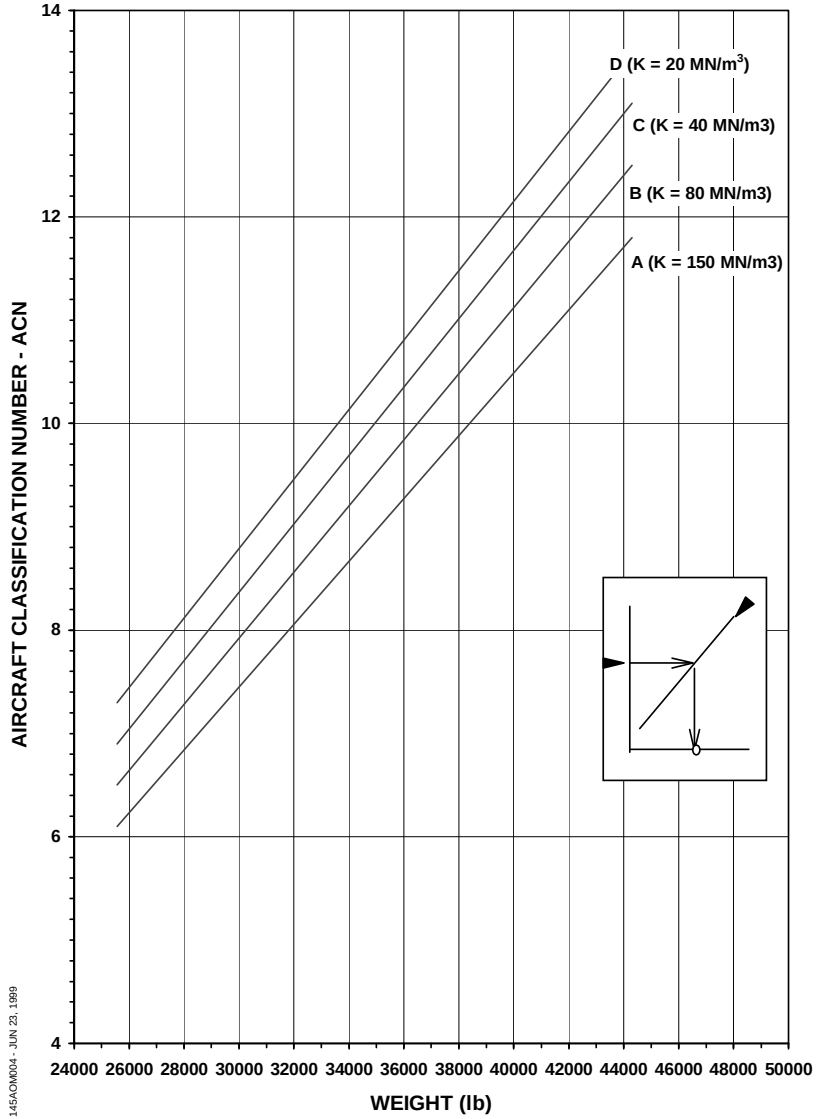
EMB-145EU - ACN RIGID PAVEMENT



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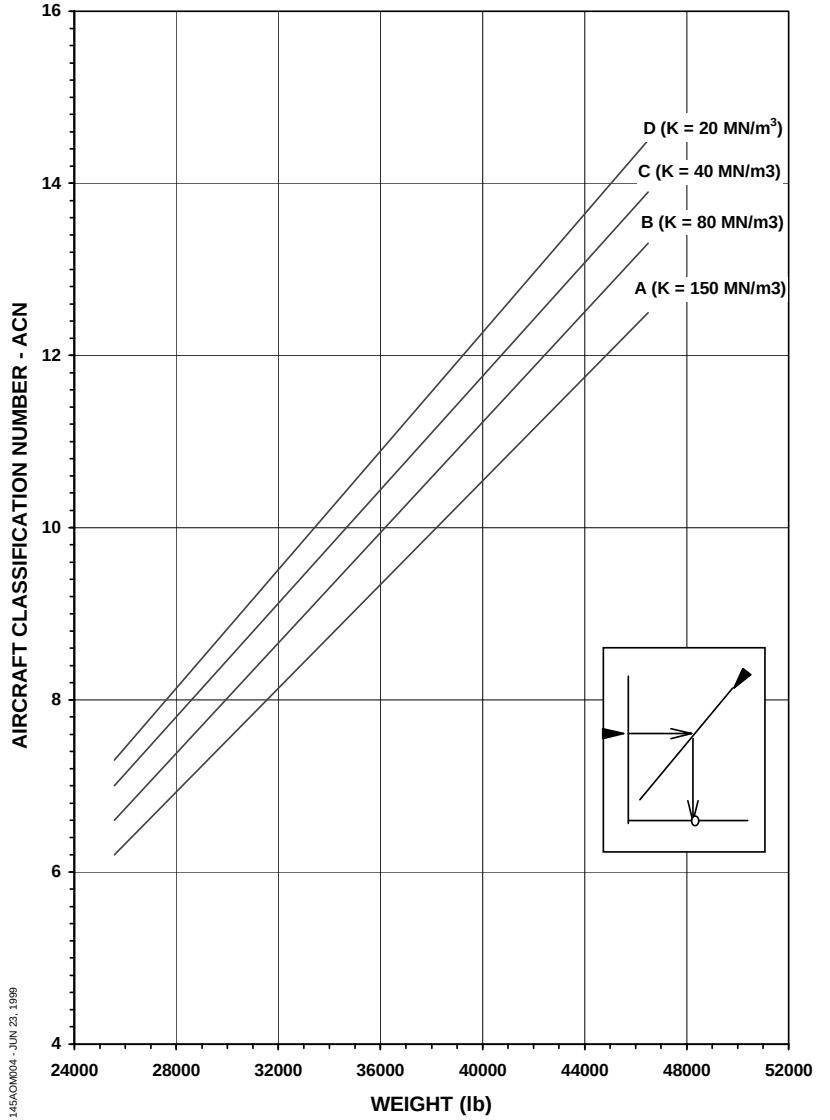
EMB-145EP/MP - ACN RIGID pavement



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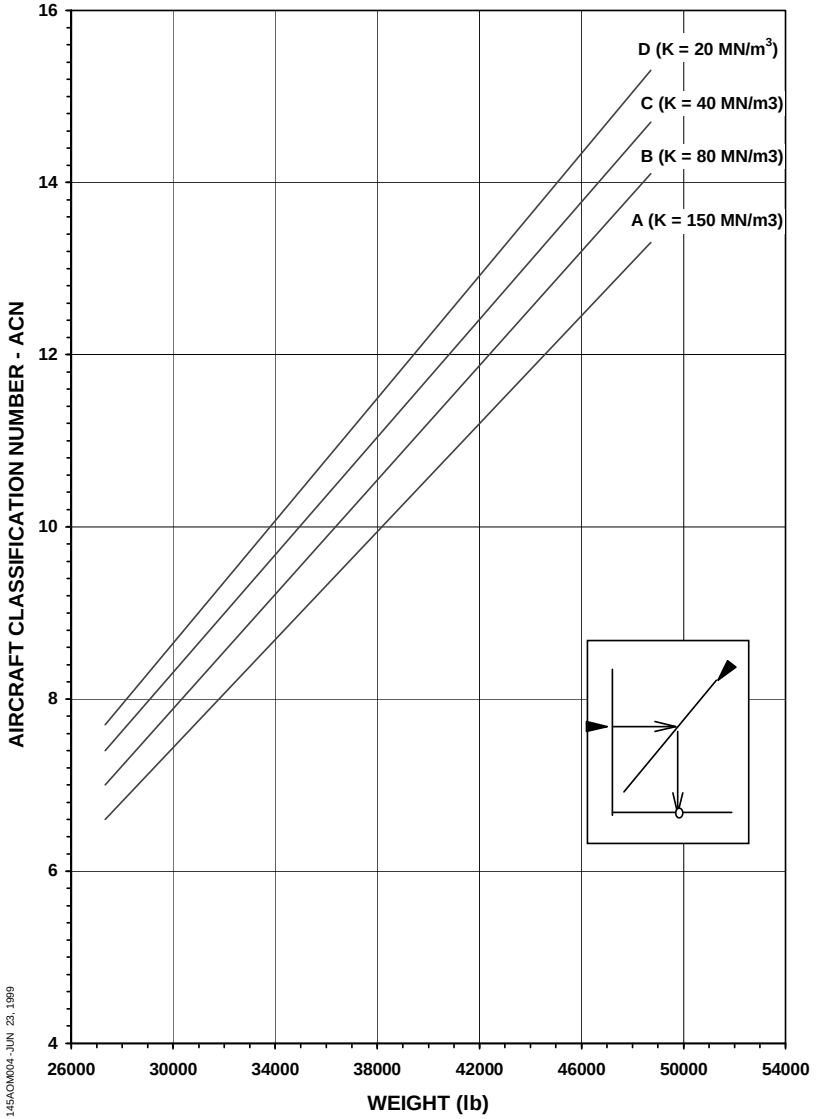
EMB-145LR/LU - ACN RIGID PAVEMENT



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TAKEOFF PERFORMANCE

Refer to the Airplane Flight Manual for a complete set of charts for determination of the limiting takeoff weights.

EMBRAER RUNWAY ANALYSIS SOFTWARE

Although the AFM presents all the required performance data for takeoff, the amount of options and charts presented, makes their use very difficult. In order to help operators, EMBRAER developed a runway analysis software for determination of the limiting weights.

THE TAKEOFF OUTPUT DATA

The program outputs the N1, weight, $V_1/V_R/V_2$, the level-off altitude and height, and the code assigned to the limitation detected during the calculation process. These data are valid for the wind and temperature associated.

The data are calculated for four reference winds for range of temperatures.

The level-off output depends upon the Minimum Level-off Height entered in the data input. If obstacle clearance requires, a value higher than the one entered will be automatically output.

NOTE: Level-off height must be corrected for temperatures below standard.

Limitation codes assigned are a number (1, 2 etc.) for Obstacle limited weight, R for Runway limited weight, W for WAT limited weight (same as Climb or Second Segment), S for Structural limited weight, V for $V1_{min}$, L for Level Off limited weight and B for a Brake Energy limited weight.

If the operation for a specific condition is considered unfeasible or outside the performance tables, the relevant data will be provided with asterisks.

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Wind (in knots)

Level off altitude and height (ft)

EMB-145 TAKEOFF ANALYSIS, ALLISON AE3007A1 ENGINES, FAA CERTIFICATION

Airport: AIRPORT NAME **ICAO:** KLAX **Runway:** 04 **Level Off Height:** 400 ft **FLAP** 9
Elevation: 5000 ft
TORA: 2000 m
Clearway: 0 m
Stopway: 0 m
Slope: .6 %
Alignment allowance: 21 m

Thrust: T/O-1
Anti Ice: OFF

DRY RUNWAY

LIMIT WEIGHTS (Lb), V1, VR, V2 (Kt) as function of Temperature and Wind:

Temp(C)/N1(%)	-10Kt	0Kt	10Kt	20Kt
-4 / 89.0	39941/118/119/131/R	42875/124/125/135/R	43815/126/126/137/R	44684/128/128/138/R
-2 / 89.4	39830/118/119/131/R	42754/124/124/135/R	43689/126/126/137/R	44572/128/128/138/R
0 / 89.8	39720/118/118/130/R	42635/124/124/135/R	43563/126/126/136/R	44460/127/127/138/R
2 / 90.1	39598/118/118/130/R	42512/124/124/135/R	43434/126/126/136/R	44346/127/127/138/R
4 / 90.4	39474/117/118/130/R	42391/124/124/135/R	43307/125/125/136/R	44234/127/127/137/R
6 / 90.7	39349/117/118/130/R	42269/123/123/134/R	43179/125/125/136/R	44121/127/127/137/R
8 / 91.0	39226/117/117/130/R	42148/123/123/134/R	43052/125/125/136/R	43993/127/127/137/R
10 / 91.4	39104/116/117/129/R	42027/123/123/134/R	42925/125/125/135/R	43860/126/126/137/R
12 / 91.7	38987/116/117/129/R	41912/123/123/134/R	42804/124/124/135/R	43733/126/126/137/R
14 / 92.0	38873/116/117/129/R	41792/122/123/134/R	42684/124/124/135/R	43607/126/126/136/R
16 / 92.3	38756/116/117/129/R	41667/122/122/133/R	42563/124/124/135/R	43479/126/126/136/R

Limitation codes: 1,2,.-Obstacle No.; L = Level off; R-Runway; S-Structural; B-Brake Energy; W-WAT

Temperature (in degrees Celsius) and N1 (in percentage)

Weight/V_1/V_R/V_2 and limitation code (weight in pounds, and speeds in knots)

EXAMPLE 1

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Wind (in knots)

Level off altitude and height (ft)

```
EMB-145 TAKEOFF ANALYSIS, ALLISON AE3007A1 ENGINES, FAA CERTIFICATION
-------------------------------------------------------------------------------------------------------------

Airport: AIRPORT NAME              ICAO: ABCD    Runway: 04     Level Off Height: 400 ft     FLAP  9
Elevation:  5000 ft
TORA:  2000 m
Clearway:  0 m
Stopway:   0 m
Slope:  .6 %
Alignment allowance:  21 m
-------------------------------------------------------------------------------------------------------------

Thrust: T/O-1
Anti Ice: OFF

DRY RUNWAY

-------------------------------------------------------------------------------------------------------------
    LIMIT WEIGHTS (Lb) as function of Temperature and Wind:
-------------------------------------------------------------------------------------------------------------
Temp(C)/N1(%) -10Kt            0Kt             10Kt             20Kt
-------------------------------------------------------------------------------------------------------------

-10  / 88.0  40280/ R         43244/ R         44186/ R         45030/ R
-8   / 88.4  40166/ R         43119/ R         44072/ R         44913/ R
-6   / 88.7  40053/ R         42997/ R         43943/ R         44798/ R
-4   / 89.0  39941/ R         42875/ R         43815/ R         44684/ R
-2   / 89.4  39830/ R         42754/ R         43689/ R         44572/ R
 0   / 89.8  39720/ R         42635/ R         43563/ R         44460/ R
 2   / 90.1  39598/ R         42512/ R         43434/ R         44346/ R
 4   / 90.4  39474/ R         42391/ R         43307/ R         44234/ R
 6   / 90.7  39349/ R         42269/ R         43179/ R         44121/ R
 8   / 91.0  39226/ R         42148/ R         43054/ R         43993/ R
 10  / 91.4  39104/ R         42027/ R         42928/ R         43860/ R
 12  / 91.7  38987/ R         41912/ R         42804/ R         43733/ R
 14  / 92.0  38873/ R         41792/ R         42684/ R         43607/ R
 16  / 92.3  38756/ R         41667/ R         42563/ R         43479/ R
 18  / 92.6  38641/ R         41542/ R         42442/ R         43352/ R
 20  / 93.0  38527/ R         41419/ R         42321/ R         43226/ R
 22  / 93.3  38414/ R         41295/ R         42201/ R         43100/ R
 24  / 93.6  37783/ R         40595/ R         41496/ R         42391/ R
-------------------------------------------------------------------------------------------------------------
Limitation codes: 1,2,... - Obstacle No.; L = Level off;  R - Runway; S - Structural; B - Brake Energy; W - WAT
```

Temperature (in degrees Celsius) and N1 (in percentage)

Weight in pounds and limitation code

```
V1/VR/V2 (Kt) vs. Weight and Temperature:

Temp/Weight  48500        46000        43500        41000        38500        36000        33500
-------------------------------------------------------------------------------------------------------------

-10      134/134/144  130/130/140  126/126/136  121/121/132  115/116/128  109/111/124  103/105/120
-6       134/134/144  130/130/140  126/126/136  121/121/132  115/116/128  109/111/124  103/105/120
-2       134/134/144  130/130/140  126/126/136  121/121/132  115/116/128  109/111/124  103/105/120
 2       134/134/144  130/130/140  126/126/136  121/121/132  115/116/128  109/111/124  103/105/120
 6       134/134/144  130/130/140  126/126/136  121/121/132  115/116/128  109/111/124  103/105/120
 10      134/134/144  130/130/140  126/126/136  121/121/132  115/116/128  109/111/124  103/105/120
 14      135/134/144  130/130/140  126/126/136  121/121/132  115/116/128  109/111/124  103/105/120
 18      135/135/144  130/130/140  126/126/136  121/121/132  115/116/128  109/111/124  103/105/120
 22      135/135/144  130/130/140  126/126/136  121/121/132  115/116/128  109/111/124  103/105/120
 26      135/135/144  131/131/140  126/127/136  122/122/132  116/117/128  110/112/124  104/106/120
```

Temperature (in degrees Celsius)

$V_1/V_R/V_2$ in knots

EXAMPLE 2

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APPROACH

APPROACH CLIMB SPEED - FLAPS 9°

WEIGHT (lb)	APPROACH CLIMB SPEED (KIAS)
27000	125
28000	128
29000	130
30000	132
31000	134
32000	136
33000	138
34000	140
35000	142
36000	144
37000	146
38000	148
39000	150
40000	152
41000	154
42000	156
43000	157
44000	159
45000	161
46000	163
47000	164
48000	166
49000	167
50000	167

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LANDING CLIMB AND REFERENCE SPEEDS

WEIGHT (lb)	V_{REF} - KIAS	
	FLAPS 45°	FLAPS 22°
27000	104	109
28000	106	111
29000	108	113
30000	109	114
31000	111	116
32000	113	118
33000	115	120
34000	117	121
35000	118	123
36000	120	125
37000	121	127
38000	123	128
39000	124	130
40000	126	131
41000	127	133
42000	128	134
43000	130	136
44000	131	137
45000	132	139
46000	134	140
47000	135	142
48000	136	143
49000	137	144
50000	137	144

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FLAP MANEUVERING SPEED

These speeds allow for an inadvertent 15° overshoot beyond the normal 30° bank over stick shaker actuation.

		FLAP MANEUVERING SPEED (KIAS)			
		BELOW MSLW*		ABOVE MSLW*	
FLAPS	GEAR	NO ICING CONDITIONS	WITH ICING CONDITIONS	NO ICING CONDITIONS	WITH ICING CONDITIONS
0°	UP	180	200	180	200
9°	UP/DN	160			
18°/22°	UP/DN	140	150		
45°	DN	140			

*Maximum Structural Landing Weight as specified on Limitations Section.

FINAL APPROACH SPEED

$V_{APP} = V_{REF}$ + wind correction.

Wind correction = ½ steady headwind component + gust increment above steady wind.

For Flaps 45° landing, there is no minimum wind correction and the maximum is 20 KIAS.

For Flaps 22° landing:

- Performing CAT I approaches, the minimum wind correction is 5 KIAS and the maximum is 20 KIAS.
- Performing CAT II or CAT III approaches, the minimum wind correction is 0 KIAS and the maximum is 20 KIAS.

For Emergency and Abnormal procedures using Flaps 0°, 9° and 18°, the minimum wind correction is 0 KIAS and the maximum is 20 KIAS. For Flaps 22°, the minimum wind correction is 0 KIAS and the maximum is 15 KIAS. When there is wind and abnormal operation speed additives, use the sum of both corrections.

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LANDING

UNFACTORED LANDING DISTANCES

Unfactored landing distance is the actual distance to land the airplane on a zero slope, ISA temperature, dry runway from a point 50 ft above runway threshold at Vref, using only the brakes and spoilers as deceleration device (i.e., no engine reverse thrust is used).

The required landing distance for dispatch is the unfactored landing distance increased by the 66.7% for dry runway or 91.7% for wet runway.

For obtaining the DRY runway factored distance, multiply unfactored landing distance by 1.667.

For obtaining the WET runway factored distance, multiply unfactored landing distance by 1.917.

NOTE: The landing distance correction factors mentioned in some emergency or abnormal procedures must be applied to the flap 45 unfactored landing distance.

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UNFACTORED LANDING DISTANCE TABLE
ALL ENGINE TYPES - FAA - FLAPS 22°

Weight (lb)	ALTITUDE							
	0 ft				1000 ft			
	WIND - (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	4206	3638	3458	3284	4304	3726	3544	3366
41000	4047	3493	3319	3148	4139	3577	3399	3227
39000	3889	3350	3180	3014	3976	3429	3257	3088
37000	3737	3213	3047	2885	3819	3287	3119	2955
35000	3587	3076	2914	2757	3664	3146	2982	2823
33000	3432	2935	2777	2623	3504	3000	2841	2685
31000	3288	2802	2649	2499	3356	2864	2709	2557
29000	3147	2673	2523	2377	3210	2731	2579	2432
27000	3000	2538	2392	2249	3059	2592	2444	2301

Weight (lb)	ALTITUDE							
	2000 ft				3000 ft			
	WIND - (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	4406	3818	3632	3452	4513	3914	3725	3542
41000	4235	3664	3483	3308	4336	3755	3571	3393
39000	4066	3511	3336	3165	4161	3597	3419	3245
37000	3904	3364	3194	3027	3993	3445	3272	3103
35000	3744	3219	3053	2891	3828	3295	3127	2962
33000	3579	3068	2907	2749	3657	3140	2976	2817
31000	3425	2928	2771	2617	3499	2995	2836	2681
29000	3275	2791	2638	2488	3344	2854	2699	2547
27000	3120	2648	2499	2353	3184	2707	2556	2409

Weight (lb)	ALTITUDE							
	4000 ft				5000 ft			
	WIND - (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	4625	4015	3822	3635	4741	4120	3925	3734
41000	4441	3849	3663	3481	4552	3949	3758	3574
39000	4260	3686	3505	3329	4364	3780	3595	3416
37000	4086	3529	3353	3182	4184	3617	3439	3265
35000	3915	3374	3203	3037	4007	3457	3284	3115
33000	3739	3214	3048	2886	3825	3292	3124	2960
31000	3575	3065	2903	2746	3655	3138	2974	2815
29000	3415	2919	2762	2609	3490	2988	2829	2673
27000	3250	2768	2615	2466	3320	2832	2677	2527

NOTE: Landing distance in ft.

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UNFACTORED LANDING DISTANCE TABLE
ALL ENGINE TYPES - FAA - FLAPS 22°

Weight (lb)	ALTITUDE							
	6000 ft				7000 ft			
	WIND - (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	4861	4230	4031	3838	4986	4344	4142	3945
41000	4665	4052	3859	3671	4783	4160	3963	3772
39000	4472	3877	3689	3507	4585	3978	3787	3601
37000	4285	3709	3527	3350	4391	3804	3619	3439
35000	4102	3544	3367	3195	4201	3633	3454	3279
33000	3914	3373	3202	3036	4006	3457	3283	3114
31000	3739	3214	3048	2886	3825	3293	3124	2960
29000	3568	3059	2898	2740	3649	3133	2969	2810
27000	3393	2899	2742	2589	3468	2967	2809	2654

Weight (lb)	ALTITUDE							
	8000 ft				9000 ft			
	WIND - (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	5117	4463	4257	4057	5253	4588	4378	4175
41000	4905	4272	4072	3878	5033	4389	4186	3988
39000	4700	4083	3889	3700	4820	4193	3996	3804
37000	4501	3903	3715	3531	4616	4007	3814	3627
35000	4304	3726	3544	3366	4412	3823	3637	3456
33000	4102	3544	3368	3196	4203	3634	3455	3281
31000	3915	3374	3204	3037	4009	3459	3286	3116
29000	3733	3209	3043	2882	3821	3289	3120	2956
27000	3546	3038	2878	2721	3627	3112	2949	2791

Weight (lb)	ALTITUDE			
	10000 ft			
	WIND - (kt)			
	-10 Kt	0 Kt	10 Kt	20 Kt
44000	5396	4718	4504	4297
42000	5167	4511	4304	4103
40000	4946	4308	4107	3912
38000	4734	4114	3919	3729
36000	4524	3924	3734	3550
34000	4307	3728	3546	3368
32000	4106	3547	3371	3199
30000	3912	3371	3200	3034
28000	3711	3189	3024	2863

NOTE: Landing distance in ft.

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UNFACTORED LANDING DISTANCE TABLE
ALL ENGINE TYPES - FAA - FLAPS 45°

Weight (lb)	ALTITUDE							
	0 ft				1000 ft			
	WIND - (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	3246	2781	2634	2493	3317	2845	2697	2553
41000	3139	2684	2542	2409	3207	2745	2600	2462
39000	3032	2591	2455	2323	3097	2647	2508	2375
37000	2924	2500	2366	2236	2989	2554	2419	2288
35000	2823	2408	2276	2148	2879	2459	2326	2197
33000	2720	2311	2181	2056	2772	2360	2229	2103
31000	2611	2209	2082	1959	2661	2256	2128	2003
29000	2501	2107	1982	1861	2549	2151	2025	1903
27000	2391	2003	1881	1762	2435	2045	1921	1802

Weight (lb)	ALTITUDE							
	2000 ft				3000 ft			
	WIND - (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	3391	2912	2762	2616	3469	2983	2830	2682
41000	3277	2809	2661	2519	3351	2876	2726	2581
39000	3165	2707	2565	2429	3235	2770	2625	2484
37000	3054	2610	2473	2341	3121	2669	2528	2394
35000	2939	2513	2379	2248	3006	2569	2433	2302
33000	2827	2411	2279	2151	2884	2464	2331	2202
31000	2713	2304	2175	2049	2766	2355	2224	2097
29000	2597	2196	2069	1946	2648	2244	2116	1992
27000	2481	2087	1963	1842	2529	2132	2007	1885

Weight (lb)	ALTITUDE							
	4000 ft				5000 ft			
	WIND - (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	3550	3056	2900	2750	3635	3132	2974	2821
41000	3428	2945	2794	2647	3508	3018	2864	2715
39000	3307	2836	2687	2544	3382	2904	2754	2608
37000	3189	2729	2585	2448	3259	2793	2646	2504
35000	3073	2626	2488	2356	3143	2687	2545	2411
33000	2947	2519	2385	2254	3015	2577	2441	2310
31000	2822	2407	2275	2147	2881	2461	2328	2199
29000	2701	2293	2164	2039	2756	2345	2214	2088
27000	2578	2179	2052	1929	2630	2227	2099	1976

NOTE: Landing distance in ft.

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UNFACTORED LANDING DISTANCE TABLE
ALL ENGINE TYPES - FAA - FLAPS 45°

Weight (lb)	ALTITUDE							
	6000 ft				7000 ft			
	WIND - (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	3723	3211	3050	2894	3812	3294	3131	2973
41000	3592	3094	2937	2785	3679	3172	3012	2858
39000	3462	2976	2823	2675	3544	3051	2895	2745
37000	3334	2860	2711	2567	3411	2930	2779	2632
35000	3211	2749	2604	2466	3282	2814	2666	2523
33000	3084	2636	2497	2365	3154	2698	2555	2420
31000	2945	2518	2383	2253	3014	2576	2441	2309
29000	2813	2398	2267	2139	2873	2453	2320	2192
27000	2684	2278	2149	2024	2740	2330	2199	2073

Weight (lb)	ALTITUDE							
	8000 ft				9000 ft			
	WIND - (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	3905	3379	3214	3053	4002	3468	3300	3137
41000	3768	3253	3091	2934	3861	3338	3173	3014
39000	3630	3128	2970	2817	3719	3208	3047	2891
37000	3492	3003	2849	2700	3576	3079	2923	2771
35000	3356	2880	2730	2586	3434	2951	2799	2652
33000	3224	2761	2615	2476	3297	2827	2679	2536
31000	3084	2636	2497	2364	3155	2698	2556	2421
29000	2936	2510	2376	2246	3006	2569	2434	2302
27000	2797	2383	2252	2124	2857	2439	2306	2177

Weight (lb)	ALTITUDE			
	10000 ft			
	WIND - (kt)			
	-10 Kt	0 Kt	10 Kt	20 Kt
44000	4101	3559	3388	3223
42000	3955	3424	3257	3095
40000	3810	3290	3127	2969
38000	3662	3157	2998	2844
36000	3515	3024	2870	2720
34000	3370	2894	2743	2598
32000	3225	2762	2616	2477
30000	3076	2629	2491	2358
28000	2918	2495	2361	2231

NOTE: Landing distance in ft.

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CONTAMINATED RUNWAYS
UNFACTORED LANDING DISTANCE - ADVISORY INFORMATION

A runway is considered to be contaminated when more than 25% of the runway surface area (whether in isolated areas or not) within the required length and width being used is covered by the following:

- Surface water more than 3 mm (0.125 in) deep, or by slush, or dry snow, equivalent to more than 3 mm (0.125 in) of water;
- Snow which has been compressed into a solid mass which resists further compression and will hold together or break into lumps if picked up (compacted snow); or
- Ice, including wet ice.

Contaminants can be classified as being: drag producing, for example by contaminant displacement or impingement; braking friction reducing; or a combination of both. Runways contaminated with compacted snow, ice and wet ice are considered slippery, once there is no impingent drag and the braking friction coefficient reduces. Other contaminants, such as, standing water, slush or dry snow, combine both effects.

The contaminated unfactored landing distance is the actual distance to land the airplane after a stabilized approach, crossing a point at 50 ft above the runway threshold at V_{REF}, on a zero slope runway, ISA temperature, using maximum manual braking effort.

The following tables present guidance information for obtaining the airplane landing distance on contaminated runways. The result is the worst value between wet and contaminated landing distance. However, this distance does not consider the 1.15 factor from EU-OPS 1.515 and 1.520. It is the operator's responsibility to evaluate the application of the factor above.

In order to find the contaminated landing distance, enter the table with the current contaminant, flaps configuration and actual landing weight and obtain a reference contaminated unfactored landing distance ($CULD_{REF}$).

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Apply corrections to the reference contaminated unfactored landing distance according to the formula below:

Final altitude correction (%) = Altitude correction from the table x (Current Altitude in ft/1000 ft)

Final tailwind correction (%) = Wind correction from the table x (Current tailwind component in kt/5 kt)

Final overspeed correction (%) = Overspeed correction from the table x (Current overspeed in kt/5 kt)

The unfactored landing distance on contaminated runways (CULD) becomes:

Additional Distance = $CULD_{REF}$ x (Final Altitude Correction + Final Tailwind Correction + Final overspeed Correction)

CULD = $CULD_{REF}$ + Additional distance

Suppose:

Airport pressure altitude:	4000 ft
Wind:	10 kt headwind
Overspeed:	V_{REF} + 5 kt
$CULD_{REF}$:	2000 ft
Altitude correction:	3%
Wind correction:	11%
Overspeed correction:	9%

Calculations:

Final Altitude Correction = 3% x (4000 ft/1000 ft) = 12%

Final Tailwind Correction = 11% x (0 kt/5 kt) = 0%

Final Overspeed Correction = 9% x (5 kt/5 kt) = 9%

Unfactored landing distance on contaminated runway:

Additional Distance = 2000 ft x (12% + 0%+ 9%) = 2000 ft x 21% = 420 ft

CULD = 2000 ft + 420 ft = 2420 ft

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ADVISORY INFORMATION
EMB-145 UNFACTORED LANDING DISTANCE TABLE (ft)
FAA – CONTAMINATED RUNWAYS
AE3007A1 AND A1P ENGINES
STANDING WATER 0.125 in/SLUSH 0.15 in
WET SNOW 0.25 in/DRY SNOW 0.625 in

WEIGHT (lb)	FLAP 22°	FLAP 45°
29000	6033	4822
30000	6194	4946
31000	6357	5071
32000	6532	5201
33000	6707	5330
34000	6883	5459
35000	7058	5589
36000	7245	5721
37000	7436	5852
38000	7627	5983
39000	7819	6114
40000	8010	6246
41000	8197	6377
42000	8383	6508
43000	8570	6639
44000	8757	6768
45000	8971	6914
46000	9188	7062
47000	9404	7210
48000	9621	7357

CORRECTIONS	
ALTITUDE	LANDING DISTANCE + 3% per 1000 ft above sea level.
WIND	LANDING DISTANCE + 11% per 5 kt tailwind.
OVERSPEED	LANDING DISTANCE + 9% per 5 kt above V_{REF}.

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ADVISORY INFORMATION
EMB-145 UNFACTORED LANDING DISTANCE TABLE (ft)
FAA – CONTAMINATED RUNWAYS
AE3007A1 AND A1P ENGINES
STANDING WATER 0.25 in/SLUSH 0.29 in
WET SNOW 0.50 in/DRY SNOW 1.25 in

WEIGHT (lb)	FLAP 22°	FLAP 45°
29000	5276	4357
30000	5411	4464
31000	5546	4571
32000	5693	4683
33000	5839	4794
34000	5986	4905
35000	6132	5016
36000	6289	5129
37000	6448	5243
38000	6608	5356
39000	6768	5470
40000	6928	5583
41000	7086	5697
42000	7243	5810
43000	7401	5923
44000	7559	6036
45000	7739	6163
46000	7922	6292
47000	8105	6421
48000	8288	6549

CORRECTIONS	
ALTITUDE	LANDING DISTANCE + 3% per 1000 ft above sea level.
WIND	LANDING DISTANCE + 11% per 5 kt tailwind.
OVERSPEED	LANDING DISTANCE + 8% per 5 kt above V_{REF}.

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ADVISORY INFORMATION
EMB-145 UNFACTORED LANDING DISTANCE TABLE (ft)
FAA – CONTAMINATED RUNWAYS
AE3007A1 AND A1P ENGINES
STANDING WATER 0.50 in/SLUSH 0.59 in
WET SNOW 1.00 in/DRY SNOW 2.50 in

WEIGHT (lb)	FLAP 22°	FLAP 45°
29000	4411	3856
30000	4515	3943
31000	4619	4031
32000	4732	4122
33000	4845	4213
34000	4957	4304
35000	5070	4395
36000	5190	4488
37000	5313	4581
38000	5436	4674
39000	5559	4766
40000	5682	4859
41000	5804	4952
42000	5926	5044
43000	6048	5137
44000	6170	5229
45000	6310	5332
46000	6451	5437
47000	6593	5542
48000	6734	5647

CORRECTIONS	
ALTITUDE	LANDING DISTANCE + 3% per 1000 ft above sea level.
WIND	LANDING DISTANCE + 10% per 5 kt tailwind.
OVERSPEED	LANDING DISTANCE + 8% per 5 kt above V_{REF}.

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ADVISORY INFORMATION
EMB-145 UNFACTORED LANDING DISTANCE TABLE (ft)
FAA – CONTAMINATED RUNWAYS
AE3007A1 AND A1P ENGINES
COMPACTED SNOW

WEIGHT (lb)	FLAP 22°	FLAP 45°
29000	3944	3645
30000	4036	3734
31000	4129	3823
32000	4222	3909
33000	4315	3996
34000	4408	4082
35000	4501	4169
36000	4593	4250
37000	4685	4329
38000	4777	4409
39000	4868	4488
40000	4960	4567
41000	5052	4646
42000	5143	4726
43000	5235	4805
44000	5327	4884
45000	5417	4960
46000	5507	5035
47000	5597	5111
48000	5688	5186

CORRECTIONS	
ALTITUDE	LANDING DISTANCE + 3% per 1000 ft above sea level.
WIND	LANDING DISTANCE + 11% per 5 kt tailwind.
OVERSPEED	LANDING DISTANCE + 7% per 5 kt above V_{REF}.

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ADVISORY INFORMATION
EMB-145 UNFACTORED LANDING DISTANCE TABLE (ft)
FAA – CONTAMINATED RUNWAYS
AE3007A1 AND A1P ENGINES
ICE

WEIGHT (lb)	FLAP 22°	FLAP 45°
29000	11551	9411
30000	11556	9406
31000	11572	9412
32000	11656	9487
33000	11740	9561
34000	11824	9635
35000	11909	9709
36000	12032	9810
37000	12170	9921
38000	12308	10032
39000	12446	10143
40000	12584	10254
41000	12721	10365
42000	12859	10476
43000	12997	10587
44000	13135	10698
45000	13303	10826
46000	13473	10955
47000	13644	11084
48000	13814	11213

CORRECTIONS	
ALTITUDE	LANDING DISTANCE + 3% per 1000 ft above sea level.
WIND	LANDING DISTANCE + 24% per 5 kt tailwind.
OVERSPEED	LANDING DISTANCE + 5% per 5 kt above V_{REF}.

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ADVISORY INFORMATION
EMB-135 UNFACTORED LANDING DISTANCE TABLE (ft)
FAA – CONTAMINATED RUNWAYS
AE3007A1/3 ENGINES
STANDING WATER 0.125 in/SLUSH 0.15 in
WET SNOW 0.25 in/DRY SNOW 0.625 in

WEIGHT (ft)	FLAP 22°	FLAP 45°
29000	6323	4930
30000	6501	5059
31000	6682	5190
32000	6874	5330
33000	7065	5469
34000	7257	5609
35000	7449	5748
36000	7658	5890
37000	7873	6033
38000	8088	6175
39000	8303	6318
40000	8517	6457
41000	8725	6596
42000	8933	6735
43000	9141	6874
44000	9349	7013

CORRECTIONS	
ALTITUDE	LANDING DISTANCE + 4% per 1000 ft above sea level.
WIND	LANDING DISTANCE + 12% per 5 kt tailwind.
OVERSPEED	LANDING DISTANCE + 8% per 5 kt above V_{REF}.

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ADVISORY INFORMATION
EMB-135 UNFACTORED LANDING DISTANCE TABLE (ft)
FAA – CONTAMINATED RUNWAYS
AE3007A1/3 ENGINES
STANDING WATER 0.25 in/SLUSH 0.29 in
WET SNOW 0.50 in/DRY SNOW 1.25 in

WEIGHT (ft)	FLAP 22°	FLAP 45°
29000	5630	4558
30000	5783	4672
31000	5938	4788
32000	6103	4912
33000	6268	5035
34000	6433	5159
35000	6598	5282
36000	6777	5408
37000	6962	5534
38000	7147	5660
39000	7331	5786
40000	7516	5911
41000	7697	6036
42000	7878	6160
43000	8059	6285
44000	8241	6409

CORRECTIONS	
ALTITUDE	LANDING DISTANCE + 4% per 1000 ft above sea level.
WIND	LANDING DISTANCE + 12% per 5 kt tailwind.
OVERSPEED	LANDING DISTANCE + 8% per 5 kt above V_{REF}.

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ADVISORY INFORMATION
EMB-135 UNFACTORED LANDING DISTANCE TABLE (ft)
FAA – CONTAMINATED RUNWAYS
AE3007A1/3 ENGINES
STANDING WATER 0.50 in/SLUSH 0.59 in
WET SNOW 1.00 in/DRY SNOW 2.50 in

WEIGHT (ft)	FLAP 22°	FLAP 45°
29000	4885	4062
30000	5010	4160
31000	5137	4258
32000	5272	4363
33000	5407	4468
34000	5543	4573
35000	5678	4678
36000	5824	4784
37000	5976	4892
38000	6127	4999
39000	6278	5106
40000	6430	5213
41000	6579	5319
42000	6729	5425
43000	6879	5532
44000	7028	5638

CORRECTIONS	
ALTITUDE	LANDING DISTANCE + 3% per 1000 ft above sea level.
WIND	LANDING DISTANCE + 11% per 5 kt tailwind.
OVERSPEED	LANDING DISTANCE + 8% per 5 kt above V_{REF}.

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ADVISORY INFORMATION
EMB-135 UNFACTORED LANDING DISTANCE TABLE (ft)
FAA – CONTAMINATED RUNWAYS
AE3007A1/3 ENGINES
COMPACTED SNOW

WEIGHT (ft)	FLAP 22°	FLAP 45°
29000	4001	3650
30000	4095	3739
31000	4189	3828
32000	4284	3915
33000	4378	4002
34000	4473	4089
35000	4567	4176
36000	4662	4259
37000	4756	4340
38000	4850	4421
39000	4944	4502
40000	5039	4583
41000	5133	4664
42000	5227	4745
43000	5321	4826
44000	5415	4907

CORRECTIONS	
ALTITUDE	LANDING DISTANCE + 3% per 1000 ft above sea level.
WIND	LANDING DISTANCE + 11% per 5 kt tailwind.
OVERSPEED	LANDING DISTANCE + 8% per 5 kt above V_{REF}.

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ADVISORY INFORMATION
EMB-135 UNFACTORED LANDING DISTANCE TABLE (ft)
FAA – CONTAMINATED RUNWAYS
AE3007A1/3 ENGINES
ICE

WEIGHT (ft)	FLAP 22°	FLAP 45°
29000	11684	9401
30000	11691	9415
31000	11707	9436
32000	11775	9504
33000	11844	9572
34000	11913	9640
35000	11982	9708
36000	12110	9810
37000	12260	9924
38000	12410	10039
39000	12560	10153
40000	12710	10268
41000	12860	10383
42000	13010	10497
43000	13160	10612
44000	13310	10727

CORRECTIONS	
ALTITUDE	LANDING DISTANCE + 3% per 1000 ft above sea level.
WIND	LANDING DISTANCE + 24% per 5 kt tailwind.
OVERSPEED	LANDING DISTANCE + 6% per 5 kt above V_{REF}.

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LANDING DISTANCE CORRECTION FACTOR - FAA

Emerg/Abnormal Procedure	Flaps - Speed	Factor
Advanced Stall Protection	Flaps 45° - $V_{REF\,45}$ + 5 kt	1.10
Aileron System Inop	Flaps 22° - $V_{REF\,45}$ + 30 kt	1.85
Both Hydraulic Systems Failure	Flaps 22° - $V_{REF\,45}$ + 30 kt	3.45
Brake Degraded	Flaps 45° - $V_{REF\,45}$	1.24
Brakes Inoperative	Flaps 45° - $V_{REF\,45}$	1.45
Erroneous Stall Protect. Actuation	Flaps 45° - $V_{REF\,45}$ + 5 kt	1.10
Flap System Failure (1)	Flaps 0°- 8° - $V_{REF\,45}$ +30 kt	1.65
Flap System Failure (2)	Flaps 9°-21°- $V_{REF\,45}$ +10 kt	1.40
Flap System Failure (3)	Flaps 22°-44°-$V_{REF\,45}$ + 5 kt	1.40
Hydraulic System 1 Failure	Flaps 45° - $V_{REF\,45}$	1.60
Hydraulic System 2 Failure	Flaps 45° - $V_{REF\,45}$	1.53
Inadvertent Spoiler Opening in Flight (spoilers closed or floating)	Flaps 22° - $V_{REF\,45}$ + 10 kt	1.50
Inadvertent Spoiler Opening in Flight (spoilers open)	Flaps 22° - $V_{REF\,45}$ + 10 kt	1.45
Jammed Aileron	Flaps 45° - $V_{REF\,45}$ + 5 kt	1.10
Jammed Elevator	Flaps 22° - $V_{REF\,45}$ + 10 kt	1.45
Jammed Rudder	Flaps 22° - $V_{REF\,45}$	1.62
Landing Gear Air/Ground System Failure	Flaps 45° - $V_{REF\,45}$	1.70
Landing Gear Air/Ground System Failure (in icing conditions)	Flaps 22° - $V_{REF\,45}$ + 30 kt	2.40
Loss of All Generators (1)	Flaps 0°- 8°- $V_{REF\,45}$ + 30 kt	1.95
Loss of All Generators (2)	Flaps 9°-21°-$V_{REF\,45}$ + 10 kt	1.95
Loss of All Generators (3)	Flaps 22°-44°-$V_{REF\,45}$ + 5 kt	1.95
One Engine Inoperative Approach and Landing	Flaps 22° - $V_{REF\,45}$ + 10 kt	1.48
Pitch Trim Inoperative (Pitch up tendency)	Flaps 22° - $V_{REF\,45}$ + 10 kt	1.45
Pitch Trim Inoperative (Pitch down tendency)	Flaps 22° - $V_{REF\,45}$ + 25 kt	1.75

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CONTINUED FROM PREVIOUS PAGE

Emerg/Abnormal Procedure	Flaps - Speed	Factor
Stabilizer Anti-Icing Failure	Flaps 22° - $V_{REF\,45}$ + 15 kt	1.55
Stabilizer + Wing Anti-Icing Failure	Flaps 22° - $V_{REF\,45}$ + 30 kt	1.85
Stall Protection Inoperative	Flaps 45° - $V_{REF\,45}$ + 5 kt	1.10
Wing Anti-Icing Asymmetry	Flaps 22° - $V_{REF\,45}$ + 30 kt	1.48
Wing Anti-Icing Failure	Flaps 22° - $V_{REF\,45}$ + 30 kt	1.85

QUICK TURN AROUND WEIGHT

For normal operation, the brake temperature can be monitored through the brake temperature indication in the MFD.

The Quick Turn Around Weight Table must be used only when the brake temperature indication is not working properly (according to the MMEL). In this case, if the landing weight exceeds the Quick Turn Around Weight, a subsequent takeoff must not be performed before 36 minutes (for LR brakes) or 33 minutes (for ER brakes) after chocks on. At the end of this time interval, check that the wheel thermal plugs have not melted.

NOTE: If the tires are not flat after 36 minutes (or 33 minutes) this is a positive indication that the wheel thermal plugs have not melted.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - SEA LEVEL
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	32507	32983	33496	34025	34483	36366	36920	37473	38059	38573
-15	32185	32655	33164	33688	34141	35984	36531	37079	37660	38169
-10	31872	32335	32841	33361	33809	35613	36152	36697	37272	37776
-5	31566	32023	32526	33041	33485	35251	35783	36324	36894	37392
0	31268	31719	32219	32729	33169	34898	35423	35960	36525	37018
4	31036	31482	31979	32487	32923	34624	35142	35677	36237	36726
8	30809	31250	31746	32249	32682	34355	34868	35400	35957	36442
12	30588	31025	31517	32018	32447	34093	34601	35130	35683	36164
16	30372	30805	31296	31793	32219	33838	34341	34868	35416	35894
20	30162	30590	31079	31573	31996	33589	34087	34611	35156	35630
24	29955	30379	30865	31357	31777	33344	33837	34358	34900	35370
28	29754	30174	30658	31147	31564	33106	33595	34113	34651	35118
32	29562	29978	30460	30946	31360	32879	33362	33879	34413	34876
36	29373	29786	30266	30749	31160	32656	33135	33649	34180	34640
40	29189	29598	30076	30556	30965	32438	32912	33424	33952	34409
44	29009	29414	29890	30368	30774	32224	32695	33204	33729	34183
48	28831	29232	29707	30182	30585	32013	32479	32987	33509	33959

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	37743	38325	38892	39498	40033	39169	39780	40362	40989	41546
-15	37339	37913	38476	39076	39605	38741	39343	39921	40542	41092
-10	36946	37512	38071	38665	39189	38325	38919	39492	40107	40650
-5	36563	37121	37676	38265	38783	37919	38504	39073	39682	40220
0	36190	36740	37291	37875	38387	37523	38100	38665	39268	39800
4	35899	36443	36991	37570	38078	37214	37786	38347	38946	39473
8	35614	36153	36698	37273	37777	36913	37478	38037	38631	39153
12	35337	35871	36413	36983	37483	36619	37178	37734	38323	38842
16	35068	35595	36135	36702	37197	36333	36887	37439	38025	38539
20	34804	35326	35863	36426	36917	36053	36601	37151	37732	38242
24	34545	35062	35596	36155	36642	35779	36321	36867	37445	37951
28	34293	34805	35336	35892	36376	35512	36049	36592	37166	37668
32	34052	34559	35088	35640	36120	35256	35788	36329	36899	37397
36	33816	34318	34845	35393	35870	35006	35533	36071	36637	37132
40	33585	34083	34607	35152	35625	34761	35283	35819	36381	36872
44	33359	33852	34374	34916	35386	34522	35039	35572	36131	36619
48	33136	33625	34144	34682	35149	34285	34797	35328	35884	36368

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 1000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	31927	32391	32898	33419	33868	35679	36219	36765	37341	37845
-15	31609	32067	32571	33086	33531	35303	35835	36377	36947	37446
-10	31300	31751	32251	32763	33202	34936	35461	35999	36564	37058
-5	31000	31445	31943	32449	32885	34581	35099	35634	36193	36682
0	30710	31149	31643	32146	32577	34238	34749	35279	35834	36317
4	30483	30918	31410	31909	32337	33970	34475	35003	35554	36033
8	30261	30692	31181	31677	32102	33707	34207	34732	35279	35755
12	30045	30471	30958	31451	31872	33451	33946	34468	35011	35483
16	29833	30255	30740	31230	31648	33200	33690	34210	34750	35218
20	29632	30050	30533	31020	31435	32962	33448	33965	34501	34965
24	29436	29850	30331	30815	31227	32730	33211	33726	34258	34719
28	29244	29654	30133	30614	31023	32503	32979	33491	34020	34478
32	29056	29462	29939	30417	30824	32280	32752	33262	33788	34242
36	28870	29273	29748	30223	30627	32061	32528	33036	33558	34009
40	28688	29086	29560	30032	30433	31844	32307	32813	33332	33780
44	28510	28905	29376	29846	30244	31633	32092	32595	33111	33556
48	28335	28727	29196	29663	30059	31427	31881	32382	32895	33337

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	37016	37583	38142	38738	39262	38398	38994	39567	40184	40728
-15	36618	37177	37732	38322	38840	37976	38563	39133	39742	40281
-10	36229	36781	37332	37916	38429	37565	38143	38709	39312	39845
-5	35854	36398	36945	37524	38031	37167	37737	38298	38896	39423
0	35490	36027	36570	37143	37645	36781	37344	37901	38493	39014
4	35206	35737	36278	36847	37344	36480	37037	37591	38178	38695
8	34929	35454	35991	36556	37050	36186	36736	37287	37870	38382
12	34657	35177	35712	36273	36762	35898	36443	36991	37570	38078
16	34392	34907	35439	35996	36481	35617	36156	36701	37276	37780
20	34141	34650	35179	35732	36214	35350	35884	36426	36997	37497
24	33895	34399	34926	35476	35954	35090	35618	36158	36725	37221
28	33654	34153	34678	35224	35698	34834	35358	35894	36458	36950
32	33418	33913	34435	34977	35449	34585	35103	35637	36197	36685
36	33186	33676	34195	34734	35202	34338	34851	35383	35939	36424
40	32957	33442	33960	34495	34960	34096	34604	35133	35685	36167
44	32734	33214	33729	34262	34723	33859	34362	34889	35438	35915
48	32515	32991	33504	34033	34491	33627	34126	34650	35195	35670

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 2000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	31352	31805	32305	32817	33258	34998	35524	36063	36629	37123
-15	31038	31485	31982	32489	32925	34627	35146	35680	36241	36730
-10	30735	31175	31669	32172	32604	34268	34779	35310	35865	36349
-5	30444	30879	31370	31869	32296	33924	34428	34956	35506	35984
0	30161	30589	31078	31572	31995	33588	34086	34610	35155	35629
4	29939	30363	30849	31340	31760	33325	33818	34339	34880	35350
8	29724	30144	30627	31115	31532	33071	33558	34077	34614	35080
12	29519	29934	30416	30901	31314	32828	33310	33826	34360	34822
16	29318	29729	30209	30691	31101	32590	33068	33581	34111	34570
20	29122	29529	30007	30486	30893	32358	32831	33342	33869	34324
24	28929	29333	29808	30284	30689	32130	32598	33107	33630	34082
28	28740	29139	29613	30086	30488	31906	32369	32876	33396	33845
32	28553	28949	29421	29892	30291	31685	32145	32649	33166	33611
36	28371	28764	29233	29701	30098	31470	31925	32427	32940	33383
40	28193	28581	29049	29515	29908	31258	31709	32209	32719	33158
44	28018	28403	28869	29332	29723	31051	31498	31995	32503	32939

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	36295	36848	37400	37985	38498	37634	38214	38780	39385	39918
-15	35902	36447	36995	37574	38082	37218	37789	38351	38949	39477
-10	35522	36059	36603	37176	37679	36815	37378	37935	38528	39049
-5	35158	35688	36228	36796	37293	36429	36984	37538	38125	38640
0	34803	35325	35862	36425	36916	36052	36600	37150	37731	38241
4	34525	35041	35575	36134	36621	35757	36299	36846	37423	37928
8	34255	34767	35298	35852	36336	35472	36008	36551	37124	37626
12	33998	34504	35032	35583	36063	35199	35730	36270	36839	37336
16	33746	34247	34773	35320	35796	34932	35457	35995	36560	37054
20	33501	33997	34520	35063	35536	34672	35192	35727	36288	36777
24	33259	33750	34271	34811	35280	34416	34931	35463	36020	36506
28	33022	33508	34026	34563	35028	34164	34674	35204	35757	36239
32	32789	33270	33786	34319	34781	33917	34422	34949	35499	35977
36	32561	33038	33551	34081	34539	33675	34175	34700	35246	35721
40	32337	32809	33320	33847	34302	33438	33933	34455	34998	35469
44	32118	32586	33095	33618	34070	33206	33696	34216	34755	35223

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 3000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	30777	31218	31713	32216	32648	34318	34830	35362	35917	36402
-15	30473	30908	31399	31898	32326	33958	34463	34991	35541	36020
-10	30177	30606	31095	31589	32013	33608	34106	34630	35175	35649
-5	29892	30315	30800	31291	31710	33269	33761	34281	34822	35291
0	29620	30038	30521	31007	31422	32948	33433	33951	34486	34950
4	29410	29823	30303	30787	31199	32699	33179	33693	34225	34686
8	29203	29612	30091	30571	30980	32454	32929	33441	33970	34427
12	29002	29407	29884	30361	30767	32217	32687	33196	33721	34174
16	28804	29205	29679	30154	30557	31982	32447	32954	33476	33926
20	28610	29007	29479	29951	30351	31752	32213	32718	33236	33682
24	28420	28813	29284	29752	30149	31527	31984	32486	33001	33444
28	28235	28624	29092	29558	29953	31308	31759	32260	32771	33211
32	28052	28438	28904	29368	29760	31092	31539	32037	32545	32982
36	27874	28257	28721	29182	29571	30881	31324	31820	32325	32759
40	27699	28078	28541	28999	29385	30674	31113	31606	32108	32539
44	27528	27903	28364	28819	29203	30471	30906	31397	31896	32324

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	35575	36113	36657	37232	37735	36871	37435	37993	38587	39109
-15	35194	35724	36265	36833	37331	36467	37023	37577	38164	38681
-10	34823	35346	35883	36446	36938	36074	36623	37172	37754	38264
-5	34465	34981	35514	36072	36559	35695	36235	36781	37357	37862
0	34126	34634	35164	35717	36198	35334	35868	36410	36980	37480
4	33861	34365	34892	35441	35918	35054	35582	36121	36688	37183
8	33603	34101	34625	35170	35644	34780	35302	35838	36401	36892
12	33351	33844	34366	34907	35377	34513	35030	35563	36122	36609
16	33103	33591	34110	34647	35114	34250	34761	35292	35847	36330
20	32860	33343	33859	34393	34856	33992	34498	35026	35577	36057
24	32622	33100	33614	34145	34604	33740	34241	34766	35314	35789
28	32389	32863	33374	33902	34357	33493	33989	34512	35056	35528
32	32161	32630	33139	33663	34115	33251	33742	34263	34803	35271
36	31938	32402	32909	33430	33879	33015	33501	34019	34556	35021
40	31718	32178	32683	33200	33646	32782	33264	33779	34312	34774
44	31503	31959	32461	32976	33418	32554	33031	33544	34074	34533

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 4000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	30213	30642	31131	31626	32050	33649	34148	34673	35219	35693
-15	29916	30339	30825	31316	31735	33298	33790	34311	34851	35321
-10	29634	30051	30534	31021	31436	32964	33449	33966	34502	34967
-5	29361	29774	30254	30736	31148	32642	33120	33635	34166	34625
0	29098	29505	29982	30461	30868	32330	32802	33313	33839	34294
4	28891	29294	29769	30245	30649	32085	32553	33061	33584	34035
8	28687	29086	29559	30032	30433	31844	32306	32812	33331	33779
12	28489	28883	29354	29824	30222	31609	32066	32570	33085	33530
16	28294	28685	29154	29621	30016	31379	31832	32333	32845	33286
20	28104	28491	28958	29422	29815	31154	31602	32101	32610	33048
24	27918	28301	28766	29227	29617	30933	31377	31873	32379	32814
28	27736	28115	28578	29037	29424	30717	31157	31651	32154	32585
32	27557	27933	28394	28850	29235	30506	30941	31433	31933	32361
36	27382	27755	28214	28667	29049	30299	30730	31220	31716	32141
40	27211	27580	28038	28489	28868	30096	30524	31011	31505	31927

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	34867	35391	35928	36492	36985	36121	36670	37220	37803	38314
-15	34496	35012	35545	36104	36591	35727	36268	36814	37391	37896
-10	34142	34651	35181	35734	36216	35352	35885	36428	36999	37498
-5	33801	34303	34829	35378	35854	34990	35517	36055	36621	37115
0	33471	33966	34489	35032	35504	34640	35159	35694	36255	36744
4	33212	33702	34222	34762	35230	34366	34880	35412	35968	36453
8	32956	33441	33959	34494	34959	34095	34603	35132	35685	36166
12	32708	33188	33702	34234	34695	33831	34334	34860	35409	35886
16	32464	32939	33452	33980	34437	33573	34071	34594	35139	35612
20	32226	32696	33206	33731	34184	33320	33813	34334	34875	35345
24	31993	32458	32965	33487	33937	33073	33560	34079	34616	35082
28	31764	32225	32730	33248	33695	32831	33313	33829	34363	34826
32	31540	31997	32499	33014	33458	32594	33071	33585	34115	34574
36	31321	31773	32274	32785	33225	32361	32834	33346	33873	34328
40	31107	31555	32053	32561	32998	32134	32603	33112	33635	34087

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 5000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	29660	30078	30561	31048	31464	32995	33481	33999	34535	35000
-15	29377	29790	30270	30753	31164	32661	33140	33654	34185	34645
-10	29104	29511	29988	30467	30874	32337	32809	33320	33847	34302
-5	28836	29237	29712	30187	30590	32019	32485	32993	33515	33965
0	28575	28972	29444	29915	30314	31711	32171	32676	33193	33639
4	28372	28764	29234	29702	30099	31470	31925	32427	32941	33383
8	28173	28561	29029	29494	29888	31235	31685	32185	32695	33134
12	27978	28363	28828	29291	29681	31005	31450	31947	32454	32890
16	27788	28168	28632	29091	29479	30779	31220	31715	32218	32650
20	27601	27978	28440	28896	29281	30558	30995	31487	31987	32416
24	27418	27791	28251	28705	29088	30342	30774	31264	31761	32187
28	27240	27609	28067	28518	28898	30130	30558	31046	31540	31962
32	27065	27431	27887	28336	28713	29923	30347	30833	31324	31743
36	26894	27256	27710	28156	28531	29720	30140	30624	31112	31528
40	26725	27084	27537	27980	28352	29521	29936	30418	30903	31317

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	34175	34685	35215	35768	36251	35387	35921	36464	37035	37535
-15	33821	34324	34850	35398	35876	35012	35538	36077	36643	37138
-10	33478	33974	34497	35040	35512	34648	35167	35702	36263	36752
-5	33142	33631	34150	34689	35156	34292	34804	35335	35891	36375
0	32816	33299	33814	34348	34810	33946	34451	34979	35529	36008
4	32561	33038	33552	34082	34540	33676	34176	34700	35247	35722
8	32312	32784	33295	33821	34276	33412	33906	34428	34970	35442
12	32068	32535	33044	33566	34017	33153	33642	34162	34700	35168
16	31829	32292	32797	33316	33764	32900	33384	33901	34435	34899
20	31596	32053	32556	33072	33516	32652	33131	33645	34176	34636
24	31367	31820	32320	32833	33274	32409	32883	33395	33923	34379
28	31143	31591	32090	32598	33036	32172	32641	33150	33674	34127
32	30924	31368	31864	32370	32804	31940	32404	32911	33432	33881
36	30709	31149	31643	32145	32576	31712	32172	32677	33194	33640
40	30498	30933	31425	31924	32352	31488	31944	32446	32960	33402

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 6000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 kt					0 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	29127	29534	30012	30492	30899	32365	32837	33349	33876	34332
-15	28849	29251	29725	30201	30604	32035	32501	33010	33531	33983
-10	28578	28975	29446	29918	30317	31714	32174	32679	33196	33642
-5	28315	28706	29175	29643	30038	31402	31855	32357	32870	33311
0	28060	28447	28912	29377	29768	31100	31547	32046	32555	32991
4	27862	28244	28708	29169	29558	30865	31307	31804	32309	32742
8	27667	28045	28507	28965	29351	30634	31072	31566	32067	32497
12	27475	27850	28309	28765	29148	30408	30840	31332	31830	32256
16	27289	27660	28118	28570	28951	30187	30615	31105	31600	32023
20	27107	27474	27930	28380	28757	29971	30395	30882	31374	31793
24	26928	27292	27745	28192	28568	29760	30179	30664	31153	31569
28	26752	27113	27565	28009	28382	29552	29968	30450	30936	31349
32	26578	26936	27386	27828	28198	29347	29758	30239	30721	31132
36	26408	26762	27211	27650	28018	29146	29553	30031	30511	30919

Temp. (°C)	WIND									
	10 kt					20 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	33508	34004	34527	35072	35544	34681	35200	35736	36298	36787
-15	33160	33648	34168	34707	35175	34312	34823	35355	35912	36396
-10	32820	33302	33818	34352	34814	33952	34455	34984	35535	36014
-5	32489	32964	33478	34006	34464	33601	34098	34623	35169	35642
0	32170	32639	33149	33673	34126	33262	33753	34274	34814	35283
4	31921	32385	32892	33412	33862	32998	33483	34002	34538	35003
8	31677	32135	32640	33157	33602	32739	33219	33735	34267	34728
12	31437	31891	32393	32906	33348	32484	32959	33472	34001	34459
16	31204	31653	32153	32663	33101	32237	32707	33218	33742	34196
20	30975	31420	31917	32424	32858	31994	32460	32968	33489	33939
24	30751	31191	31686	32189	32621	31757	32217	32723	33240	33687
28	30531	30967	31460	31960	32388	31524	31979	32483	32997	33440
32	30314	30745	31236	31732	32157	31293	31744	32245	32756	33196
36	30101	30527	31016	31510	31931	31067	31514	32012	32520	32956

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 7000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 kt					0 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	28598	28995	29467	29939	30338	31738	32198	32703	33221	33667
-15	28326	28717	29186	29654	30049	31415	31868	32370	32883	33325
-10	28059	28445	28910	29375	29766	31098	31545	32044	32552	32989
-5	27802	28183	28646	29107	29495	30795	31235	31731	32235	32667
0	27551	27927	28388	28844	29228	30497	30932	31425	31924	32351
4	27356	27728	28187	28640	29022	30266	30696	31187	31683	32106
8	27164	27533	27989	28440	28819	30040	30465	30953	31446	31866
12	26978	27343	27798	28245	28621	29819	30240	30726	31216	31632
16	26796	27157	27609	28054	28428	29604	30020	30503	30990	31404
20	26615	26973	27423	27865	28236	29390	29802	30283	30766	31177
24	26437	26792	27241	27680	28048	29180	29588	30067	30547	30955
28	26260	26611	27058	27495	27860	28971	29375	29851	30328	30733
32	26088	26436	26881	27315	27678	28767	29167	29641	30116	30517
36	25920	26264	26708	27139	27500	28568	28965	29436	29908	30307

Temp. (°C)	WIND									
	10 kt					20 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	32845	33327	33844	34378	34841	33978	34482	35011	35563	36042
-15	32503	32978	33492	34021	34478	33615	34113	34638	35184	35657
-10	32168	32637	33147	33670	34123	33260	33750	34271	34812	35281
-5	31846	32309	32815	33334	33782	32919	33402	33920	34455	34919
0	31532	31988	32491	33006	33449	32585	33062	33576	34106	34566
4	31287	31738	32239	32750	33190	32326	32798	33309	33835	34291
8	31048	31493	31992	32499	32935	32071	32538	33047	33569	34021
12	30814	31256	31752	32256	32688	31824	32286	32792	33311	33759
16	30586	31022	31516	32017	32445	31581	32038	32542	33057	33501
20	30359	30791	31282	31780	32205	31341	31793	32294	32806	33246
24	30137	30564	31054	31548	31970	31106	31553	32052	32560	32997
28	29915	30338	30825	31316	31734	30870	31313	31809	32314	32747
32	29700	30119	30603	31091	31506	30642	31080	31574	32076	32505
36	29490	29904	30386	30871	31283	30419	30852	31344	31842	32268

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22^{o} - 8000 FT
ER BRAKES

Temp. (^{o}C)	WIND									
	-10 kt					0 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	28077	28463	28929	29394	29785	31120	31567	32066	32575	33012
-15	27809	28191	28654	29114	29502	30803	31244	31740	32244	32676
-10	27547	27924	28384	28840	29225	30493	30928	31420	31920	32347
-5	27295	27666	28123	28576	28957	30194	30622	31112	31607	32029
0	27049	27415	27870	28319	28696	29903	30325	30812	31303	31721
4	26857	27220	27673	28119	28493	29676	30094	30578	31066	31481
8	26669	27028	27479	27922	28294	29454	29867	30349	30833	31245
12	26484	26840	27289	27729	28098	29236	29645	30124	30605	31014
16	26302	26653	27101	27538	27904	29020	29425	29901	30379	30785
20	26121	26469	26915	27349	27713	28806	29207	29681	30156	30558
24	25945	26290	26734	27166	27527	28598	28995	29467	29939	30338
28	25774	26115	26557	26986	27345	28395	28788	29258	29727	30123
32	-	-	-	-	-	28196	28585	29053	29519	29912

Temp. (^{o}C)	WIND									
	10 kt					20 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	32190	32660	33170	33694	34147	33284	33775	34296	34837	35306
-15	31855	32318	32825	33344	33792	32928	33412	33930	34466	34930
-10	31527	31983	32486	33001	33444	32580	33057	33571	34101	34560
-5	31211	31660	32160	32670	33108	32244	32714	33225	33750	34204
0	30903	31346	31843	32348	32782	31917	32381	32889	33409	33858
4	30663	31101	31595	32097	32527	31663	32121	32626	33143	33588
8	30427	30860	31352	31851	32277	31413	31866	32369	32881	33323
12	30196	30625	31114	31609	32032	31168	31616	32116	32625	33063
16	29968	30391	30878	31370	31789	30926	31369	31866	32372	32806
20	29741	30160	30645	31134	31549	30685	31124	31619	32121	32551
24	29521	29936	30418	30904	31317	30453	30886	31378	31877	32304
28	29306	29717	30197	30679	31089	30224	30653	31143	31639	32062
32	29096	29502	29980	30459	30865	30001	30425	30913	31405	31825

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 8500 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 kt					0 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	27797	28178	28641	29101	29489	30788	31229	31725	32228	32660
-15	27530	27906	28366	28822	29206	30473	30907	31399	31898	32325
-10	27271	27642	28099	28551	28932	30166	30594	31083	31578	32000
-5	27022	27387	27842	28291	28667	29871	30292	30779	31269	31687
0	26779	27140	27593	28037	28410	29584	30000	30483	30970	31383
4	26591	26949	27399	27841	28211	29362	29774	30254	30737	31147
8	26408	26762	27211	27650	28018	29146	29553	30031	30511	30919
12	26229	26580	27026	27463	27828	28934	29337	29813	30290	30694
16	26056	26403	26847	27281	27644	28729	29128	29601	30075	30477
20	25886	26229	26672	27103	27464	28528	28923	29394	29865	30264
24	25721	26061	26503	26931	27289	28333	28725	29194	29662	30057
28	-	-	-	-	-	28146	28534	29001	29466	29859
32	-	-	-	-	-	27963	28348	28812	29275	29665

Temp. (°C)	WIND									
	10 kt					20 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	31840	32302	32808	33327	33775	32912	33395	33913	34448	34912
-15	31506	31961	32464	32978	33421	32557	33034	33548	34078	34536
-10	31181	31630	32130	32639	33077	32213	32682	33193	33717	34171
-5	30869	31311	31808	32312	32745	31881	32344	32851	33371	33820
0	30565	31001	31495	31995	32424	31560	32016	32520	33035	33478
4	30330	30761	31252	31749	32174	31310	31761	32262	32773	33213
8	30101	30527	31016	31510	31931	31067	31514	32012	32520	32956
12	29877	30299	30785	31276	31693	30830	31271	31767	32271	32704
16	29660	30077	30561	31048	31463	30599	31036	31529	32030	32459
20	29447	29860	30341	30826	31237	30373	30805	31297	31794	32220
24	29241	29650	30129	30610	31019	30155	30582	31071	31566	31988
28	29042	29448	29925	30403	30809	29945	30368	30855	31346	31765
32	28849	29250	29725	30201	30604	29739	30158	30643	31132	31547

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - SEA LEVEL
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	34824	35263	35733	36167	36612	39023	39516	40026	40511	41014
-15	34489	34924	35391	35821	36261	38624	39113	39619	40099	40597
-10	34165	34595	35059	35485	35921	38238	38721	39224	39699	40191
-5	33848	34275	34736	35157	35589	37861	38339	38839	39309	39796
0	33543	33965	34423	34841	35269	37497	37971	38467	38933	39415
4	33303	33723	34179	34593	35018	37212	37682	38175	38638	39116
8	33069	33485	33939	34351	34772	36933	37399	37890	38349	38823
12	32840	33253	33705	34114	34532	36660	37123	37611	38067	38538
16	32616	33026	33476	33882	34297	36394	36853	37338	37791	38258
20	32397	32804	33252	33655	34067	36133	36589	37071	37521	37984
24	32184	32589	33032	33433	33841	35877	36329	36810	37256	37716
28	31981	32382	32817	33215	33621	35626	36076	36554	36997	37453
32	31781	32179	32606	33001	33404	35380	35827	36302	36742	37195
36	31585	31981	32399	32792	33192	35140	35583	36056	36493	36943
40	31395	31788	32198	32589	32986	34906	35346	35817	36251	36697
44	31207	31597	31999	32388	32783	34675	35112	35581	36012	36455
48	31022	31410	31805	32191	32583	34448	34882	35348	35777	36217

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	40510	41023	41548	42051	42575	42088	42622	43161	43683	44229
-15	40089	40596	41117	41614	42132	41644	42172	42707	43224	43764
-10	39680	40182	40698	41191	41703	41213	41735	42266	42778	43312
-5	39281	39778	40291	40779	41286	40794	41310	41837	42344	42872
0	38896	39388	39897	40380	40882	40388	40899	41422	41924	42446
4	38595	39083	39589	40068	40566	40070	40578	41098	41595	42113
8	38299	38783	39287	39762	40256	39759	40262	40780	41273	41787
12	38011	38491	38992	39464	39953	39455	39955	40469	40959	41468
16	37729	38205	38703	39172	39658	39158	39654	40165	40651	41157
20	37452	37926	38421	38886	39368	38867	39359	39868	40350	40852
24	37181	37651	38144	38606	39084	38582	39070	39576	40055	40552
28	36916	37383	37873	38332	38806	38303	38787	39290	39766	40260
32	36656	37119	37607	38062	38533	38029	38509	39010	39483	39972
36	36402	36861	37346	37799	38266	37761	38238	38736	39205	39691
40	36154	36610	37093	37543	38006	37500	37973	38469	38935	39417
44	35909	36362	36843	37290	37750	37242	37712	38206	38669	39147
48	35669	36119	36598	37041	37498	36989	37456	37947	38407	38882

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 1000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	34220	34651	35115	35541	35978	38303	38787	39290	39766	40260
-15	33891	34317	34779	35201	35633	37911	38390	38890	39361	39849
-10	33573	33996	34454	34872	35300	37533	38007	38503	38970	39452
-5	33263	33682	34138	34552	34976	37164	37634	38126	38588	39066
0	32963	33378	33831	34241	34661	36807	37272	37761	38218	38691
4	32728	33140	33590	33998	34414	36527	36988	37474	37929	38397
8	32498	32907	33355	33760	34173	36253	36711	37194	37645	38110
12	32273	32679	33125	33527	33937	35985	36440	36921	37368	37830
16	32060	32463	32901	33300	33707	35724	36174	36653	37098	37555
20	31852	32252	32681	33078	33482	35468	35915	36392	36833	37287
24	31648	32044	32465	32859	33260	35216	35661	36135	36573	37023
28	31449	31843	32255	32647	33045	34972	35413	35885	36320	36768
32	31253	31644	32048	32438	32833	34732	35169	35639	36071	36515
36	31061	31449	31846	32232	32625	34495	34930	35397	35827	36267
40	30836	31221	31608	31992	32381	34264	34696	35161	35587	36025
44	30593	30974	31351	31732	32117	34037	34466	34929	35353	35787
48	30354	30732	31099	31477	31859	33815	34241	34702	35123	35554

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	39749	40252	40769	41262	41776	41286	41809	42341	42853	43388
-15	39334	39832	40345	40833	41341	40849	41367	41894	42401	42930
-10	38934	39426	39936	40419	40922	40428	40940	41463	41965	42488
-5	38544	39032	39537	40016	40513	40017	40524	41043	41540	42057
0	38166	38648	39150	39624	40116	39619	40120	40636	41128	41640
4	37869	38348	38847	39318	39805	39307	39804	40317	40805	41312
8	37580	38054	38551	39018	39501	39001	39495	40005	40489	40992
12	37297	37768	38262	38725	39205	38703	39193	39700	40181	40680
16	37020	37487	37978	38439	38914	38412	38897	39402	39879	40374
20	36749	37213	37702	38159	38630	38126	38608	39110	39584	40075
24	36483	36943	37429	37883	38351	37846	38324	38823	39294	39781
28	36224	36682	37165	37616	38080	37574	38049	38545	39012	39496
32	35970	36424	36905	37352	37813	37306	37777	38271	38734	39214
36	35720	36170	36649	37094	37551	37042	37510	38002	38462	38938
40	35475	35923	36399	36840	37295	36785	37249	37738	38195	38668
44	35235	35679	36153	36592	37043	36532	36993	37479	37934	38403
48	35000	35441	35913	36349	36796	36284	36742	37226	37677	38143

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 2000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	33624	34047	34506	34925	35353	37593	38068	38565	39032	39516
-15	33301	33720	34176	34591	35015	37209	37679	38172	38635	39113
-10	32987	33402	33855	34266	34686	36835	37300	37790	38248	38721
-5	32685	33096	33546	33953	34369	36475	36936	37422	37875	38343
0	32391	32798	33245	33649	34061	36125	36581	37064	37513	37977
4	32163	32567	33009	33410	33818	35850	36303	36783	37229	37688
8	31944	32345	32778	33176	33581	35581	36030	36508	36950	37406
12	31731	32129	32553	32948	33350	35319	35764	36239	36679	37131
16	31522	31917	32332	32725	33124	35062	35504	35977	36413	36862
20	31319	31711	32118	32508	32904	34812	35251	35722	36155	36600
24	31119	31508	31907	32294	32687	34566	35002	35470	35900	36342
28	30902	31288	31678	32062	32453	34326	34758	35224	35651	36089
32	30649	31030	31410	31791	32178	34089	34519	34982	35406	35841
36	30400	30778	31147	31526	31909	33858	34284	34745	35167	35599
40	30157	30531	30890	31266	31645	33631	34054	34513	34932	35361
44	29918	30289	30638	31010	31386	33408	33829	34286	34702	35127

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	38998	39491	40001	40486	40989	40495	41008	41532	42035	42559
-15	38592	39080	39586	40065	40562	40067	40574	41094	41592	42110
-10	38196	38679	39181	39656	40148	39650	40152	40668	41161	41673
-5	37815	38293	38791	39261	39748	39249	39746	40258	40745	41252
0	37445	37918	38413	38878	39360	38859	39351	39859	40342	40843
4	37154	37623	38115	38577	39055	38553	39040	39546	40025	40522
8	36869	37335	37824	38283	38756	38253	38736	39239	39715	40207
12	36591	37053	37540	37995	38465	37960	38440	38940	39412	39900
16	36319	36778	37262	37714	38180	37674	38150	38647	39116	39600
20	36055	36510	36992	37441	37903	37396	37868	38363	38828	39309
24	35795	36246	36726	37171	37630	37121	37590	38082	38544	39021
28	35540	35988	36466	36908	37363	36853	37319	37808	38266	38740
32	35290	35735	36210	36649	37101	36590	37052	37539	37994	38463
36	35045	35487	35959	36395	36844	36332	36790	37275	37727	38193
40	34805	35244	35714	36147	36592	36079	36534	37016	37465	37928
44	34569	35005	35473	35903	36345	35831	36283	36763	37208	37668

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 3000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	33029	33444	33898	34309	34730	36885	37351	37841	38299	38773
-15	32713	33124	33575	33982	34398	36509	36970	37456	37910	38379
-10	32406	32814	33261	33665	34077	36144	36600	37083	37532	37996
-5	32114	32518	32958	33358	33765	35790	36242	36721	37166	37625
0	31835	32234	32662	33059	33463	35446	35894	36370	36811	37265
4	31615	32011	32431	32825	33225	35177	35620	36094	36532	36982
8	31402	31795	32206	32597	32994	34915	35355	35826	36261	36707
12	31193	31582	31984	32373	32767	34657	35094	35563	35994	36437
16	30988	31375	31768	32154	32546	34406	34839	35305	35734	36173
20	30724	31106	31489	31871	32259	34159	34589	35053	35479	35915
24	30465	30844	31215	31595	31979	33918	34345	34807	35229	35662
28	30211	30586	30947	31324	31704	33681	34106	34565	34984	35414
32	29962	30334	30685	31058	31435	33450	33871	34328	34745	35171
36	29722	30090	30431	30801	31174	33226	33644	34099	34513	34936
40	29490	29854	30186	30553	30923	33010	33425	33878	34289	34709
44	29262	29623	29945	30310	30676	32798	33210	33661	34070	34487

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	38248	38732	39235	39710	40203	39706	40208	40725	41218	41731
-15	37851	38329	38828	39298	39785	39287	39784	40296	40784	41291
-10	37464	37937	38433	38898	39380	38880	39371	39880	40363	40865
-5	37090	37558	38050	38511	38988	38486	38972	39477	39955	40451
0	36726	37190	37678	38135	38607	38102	38584	39085	39559	40050
4	36441	36901	37387	37840	38307	37802	38280	38778	39248	39734
8	36163	36620	37103	37553	38016	37510	37984	38479	38946	39428
12	35891	36344	36824	37270	37731	37222	37693	38186	38648	39127
16	35625	36074	36552	36995	37452	36942	37409	37899	38358	38833
20	35364	35810	36285	36725	37178	36667	37130	37618	38074	38545
24	35109	35551	36024	36461	36910	36399	36858	37343	37796	38263
28	34859	35298	35769	36202	36648	36135	36591	37074	37523	37987
32	34613	35050	35518	35949	36391	35877	36330	36810	37256	37716
36	34376	34809	35275	35703	36142	35627	36077	36555	36998	37454
40	34148	34578	35042	35467	35903	35386	35833	36308	36749	37202
44	33923	34350	34812	35235	35667	35150	35593	36067	36504	36954

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 4000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	32441	32849	33297	33701	34113	36185	36642	37125	37575	38039
-15	32137	32540	32981	33382	33790	35818	36270	36750	37195	37654
-10	31846	32246	32675	33071	33475	35461	35908	36384	36826	37280
-5	31564	31959	32376	32770	33169	35114	35556	36029	36466	36916
0	31291	31682	32088	32478	32874	34778	35216	35686	36119	36563
4	31076	31464	31861	32248	32641	34513	34948	35416	35845	36286
8	30827	31211	31598	31982	32371	34255	34687	35152	35578	36015
12	30555	30936	31311	31692	32077	34002	34431	34893	35317	35750
16	30291	30667	31032	31409	31790	33756	34181	34641	35061	35492
20	30031	30403	30757	31131	31509	33513	33935	34393	34811	35238
24	29778	30147	30490	30861	31235	33278	33697	34153	34567	34991
28	29537	29902	30235	30603	30974	33053	33469	33923	34334	34755
32	29299	29661	29985	30349	30717	32832	33245	33697	34106	34523
36	29067	29426	29740	30101	30465	32616	33026	33476	33882	34297
40	28841	29196	29500	29859	30220	32405	32813	33260	33664	34075

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	37508	37982	38478	38944	39426	38926	39418	39927	40411	40913
-15	37119	37588	38080	38542	39019	38516	39003	39509	39987	40484
-10	36741	37205	37694	38151	38622	38118	38600	39102	39575	40066
-5	36374	36833	37318	37770	38237	37731	38208	38706	39175	39661
0	36018	36473	36955	37403	37864	37357	37829	38323	38788	39268
4	35739	36190	36669	37113	37571	37062	37531	38022	38483	38959
8	35465	35913	36389	36830	37285	36774	37239	37728	38185	38657
12	35198	35642	36116	36554	37004	36493	36954	37440	37893	38362
16	34937	35378	35849	36284	36731	36218	36675	37159	37609	38074
20	34681	35118	35587	36018	36462	35948	36401	36883	37330	37790
24	34432	34866	35332	35761	36201	35686	36136	36615	37058	37516
28	34194	34625	35089	35515	35951	35435	35882	36358	36799	37253
32	33960	34388	34850	35272	35706	35189	35632	36106	36544	36994
36	33731	34156	34616	35036	35466	34948	35388	35860	36295	36742
40	33508	33930	34388	34805	35232	34712	35150	35619	36051	36495

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 5000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	31873	32273	32703	33100	33504	35493	35941	36418	36859	37314
-15	31579	31975	32393	32786	33186	35132	35575	36048	36486	36935
-10	31295	31686	32093	32482	32878	34783	35221	35691	36124	36569
-5	31018	31405	31800	32186	32578	34442	34876	35343	35772	36212
0	30672	31054	31435	31817	32204	34111	34541	35005	35429	35865
4	30395	30773	31142	31520	31903	33853	34279	34740	35162	35594
8	30123	30497	30855	31230	31609	33600	34023	34481	34900	35328
12	29857	30227	30574	30945	31321	33352	33772	34228	34643	35068
16	29604	29970	30306	30674	31046	33116	33532	33986	34399	34820
20	29357	29719	30045	30411	30779	32886	33299	33751	34161	34579
24	29114	29473	29789	30151	30516	32659	33070	33520	33927	34342
28	28878	29233	29539	29899	30260	32439	32847	33295	33699	34112
32	28652	29004	29300	29657	30015	32224	32629	33074	33475	33884
36	28460	28810	29098	29452	29808	32018	32420	32856	33255	33662
40	28273	28619	28900	29252	29605	31817	32216	32643	33040	33443

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	36776	37240	37729	38186	38659	38155	38637	39139	39613	40104
-15	36394	36853	37338	37791	38258	37752	38229	38727	39196	39682
-10	36024	36479	36960	37408	37870	37363	37835	38329	38794	39274
-5	35664	36114	36592	37036	37492	36983	37450	37941	38401	38876
0	35313	35759	36234	36673	37125	36614	37077	37564	38019	38489
4	35040	35482	35954	36390	36838	36326	36785	37269	37721	38187
8	34772	35210	35680	36113	36557	36044	36499	36981	37429	37891
12	34510	34945	35412	35841	36282	35768	36219	36698	37143	37601
16	34260	34691	35156	35583	36020	35504	35952	36429	36871	37325
20	34016	34445	34908	35331	35765	35248	35693	36167	36606	37057
24	33777	34202	34663	35083	35514	34996	35437	35909	36345	36792
28	33544	33967	34425	34843	35270	34751	35189	35659	36091	36535
32	33315	33734	34190	34605	35030	34509	34944	35412	35841	36282
36	33090	33506	33960	34373	34794	34272	34704	35169	35596	36034
40	32870	33283	33735	34144	34563	34040	34469	34932	35356	35790

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 6000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 kt					0 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	31320	31712	32118	32508	32905	34813	35251	35722	36155	36599
-15	31032	31419	31814	32201	32593	34459	34892	35360	35788	36228
-10	30674	31056	31436	31819	32205	34113	34542	35006	35430	35865
-5	30314	30691	31056	31435	31816	33778	34203	34664	35084	35514
0	-	-	-	-	-	33454	33875	34332	34748	35174
4	-	-	-	-	-	33205	33622	34077	34490	34913
8	-	-	-	-	-	32965	33379	33831	34241	34661
12	-	-	-	-	-	32728	33140	33590	33997	34413
16	-	-	-	-	-	32499	32907	33355	33759	34172
20	-	-	-	-	-	32271	32677	33122	33524	33934
24	-	-	-	-	-	32057	32459	32896	33295	33702
28	-	-	-	-	-	31847	32246	32674	33071	33475
32	-	-	-	-	-	31641	32037	32457	32851	33252
36	-	-	-	-	-	31439	31833	32244	32636	33033

Temp. (°C)	WIND									
	10 kt					20 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	36055	36511	36993	37441	37904	37396	37869	38364	38828	39310
-15	35680	36131	36610	37053	37510	37001	37469	37961	38420	38896
-10	35315	35760	36236	36675	37127	36615	37079	37567	38022	38492
-5	34961	35401	35874	36308	36755	36242	36701	37185	37635	38101
0	34618	35053	35523	35953	36395	35881	36334	36815	37261	37721
4	34355	34786	35253	35680	36118	35604	36053	36531	36974	37430
8	34101	34529	34993	35417	35852	35336	35781	36257	36696	37148
12	33851	34276	34738	35158	35590	35073	35514	35988	36424	36872
16	33608	34030	34489	34907	35335	34817	35255	35726	36159	36603
20	33367	33786	34243	34658	35082	34563	34998	35466	35896	36337
24	33133	33549	34003	34415	34837	34317	34748	35214	35641	36078
28	32903	33317	33769	34178	34597	34075	34503	34967	35391	35825
32	32678	33089	33539	33945	34361	33838	34263	34725	35145	35576
36	32458	32866	33313	33717	34130	33606	34028	34487	34905	35333

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 7000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 kt					0 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	30702	31084	31465	31848	32235	34139	34568	35033	35457	35892
-15	30328	30705	31071	31449	31831	33791	34216	34677	35097	35527
-10	-	-	-	-	-	33452	33872	34330	34746	35172
-5	-	-	-	-	-	33130	33546	34001	34412	34834
0	-	-	-	-	-	32821	33233	33684	34092	34510
4	-	-	-	-	-	32578	32988	33436	33841	34256
8	-	-	-	-	-	32344	32751	33197	33599	34010
12	-	-	-	-	-	32117	32520	32960	33359	33767
16	-	-	-	-	-	31896	32297	32727	33124	33529
20	-	-	-	-	-	31682	32079	32501	32895	33297
24	-	-	-	-	-	31472	31866	32279	32671	33069
28	-	-	-	-	-	31264	31655	32059	32449	32844
32	-	-	-	-	-	31063	31451	31846	32234	32626
36	-	-	-	-	-	30865	31250	31638	32023	32412

Temp. (°C)	WIND									
	10 kt					20 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	35342	35788	36264	36703	37155	36644	37108	37596	38052	38523
-15	34975	35415	35888	36322	36769	36257	36715	37200	37650	38116
-10	34616	35051	35520	35951	36392	35879	36332	36813	37259	37719
-5	34275	34706	35172	35598	36035	35520	35968	36446	36887	37342
0	33948	34375	34837	35259	35692	35176	35619	36093	36530	36980
4	33692	34115	34575	34994	35423	34905	35345	35817	36250	36696
8	33444	33864	34322	34738	35163	34645	35080	35550	35980	36422
12	33199	33616	34071	34484	34906	34386	34818	35285	35713	36151
16	32958	33372	33825	34234	34654	34132	34561	35026	35450	35885
20	32724	33135	33585	33992	34408	33886	34312	34774	35195	35627
24	32494	32903	33351	33755	34168	33644	34067	34526	34945	35373
28	32267	32673	33118	33520	33930	33405	33824	34281	34697	35122
32	32054	32456	32893	33292	33699	33172	33589	34044	34456	34879
36	31845	32244	32672	33069	33473	32945	33359	33811	34221	34640

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 8000 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 kt					0 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	-	-	-	-	-	33473	33894	34352	34768	35194
-15	-	-	-	-	-	33136	33553	34007	34419	34841
-10	-	-	-	-	-	32814	33227	33678	34086	34503
-5	-	-	-	-	-	32503	32912	33359	33764	34177
0	-	-	-	-	-	32200	32605	33048	33448	33857
4	-	-	-	-	-	31971	32373	32806	33204	33610
8	-	-	-	-	-	31745	32143	32567	32962	33364
12	-	-	-	-	-	31526	31921	32336	32729	33128
16	-	-	-	-	-	31310	31702	32108	32498	32894
20	-	-	-	-	-	31100	31489	31886	32274	32667
24	-	-	-	-	-	30892	31278	31666	32052	32441
28	-	-	-	-	-	30691	31073	31453	31836	32223
32	-	-	-	-	-	30491	30870	31243	31623	32007

Temp. (°C)	WIND									
	10 kt					20 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	34639	35074	35544	35974	36416	35903	36356	36837	37284	37744
-15	34282	34713	35179	35605	36042	35527	35975	36453	36895	37349
-10	33942	34368	34830	35252	35685	35168	35611	36086	36523	36973
-5	33612	34034	34494	34912	35340	34822	35260	35731	36164	36608
0	33289	33708	34164	34578	35001	34482	34915	35383	35812	36252
4	33040	33455	33908	34319	34739	34219	34648	35114	35539	35975
8	32792	33204	33655	34063	34480	33958	34384	34847	35269	35702
12	32553	32963	33411	33816	34230	33706	34130	34590	35009	35438
16	32317	32723	33169	33571	33982	33457	33878	34335	34751	35177
20	32093	32496	32935	33334	33742	33215	33633	34088	34501	34924
24	31873	32273	32702	33099	33503	32976	33390	33843	34253	34673
28	31660	32057	32477	32871	33272	32744	33155	33606	34013	34429
32	31449	31842	32254	32646	33044	32514	32923	33371	33775	34188

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 8500 FT
ER BRAKES

Temp. (°C)	WIND									
	-10 kt					0 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	-	-	-	-	-	33152	33569	34024	34436	34858
-15	-	-	-	-	-	32822	33234	33686	34094	34511
-10	-	-	-	-	-	32503	32911	33359	33763	34176
-5	-	-	-	-	-	32195	32600	33042	33443	33852
0	-	-	-	-	-	31903	32303	32734	33131	33535
4	-	-	-	-	-	31674	32071	32492	32886	33288
8	-	-	-	-	-	31452	31845	32257	32649	33047
12	-	-	-	-	-	31234	31625	32028	32417	32812
16	-	-	-	-	-	31020	31407	31801	32188	32580
20	-	-	-	-	-	30811	31195	31581	31965	32354
24	-	-	-	-	-	30606	30988	31364	31746	32132
28	-	-	-	-	-	30407	30785	31154	31533	31916
32	-	-	-	-	-	30210	30586	30946	31323	31703

Temp. (°C)	WIND									
	10 kt					20 kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	34299	34730	35196	35623	36060	35545	35994	36471	36913	37368
-15	33950	34376	34839	35261	35693	35177	35620	36094	36532	36981
-10	33612	34034	34493	34911	35339	34821	35259	35730	36163	36608
-5	33284	33702	34158	34572	34996	34476	34909	35377	35806	36245
0	32965	33379	33832	34241	34661	34140	34568	35033	35457	35893
4	32715	33126	33576	33983	34399	33876	34302	34764	35185	35617
8	32472	32880	33327	33731	34144	33620	34042	34502	34920	35348
12	32235	32640	33085	33486	33895	33370	33789	34246	34661	35086
16	32008	32410	32845	33244	33650	33123	33540	33994	34406	34827
20	31787	32186	32612	33008	33411	32883	33296	33748	34157	34575
24	31571	31966	32383	32776	33176	32647	33057	33507	33913	34328
28	31360	31752	32160	32551	32947	32417	32825	33271	33675	34087
32	31152	31541	31940	32329	32722	32193	32598	33040	33441	33850

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - SEA LEVEL
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	41842	42435	43083	43769	44362	46257	46907	47607	48358	49006
-15	41420	42008	42651	43331	43919	45765	46409	47103	47847	48489
-10	41019	41602	42240	42914	43497	45298	45936	46624	47361	47997
-5	40628	41206	41840	42507	43086	44842	45474	46158	46888	47518
0	40246	40818	41448	42110	42683	44397	45023	45701	46425	47049
4	39944	40513	41139	41796	42366	44045	44667	45341	46059	46679
8	39647	40211	40834	41487	42053	43698	44315	44985	45698	46314
12	39355	39916	40536	41184	41747	43359	43971	44637	45346	45957
16	39072	39629	40245	40889	41448	43028	43636	44299	45002	45609
20	38794	39347	39960	40600	41156	42704	43308	43967	44665	45269
24	38521	39071	39681	40317	40869	42386	42987	43641	44335	44935
28	38255	38801	39408	40040	40589	42076	42672	43323	44012	44608
32	37995	38538	39142	39770	40316	41773	42366	43013	43698	44290
36	37741	38280	38881	39505	40048	41477	42065	42709	43389	43978
40	37492	38028	38626	39247	39786	41186	41771	42412	43088	43673
44	37248	37782	38376	38994	39530	40903	41484	42121	42793	43374
48	37010	37540	38132	38746	39280	40625	41203	41837	42504	43082

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	47887	48559	49277	50053	50721	49510	50203	50941	51652	52264
-15	47372	48037	48750	49518	50179	48968	49654	50385	51177	51858
-10	46882	47540	48248	49008	49663	48453	49132	49857	50641	51316
-5	46405	47057	47758	48512	49161	47951	48623	49343	50119	50788
0	45937	46584	47280	48026	48670	47459	48125	48839	49608	50271
4	45569	46210	46902	47643	48282	47071	47732	48442	49205	49863
8	45205	45842	46530	47265	47900	46689	47345	48050	48808	49460
12	44849	45481	46165	46895	47526	46315	46966	47666	48419	49067
16	44503	45130	45810	46535	47161	45950	46596	47293	48039	48683
20	44163	44786	45462	46182	46804	45593	46235	46927	47668	48308
24	43830	44449	45121	45836	46454	45243	45880	46568	47304	47939
28	43505	44120	44788	45498	46112	44901	45533	46217	46948	47579
32	43188	43798	44462	45168	45778	44567	45195	45875	46601	47228
36	42877	43483	44144	44845	45451	44240	44864	45540	46261	46884
40	42573	43175	43832	44529	45131	43920	44540	45212	45929	46547
44	42275	42874	43527	44219	44818	43607	44223	44892	45604	46219
48	41984	42579	43229	43917	44512	43301	43913	44578	45285	45897

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 1000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	41086	41669	42309	42983	43567	45376	46015	46704	47443	48079
-15	40680	41258	41893	42561	43140	44903	45535	46220	46951	47582
-10	40283	40856	41486	42149	42723	44440	45067	45745	46470	47095
-5	39893	40461	41087	41743	42312	43985	44606	45280	45997	46617
0	39512	40075	40696	41347	41911	43541	44156	44824	45535	46149
4	39213	39772	40390	41036	41597	43193	43803	44467	45173	45783
8	38921	39476	40090	40732	41289	42852	43458	44118	44819	45424
12	38636	39188	39799	40436	40990	42520	43122	43779	44474	45076
16	38358	38906	39514	40148	40698	42197	42794	43447	44138	44735
20	38087	38631	39236	39865	40412	41880	42474	43122	43809	44402
24	37822	38362	38964	39590	40133	41571	42161	42806	43487	44077
28	37562	38100	38698	39320	39860	41269	41854	42496	43173	43759
32	37308	37843	38438	39056	39594	40973	41555	42193	42866	43448
36	37060	37591	38184	38798	39332	40684	41262	41897	42565	43144
40	36817	37345	37935	38546	39077	40401	40975	41607	42271	42846
44	36579	37104	37691	38298	38827	40123	40694	41322	41982	42554
48	36346	36868	37452	38056	38581	39852	40419	41044	41700	42268

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	46964	47623	48331	49093	49749	48539	49219	49945	50731	51406
-15	46468	47121	47823	48578	49228	48017	48690	49411	50188	50858
-10	45983	46630	47326	48074	48718	47507	48174	48888	49658	50321
-5	45506	46147	46838	47578	48217	47006	47666	48375	49137	49794
0	45041	45675	46361	47094	47727	46516	47169	47872	48628	49278
4	44676	45305	45987	46715	47343	46132	46780	47479	48228	48874
8	44318	44943	45621	46343	46967	45756	46400	47094	47838	48479
12	43971	44592	45265	45982	46601	45391	46030	46719	47458	48095
16	43632	44248	44917	45629	46244	45034	45668	46354	47087	47719
20	43300	43912	44577	45284	45895	44684	45314	45996	46724	47352
24	42976	43584	44245	44948	45555	44344	44969	45647	46370	46994
28	42659	43263	43920	44618	45221	44010	44631	45305	46023	46643
32	42349	42949	43603	44296	44895	43684	44301	44971	45684	46300
36	42046	42641	43292	43981	44576	43365	43978	44644	45353	45964
40	41749	42341	42988	43672	44264	43053	43662	44324	45028	45636
44	41458	42046	42690	43370	43959	42747	43352	44011	44710	45315
48	41173	41758	42398	43074	43659	42448	43049	43704	44399	44999

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 2000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	40345	40919	41550	42213	42788	44513	45140	45820	46545	47171
-15	39940	40508	41134	41792	42361	44040	44661	45335	46054	46674
-10	39542	40105	40727	41378	41943	43576	44191	44860	45571	46186
-5	39158	39716	40333	40979	41539	43128	43738	44402	45106	45715
0	38785	39338	39951	40591	41147	42694	43298	43956	44654	45258
4	38492	39042	39651	40287	40839	42353	42952	43607	44300	44899
8	38207	38753	39359	39991	40539	42021	42616	43266	43955	44550
12	37929	38472	39074	39702	40247	41697	42288	42935	43618	44209
16	37658	38197	38796	39420	39961	41381	41968	42611	43289	43877
20	37393	37929	38525	39144	39683	41072	41655	42294	42968	43552
24	37134	37666	38260	38875	39410	40770	41349	41985	42655	43235
28	36881	37410	38000	38612	39144	40475	41051	41683	42348	42924
32	36634	37159	37747	38355	38884	40187	40758	41388	42048	42621
36	36391	36914	37498	38103	38629	39904	40472	41098	41754	42324
40	36154	36673	37255	37856	38379	39627	40191	40814	41466	42032
44	35922	36438	37017	37614	38135	39357	39917	40537	41185	41748

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	46059	46707	47404	48153	48798	47587	48255	48970	49741	50405
-15	45563	46205	46897	47638	48277	47066	47727	48436	49199	49857
-10	45077	45712	46398	47132	47765	46554	47208	47912	48668	49319
-5	44608	45237	45918	46645	47272	46061	46709	47406	48155	48800
0	44153	44776	45451	46171	46793	45582	46223	46915	47656	48296
4	43795	44413	45085	45799	46417	45206	45842	46530	47266	47900
8	43447	44061	44728	45437	46050	44839	45471	46155	46885	47515
12	43107	43717	44380	45084	45693	44482	45110	45789	46514	47139
16	42776	43381	44041	44740	45345	44134	44756	45432	46151	46773
20	42452	43053	43709	44404	45004	43793	44412	45083	45797	46415
24	42136	42733	43385	44075	44672	43460	44074	44742	45451	46065
28	41827	42420	43068	43754	44346	43135	43745	44409	45113	45723
32	41525	42114	42759	43439	44029	42817	43423	44083	44783	45388
36	41228	41814	42455	43131	43717	42506	43107	43763	44459	45060
40	40938	41519	42157	42829	43411	42200	42798	43450	44141	44739
44	40655	41232	41867	42535	43113	41902	42496	43145	43831	44425

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 3000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	39595	40159	40781	41433	41999	43638	44254	44924	45636	46251
-15	39193	39752	40370	41016	41576	43170	43780	44444	45149	45759
-10	38805	39359	39972	40612	41168	42717	43322	43980	44679	45283
-5	38428	38977	39585	40220	40771	42278	42877	43530	44222	44821
0	38064	38608	39212	39841	40388	41853	42446	43095	43780	44374
4	37779	38319	38920	39545	40088	41521	42110	42755	43436	44025
8	37501	38038	38635	39256	39796	41197	41782	42423	43099	43684
12	37229	37763	38357	38974	39510	40881	41461	42099	42770	43351
16	36965	37495	38087	38699	39233	40573	41150	41783	42450	43027
20	36707	37233	37822	38431	38961	40272	40844	41474	42137	42710
24	36454	36977	37562	38168	38694	39977	40546	41172	41830	42400
28	36206	36726	37309	37910	38434	39688	40253	40877	41530	42097
32	35965	36482	37062	37660	38181	39407	39969	40589	41238	41801
36	35729	36243	36820	37414	37932	39132	39690	40307	40952	41512
40	35498	36009	36583	37174	37689	38863	39418	40031	40672	41229
44	35273	35781	36353	36940	37453	38601	39152	39763	40400	40953

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	45142	45778	46465	47200	47833	46623	47278	47982	48739	49391
-15	44652	45281	45962	46690	47318	46107	46755	47453	48202	48848
-10	44177	44801	45476	46197	46819	45608	46250	46942	47684	48323
-5	43717	44334	45004	45718	46334	45123	45759	46445	47180	47813
0	43271	43883	44548	45255	45866	44655	45284	45965	46693	47321
4	42924	43531	44192	44893	45500	44289	44914	45590	46313	46936
8	42584	43187	43844	44540	45143	43932	44552	45225	45941	46560
12	42252	42851	43504	44196	44794	43583	44198	44867	45578	46193
16	41930	42524	43173	43860	44454	43243	43854	44519	45226	45836
20	41614	42204	42850	43532	44122	42911	43518	44179	44880	45487
24	41305	41891	42533	43211	43797	42586	43189	43846	44542	45145
28	41002	41584	42223	42896	43479	42268	42866	43520	44211	44810
32	40708	41286	41921	42590	43169	41958	42553	43202	43890	44484
36	40420	40994	41626	42290	42866	41655	42245	42892	43574	44165
40	40138	40709	41337	41997	42569	41358	41945	42587	43266	43853
44	39863	40430	41055	41711	42280	41069	41652	42291	42965	43549

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 4000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	38850	39404	40017	40658	41215	42769	43374	44034	44733	45337
-15	38458	39007	39616	40251	40803	42313	42912	43566	44258	44857
-10	38079	38624	39228	39858	40404	41872	42465	43114	43800	44393
-5	37712	38252	38852	39476	40018	41444	42032	42676	43355	43943
0	37356	37891	38487	39106	39644	41029	41611	42250	42924	43507
4	37078	37610	38203	38817	39352	40705	41283	41918	42587	43166
8	36807	37335	37925	38535	39066	40389	40963	41595	42259	42834
12	36543	37067	37654	38260	38788	40081	40651	41279	41938	42510
16	36284	36805	37388	37991	38516	39779	40345	40969	41624	42192
20	36032	36549	37130	37729	38250	39485	40047	40668	41319	41883
24	35785	36300	36878	37473	37991	39198	39757	40374	41020	41581
28	35545	36056	36631	37223	37738	38917	39472	40087	40729	41286
32	35310	35818	36390	36979	37491	38644	39195	39806	40444	40998
36	35077	35583	36152	36737	37247	38373	38921	39529	40162	40713
40	34847	35349	35916	36497	37004	38104	38649	39254	39883	40431

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	44232	44856	45532	46253	46876	45665	46307	47000	47743	48383
-15	43753	44371	45042	45756	46372	45161	45798	46485	47220	47854
-10	43291	43903	44568	45275	45886	44675	45305	45986	46714	47342
-5	42843	43449	44109	44809	45415	44203	44827	45503	46224	46846
0	42407	43008	43663	44357	44957	43746	44364	45034	45748	46365
4	42068	42664	43315	44004	44600	43389	44002	44668	45377	45989
8	41737	42328	42976	43660	44251	43040	43649	44311	45015	45623
12	41414	42001	42645	43324	43912	42701	43305	43963	44662	45265
16	41097	41681	42320	42995	43579	42368	42967	43622	44315	44915
20	40789	41368	42005	42674	43255	42043	42639	43290	43978	44574
24	40488	41064	41696	42362	42938	41727	42319	42966	43649	44241
28	40194	40766	41395	42056	42629	41418	42005	42649	43328	43916
32	39908	40476	41101	41758	42327	41116	41700	42340	43014	43598
36	39623	40188	40810	41463	42028	40817	41397	42033	42703	43284
40	39342	39903	40522	41170	41732	40521	41097	41730	42396	42973

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 5000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	38115	38660	39265	39895	40442	41913	42507	43156	43843	44437
-15	37733	38273	38873	39497	40040	41468	42056	42700	43380	43969
-10	37363	37898	38494	39113	39651	41037	41619	42258	42932	43515
-5	37004	37535	38127	38740	39274	40619	41196	41830	42497	43075
0	36657	37183	37771	38379	38908	40214	40786	41415	42076	42649
4	36386	36908	37493	38097	38623	39898	40466	41092	41748	42317
8	36121	36640	37221	37822	38344	39589	40153	40775	41427	41992
12	35864	36379	36958	37554	38074	39289	39849	40468	41115	41677
16	35612	36124	36700	37293	37809	38996	39552	40167	40810	41368
20	35367	35876	36449	37038	37551	38710	39262	39874	40513	41068
24	35125	35631	36201	36786	37297	38428	38977	39585	40220	40771
28	34885	35387	35955	36537	37044	38148	38693	39299	39929	40477
32	34649	35149	35713	36292	36796	37873	38415	39017	39644	40188
36	34419	34916	35478	36052	36554	37605	38144	38743	39365	39906
40	34193	34687	35246	35818	36317	37342	37877	38473	39091	39629

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	43334	43947	44612	45320	45932	44721	45351	46033	46762	47390
-15	42868	43474	44134	44835	45441	44230	44854	45530	46251	46874
-10	42416	43016	43671	44365	44965	43754	44372	45043	45757	46374
-5	41977	42572	43222	43910	44505	43293	43905	44571	45278	45889
0	41553	42142	42787	43469	44058	42847	43453	44113	44814	45419
4	41222	41807	42448	43125	43710	42499	43100	43757	44452	45053
8	40898	41479	42116	42788	43369	42158	42755	43407	44098	44695
12	40584	41161	41794	42461	43039	41828	42420	43069	43754	44347
16	40276	40849	41479	42142	42715	41504	42093	42737	43418	44007
20	39977	40546	41172	41830	42400	41189	41774	42414	43090	43675
24	39682	40247	40870	41523	42090	40878	41459	42096	42767	43348
28	39388	39949	40569	41218	41781	40569	41146	41780	42446	43024
32	39100	39658	40274	40919	41478	40267	40839	41469	42131	42705
36	38819	39373	39986	40627	41183	39971	40540	41166	41824	42394
40	38543	39094	39704	40340	40892	39681	40246	40869	41522	42089

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 6000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	37394	37929	38526	39145	39683	41072	41656	42295	42969	43553
-15	37020	37551	38143	38757	39291	40637	41215	41849	42517	43095
-10	36659	37185	37773	38381	38910	40216	40788	41417	42079	42652
-5	36308	36830	37413	38017	38542	39808	40374	40999	41654	42222
0	35970	36486	37066	37664	38185	39413	39974	40594	41244	41807
4	35837	36352	36930	37526	38046	39258	39817	40436	41083	41644
8	35706	36219	36796	37390	37908	39105	39663	40279	40924	41484
12	35449	35959	36533	37123	37638	38806	39360	39973	40613	41169
16	35198	35705	36276	36863	37374	38514	39064	39673	40309	40861
20	34947	35451	36019	36602	37110	38221	38767	39374	40005	40554
24	34702	35202	35767	36346	36852	37935	38477	39080	39708	40253
28	34461	34959	35521	36097	36599	37655	38194	38793	39416	39958
32	34226	34720	35280	35852	36351	37381	37916	38512	39131	39669
36	33992	34483	35040	35609	36105	37108	37640	38233	38848	39383
40	33763	34252	34806	35371	35864	36841	37369	37959	38570	39102

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	42453	43054	43710	44404	45005	43794	44412	45083	45798	46415
-15	41997	42592	43242	43930	44525	43314	43926	44592	45299	45911
-10	41555	42145	42790	43471	44061	42849	43456	44116	44816	45422
-5	41127	41711	42351	43026	43610	42399	42999	43654	44348	44948
0	40713	41292	41927	42596	43175	41964	42558	43208	43896	44490
4	40551	41127	41761	42427	43004	41793	42385	43033	43718	44311
8	40391	40966	41597	42261	42836	41625	42215	42861	43543	44134
12	40077	40648	41275	41935	42506	41295	41881	42523	43200	43787
16	39771	40337	40962	41616	42184	40973	41554	42193	42865	43448
20	39465	40027	40648	41298	41862	40650	41228	41862	42530	43109
24	39165	39723	40340	40986	41546	40335	40908	41539	42202	42776
28	38871	39425	40039	40680	41237	40025	40595	41222	41881	42451
32	38584	39134	39745	40382	40935	39723	40289	40912	41566	42133
36	38298	38845	39452	40085	40634	39422	39984	40604	41254	41817
40	38018	38562	39165	39794	40340	39128	39686	40303	40948	41508

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 7000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	36686	37212	37800	38409	38938	40247	40820	41449	42111	42685
-15	36321	36842	37426	38029	38555	39822	40389	41013	41669	42237
-10	35968	36485	37065	37663	38184	39411	39972	40592	41242	41805
-5	35627	36139	36715	37308	37825	39013	39570	40185	40828	41387
0	35298	35806	36378	36966	37478	38629	39181	39792	40429	40983
4	35168	35674	36245	36831	37342	38478	39027	39637	40272	40824
8	35037	35542	36111	36695	37204	38326	38873	39481	40114	40664
12	34780	35282	35847	36428	36934	38026	38570	39174	39802	40349
16	34529	35027	35590	36166	36669	37733	38273	38873	39498	40040
20	34283	34778	35338	35911	36411	37447	37983	38580	39200	39739
24	34040	34532	35089	35659	36156	37164	37696	38290	38906	39441
28	33801	34290	34844	35410	35904	36885	37414	38004	38616	39148
32	33567	34053	34605	35167	35658	36613	37138	37725	38333	38862
36	33339	33822	34371	34930	35418	36347	36868	37453	38056	38582
40	33116	33596	34142	34698	35183	36087	36605	37186	37786	38308

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	41588	42178	42823	43505	44095	42884	43491	44151	44852	45458
-15	41142	41726	42367	43042	43626	42415	43015	43670	44365	44965
-10	40711	41290	41925	42594	43173	41962	42556	43206	43893	44488
-5	40295	40868	41498	42161	42735	41523	42112	42757	43438	44027
0	39892	40460	41086	41742	42312	41100	41684	42323	42998	43582
4	39734	40299	40923	41577	42145	40933	41514	42152	42824	43406
8	39574	40138	40760	41412	41977	40765	41344	41980	42650	43230
12	39260	39820	40438	41085	41647	40435	41010	41642	42306	42882
16	38953	39509	40123	40766	41323	40112	40682	41311	41970	42542
20	38653	39205	39816	40454	41008	39796	40363	40987	41643	42211
24	38356	38904	39512	40145	40696	39484	40047	40667	41318	41882
28	38064	38608	39213	39842	40388	39177	39735	40353	40998	41559
32	37779	38319	38920	39545	40088	38877	39431	40045	40686	41243
36	37500	38036	38634	39255	39795	38583	39134	39744	40381	40934
40	37227	37760	38355	38972	39508	38296	38843	39450	40083	40633

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 8000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	35989	36507	37087	37685	38206	39436	39998	40618	41268	41831
-15	35634	36147	36723	37316	37832	39022	39578	40194	40837	41396
-10	35291	35800	36371	36959	37472	38622	39174	39784	40422	40976
-5	34953	35457	36025	36608	37116	38228	38774	39381	40012	40561
0	34623	35123	35687	36265	36769	37844	38385	38986	39612	40156
2	34494	34992	35554	36130	36633	37693	38232	38832	39456	39998
4	34366	34862	35423	35998	36499	37544	38081	38679	39301	39841
8	34114	34606	35165	35735	36233	37250	37783	38378	38995	39532
12	33863	34353	34908	35475	35970	36958	37488	38079	38692	39225
16	33620	34106	34659	35222	35714	36674	37200	37788	38397	38926
20	33381	33864	34414	34973	35462	36396	36918	37503	38107	38633
24	33148	33628	34175	34731	35217	36124	36643	37225	37825	38348
28	32920	33397	33942	34494	34978	35858	36374	36952	37549	38068
32	32697	33172	33713	34263	34743	35599	36111	36687	37279	37795

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	40738	41316	41952	42621	43201	41989	42584	43234	43922	44517
-15	40304	40877	41507	42170	42744	41533	42122	42767	43447	44037
-10	39885	40453	41078	41735	42304	41092	41676	42315	42990	43574
-5	39472	40034	40655	41305	41869	40658	41235	41870	42538	43116
0	39069	39626	40242	40886	41445	40234	40806	41435	42097	42670
2	38911	39466	40080	40722	41279	40068	40638	41265	41924	42496
4	38755	39308	39920	40560	41115	39903	40471	41097	41754	42323
8	38446	38995	39604	40239	40790	39579	40142	40764	41416	41981
12	38141	38686	39291	39921	40469	39257	39817	40435	41082	41643
16	37843	38384	38986	39612	40156	38944	39499	40114	40756	41314
20	37551	38089	38687	39308	39849	38637	39189	39800	40437	40991
24	37266	37800	38395	39012	39549	38338	38885	39493	40126	40676
28	36988	37518	38110	38723	39256	38045	38589	39193	39822	40368
32	36716	37243	37831	38440	38970	37759	38299	38899	39524	40067

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 9000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	35306	35814	36386	36975	37487	38639	39191	39802	40440	40993
-15	34955	35459	36027	36610	37118	38230	38776	39383	40014	40563
-10	34612	35111	35675	36253	36757	37830	38371	38973	39599	40142
-5	34279	34774	35334	35907	36407	37442	37978	38575	39195	39734
0	33952	34443	34999	35567	36063	37061	37593	38185	38799	39334
2	33824	34313	34868	35434	35928	36912	37441	38032	38644	39176
4	33697	34184	34737	35302	35794	36764	37291	37880	38490	39020
8	33447	33931	34482	35042	35532	36473	36996	37582	38188	38715
12	33204	33685	34232	34789	35276	36189	36709	37291	37893	38416
16	32965	33443	33988	34541	35025	35911	36428	37007	37604	38124
20	32733	33208	33751	34300	34781	35641	36154	36730	37323	37840
24	32506	32978	33517	34063	34542	35375	35885	36458	37047	37560
28	32283	32752	33289	33832	34308	35116	35622	36192	36777	37287
32	32065	32532	33066	33606	34078	34862	35365	35932	36513	37021

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	39903	40471	41096	41753	42322	41111	41695	42334	43009	43593
-15	39474	40036	40657	41307	41871	40660	41238	41872	42540	43119
-10	39055	39612	40228	40872	41431	40219	40791	41420	42082	42655
-5	38648	39200	39811	40449	41003	39791	40358	40982	41637	42205
0	38249	38795	39402	40034	40583	39371	39932	40552	41201	41763
2	38092	38636	39241	39871	40418	39206	39765	40383	41029	41590
4	37937	38479	39082	39709	40254	39043	39599	40215	40859	41418
8	37632	38170	38770	39393	39934	38722	39275	39887	40526	41081
12	37335	37869	38465	39084	39621	38409	38958	39566	40201	40752
16	37044	37574	38167	38781	39315	38103	38648	39252	39882	40429
20	36760	37287	37876	38486	39017	37805	38346	38947	39572	40116
24	36482	37005	37591	38197	38724	37512	38049	38647	39268	39808
28	36210	36730	37313	37914	38438	37226	37759	38354	38971	39507
32	35944	36460	37040	37638	38158	36946	37476	38067	38680	39213

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 22° - 10000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	34621	35120	35684	36262	36766	37840	38382	38983	39609	40153
-15	34275	34770	35330	35903	36403	37438	37974	38571	39191	39730
-10	33937	34427	34983	35551	36047	37043	37574	38167	38781	39315
-5	33606	34093	34645	35208	35699	36658	37184	37772	38380	38910
0	33286	33768	34316	34874	35362	36285	36806	37389	37992	38517
2	33161	33641	34188	34744	35231	36139	36658	37240	37841	38363
4	33037	33516	34061	34616	35100	35995	36512	37092	37690	38212
8	32794	33270	33813	34363	34845	35712	36225	36802	37396	37914
12	32556	33028	33568	34116	34594	35434	35944	36517	37108	37622
16	32323	32793	33330	33874	34350	35163	35669	36240	36826	37337
20	32096	32562	33097	33637	34110	34898	35401	35968	36550	37058
24	31874	32338	32870	33407	33877	34639	35139	35703	36281	36786
28	31657	32118	32647	33181	33649	34386	34883	35444	36018	36520

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	39065	39622	40238	40883	41442	40230	40802	41432	42093	42667
-15	38644	39195	39806	40444	40998	39787	40353	40977	41632	42200
-10	38230	38776	39383	40014	40563	39351	39912	40531	41180	41742
-5	37826	38367	38969	39595	40138	38927	39482	40096	40738	41296
0	37435	37971	38568	39187	39726	38515	39065	39674	40310	40862
2	37282	37816	38411	39029	39566	38354	38902	39510	40143	40693
4	37131	37663	38256	38872	39407	38195	38741	39347	39978	40526
8	36834	37362	37952	38563	39095	37883	38425	39027	39654	40198
12	36543	37067	37654	38261	38788	37577	38114	38713	39335	39876
16	36259	36780	37363	37965	38490	37278	37812	38407	39024	39561
20	35981	36498	37078	37676	38197	36985	37516	38107	38720	39254
24	35710	36224	36800	37395	37912	36700	37227	37815	38424	38954
28	35445	35955	36529	37119	37633	36421	36944	37529	38134	38661

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - SEA LEVEL
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	44410	44988	45532	46196	46713	49231	49861	50461	51191	51732
-15	43974	44547	45086	45744	46259	48723	49347	49941	50664	51203
-10	43553	44121	44655	45307	45820	48232	48850	49439	50155	50692
-5	43141	43706	44235	44881	45392	47752	48366	48949	49659	50193
0	42742	43302	43826	44467	44976	47286	47895	48473	49176	49708
4	42430	42986	43507	44144	44651	46923	47528	48101	48799	49329
8	42125	42678	43196	43828	44334	46568	47169	47738	48431	48959
12	41827	42377	42891	43520	44024	46221	46818	47383	48072	48598
16	41536	42083	42594	43218	43721	45881	46475	47036	47720	48245
20	41252	41796	42304	42924	43426	45551	46141	46698	47378	47901
24	40973	41514	42018	42634	43134	45225	45811	46365	47040	47561
28	40699	41237	41738	42351	42849	44906	45489	46039	46709	47229
32	40431	40966	41464	42073	42570	44593	45173	45719	46386	46904
36	40168	40700	41195	41800	42297	44287	44864	45406	46068	46585
40	39911	40440	40932	41534	42029	43987	44560	45099	45757	46273
44	39658	40185	40674	41272	41766	43693	44263	44799	45452	45966
48	39411	39935	40421	41016	41508	43404	43972	44504	45154	45666

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	50999	51648	52269	52482	52640	51520	52174	52801	52837	52864
-15	50467	51110	51724	52119	52411	51293	51945	52569	52683	52767
-10	49952	50589	51198	51767	52189	51074	51724	52345	52533	52672
-5	49449	50081	50684	51417	51960	50860	51507	52126	52387	52580
0	48961	49588	50185	50911	51451	50634	51279	51895	52233	52483
4	48580	49203	49795	50517	51055	50233	50874	51485	51959	52310
8	48208	48827	49415	50131	50667	49842	50478	51085	51692	52141
12	47844	48459	49043	49754	50288	49459	50091	50694	51427	51969
16	47489	48099	48679	49385	49918	49085	49713	50311	51039	51580
20	47142	47749	48325	49026	49557	48720	49344	49939	50662	51200
24	46800	47404	47976	48672	49202	48361	48981	49571	50289	50826
28	46466	47066	47634	48326	48853	48009	48626	49212	49925	50460
32	46138	46735	47299	47986	48512	47665	48277	48859	49568	50101
36	45817	46410	46971	47654	48178	47327	47936	48514	49218	49750
40	45503	46093	46649	47328	47851	46996	47602	48176	48875	49405
44	45194	45781	46334	47008	47530	46671	47274	47844	48539	49067
48	44892	45475	46025	46695	47215	46354	46952	47519	48210	48737

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 1000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	43621	44190	44725	45378	45891	48311	48931	49520	50238	50774
-15	43193	43758	44287	44934	45446	47812	48427	49010	49721	50255
-10	42777	43338	43863	44504	45013	47328	47937	48515	49219	49751
-5	42375	42931	43451	44087	44594	46859	47463	48036	48733	49263
0	41984	42536	43052	43682	44188	46404	47003	47570	48261	48789
4	41678	42227	42739	43365	43869	46047	46643	47206	47892	48418
8	41379	41925	42433	43055	43558	45698	46290	46849	47531	48054
12	41088	41630	42136	42754	43255	45359	45947	46503	47179	47701
16	40802	41342	41844	42458	42957	45026	45611	46162	46834	47355
20	40523	41059	41558	42168	42666	44700	45281	45829	46497	47015
24	40249	40783	41278	41885	42381	44382	44959	45503	46166	46683
28	39981	40511	41004	41606	42102	44069	44643	45183	45842	46358
32	39717	40245	40735	41334	41828	43762	44333	44869	45524	46038
36	39460	39985	40471	41067	41560	43462	44030	44563	45213	45726
40	39207	39730	40213	40805	41297	43167	43732	44261	44908	45419
44	38960	39479	39960	40549	41039	42879	43440	43967	44609	45119
48	38718	39235	39713	40298	40787	42597	43156	43678	44317	44826

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	50035	50673	51283	51824	52225	51110	51759	52381	52557	52688
-15	49512	50145	50748	51467	52000	50887	51534	52154	52405	52592
-10	49005	49632	50229	50956	51497	50671	51316	51933	52258	52499
-5	48513	49135	49727	50447	50985	50163	50803	51414	51911	52280
0	48036	48653	49239	49953	50488	49661	50295	50900	51569	52064
4	47662	48275	48857	49566	50099	49268	49898	50498	51229	51770
8	47297	47906	48483	49187	49718	48883	49509	50105	50830	51370
12	46941	47546	48120	48818	49348	48509	49131	49723	50443	50981
16	46592	47194	47763	48457	48985	48142	48760	49348	50063	50599
20	46251	46848	47414	48103	48629	47783	48397	48980	49690	50224
24	45916	46511	47072	47757	48281	47431	48041	48621	49326	49858
28	45588	46179	46737	47417	47940	47086	47693	48268	48968	49499
32	45267	45854	46408	47084	47605	46748	47351	47922	48618	49147
36	44953	45536	46087	46758	47278	46417	47017	47584	48275	48803
40	44644	45224	45771	46438	46956	46092	46688	47252	47939	48464
44	44341	44919	45462	46125	46642	45774	46367	46927	47609	48133
48	44046	44620	45160	45819	46334	45463	46053	46609	47287	47810

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 2000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	42840	43401	43927	44569	45079	47401	48011	48590	49295	49827
-15	42420	42977	43497	44134	44641	46912	47516	48089	48788	49317
-10	42012	42565	43081	43712	44217	46437	47036	47604	48296	48823
-5	41619	42167	42678	43304	43807	45978	46573	47135	47820	48345
0	41237	41781	42288	42909	43410	45533	46123	46680	47360	47883
4	40937	41478	41982	42598	43098	45184	45770	46323	46997	47518
8	40644	41182	41682	42294	42792	44842	45424	45973	46643	47163
12	40357	40892	41389	41997	42494	44508	45087	45632	46297	46815
16	40077	40609	41102	41707	42202	44181	44757	45298	45959	46475
20	39802	40331	40821	41422	41916	43861	44433	44971	45627	46142
24	39534	40060	40547	41144	41637	43548	44117	44651	45303	45816
28	39271	39794	40278	40871	41363	43242	43807	44337	44985	45497
32	39013	39534	40015	40604	41095	42941	43504	44030	44674	45184
36	38761	39279	39757	40343	40832	42648	43207	43730	44370	44878
40	38514	39029	39504	40087	40575	42359	42915	43436	44071	44578
44	38271	38783	39256	39835	40322	42076	42629	43146	43777	44283

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	49082	49710	50308	51036	51577	50704	51349	51966	52280	52513
-15	48568	49191	49783	50504	51042	50221	50861	51473	51951	52305
-10	48070	48688	49274	49988	50524	49697	50332	50937	51594	52079
-5	47590	48202	48783	49490	50023	49191	49821	50420	51150	51691
0	47124	47731	48306	49007	49538	48701	49325	49919	50642	51181
4	46757	47360	47932	48628	49157	48316	48935	49525	50242	50779
8	46399	46998	47565	48256	48784	47939	48554	49139	49852	50387
12	46048	46644	47207	47893	48419	47570	48182	48763	49470	50003
16	45706	46298	46857	47539	48063	47210	47818	48395	49097	49628
20	45371	45959	46514	47191	47713	46857	47461	48034	48731	49261
24	45043	45628	46179	46852	47372	46512	47113	47681	48374	48902
28	44722	45303	45851	46519	47037	46174	46771	47336	48024	48550
32	44407	44985	45529	46192	46710	45843	46436	46997	47681	48205
36	44099	44674	45214	45874	46389	45519	46109	46666	47345	47868
40	43797	44368	44905	45561	46075	45201	45788	46341	47016	47537
44	43500	44068	44601	45253	45765	44889	45472	46021	46692	47212

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 3000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	42065	42617	43134	43766	44271	46497	47098	47666	48358	48886
-15	41654	42202	42714	43340	43844	46019	46614	47177	47863	48388
-10	41255	41799	42306	42927	43428	45554	46144	46701	47381	47904
-5	40870	41410	41912	42527	43027	45105	45690	46242	46915	47436
0	40494	41030	41529	42138	42636	44667	45248	45795	46462	46981
4	40200	40733	41228	41834	42330	44325	44902	45445	46107	46624
8	39913	40443	40934	41536	42031	43990	44563	45102	45760	46275
12	39632	40158	40647	41245	41738	43662	44232	44767	45421	45934
16	39357	39880	40366	40960	41452	43341	43908	44439	45089	45601
20	39087	39608	40090	40681	41171	43027	43590	44118	44763	45274
24	38825	39343	39822	40409	40899	42722	43282	43806	44447	44956
28	38567	39082	39558	40142	40630	42421	42978	43498	44135	44642
32	38314	38827	39300	39880	40367	42126	42680	43197	43830	44336
36	38067	38577	39047	39624	40110	41839	42389	42903	43531	44036
40	37824	38332	38799	39372	39857	41555	42103	42614	43238	43741
44	37586	38091	38556	39126	39609	41278	41822	42330	42951	43452

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	48134	48752	49339	50054	50590	49764	50399	51006	51639	52108
-15	47633	48245	48827	49535	50068	49237	49866	50466	51196	51738
-10	47145	47752	48328	49029	49560	48724	49348	49942	50665	51204
-5	46674	47277	47847	48542	49070	48228	48847	49436	50152	50688
0	46216	46813	47378	48067	48593	47746	48360	48942	49652	50186
4	45857	46450	47011	47695	48219	47368	47978	48556	49261	49793
8	45506	46095	46652	47331	47854	46999	47605	48179	48878	49408
12	45162	45748	46301	46975	47496	46638	47239	47809	48504	49032
16	44826	45409	45957	46627	47146	46284	46882	47448	48138	48664
20	44497	45076	45621	46286	46804	45938	46532	47094	47779	48304
24	44177	44752	45294	45954	46470	45601	46192	46750	47430	47953
28	43861	44433	44971	45627	46142	45269	45856	46410	47086	47608
32	43553	44121	44655	45307	45820	44945	45528	46078	46750	47270
36	43251	43817	44347	44995	45506	44627	45207	45754	46421	46939
40	42954	43517	44044	44687	45197	44315	44892	45435	46097	46614
44	42663	43223	43746	44386	44895	44009	44583	45122	45780	46296

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 4000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	41299	41843	42351	42972	43474	45605	46196	46754	47434	47957
-15	40899	41439	41942	42558	43057	45139	45724	46277	46951	47472
-10	40508	41045	41543	42153	42651	44684	45265	45812	46479	46998
-5	40129	40661	41156	41760	42256	44242	44818	45360	46021	46538
0	39761	40289	40779	41379	41873	43812	44384	44921	45576	46091
4	39472	39997	40484	41080	41572	43476	44044	44577	45228	45741
8	39190	39712	40195	40787	41279	43147	43712	44241	44887	45398
12	38915	39434	39914	40502	40992	42827	43388	43913	44555	45065
16	38646	39162	39639	40224	40712	42513	43071	43593	44231	44738
20	38382	38896	39370	39951	40438	42206	42760	43279	43912	44418
24	38124	38635	39106	39683	40169	41905	42456	42971	43600	44105
28	37871	38379	38847	39421	39906	41610	42158	42670	43295	43798
32	37624	38129	38594	39164	39648	41322	41866	42375	42996	43498
36	37381	37884	38346	38913	39395	41039	41581	42085	42703	43203
40	37143	37643	38102	38666	39147	40761	41300	41802	42415	42914

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	47199	47807	48383	49085	49616	48780	49405	50000	50724	51263
-15	46710	47313	47883	48579	49108	48266	48885	49474	50191	50727
-10	46233	46831	47396	48085	48611	47764	48378	48961	49671	50205
-5	45770	46363	46922	47605	48129	47277	47886	48463	49166	49698
0	45320	45908	46462	47138	47660	46804	47407	47979	48676	49205
4	44967	45551	46102	46773	47293	46433	47032	47600	48292	48819
8	44623	45203	45750	46416	46935	46070	46666	47229	47916	48441
12	44287	44863	45406	46068	46585	45717	46309	46868	47550	48073
16	43958	44531	45070	45728	46243	45371	45959	46515	47192	47714
20	43636	44206	44741	45394	45907	45032	45617	46168	46840	47361
24	43321	43887	44418	45067	45579	44700	45281	45829	46497	47015
28	43012	43575	44102	44747	45257	44375	44953	45497	46160	46677
32	42709	43269	43793	44433	44942	44057	44631	45171	45830	46346
36	42413	42969	43490	44126	44634	43745	44316	44852	45507	46021
40	42122	42675	43193	43825	44331	43439	44007	44540	45190	45702

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 5000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	40543	41080	41579	42190	42688	44725	45306	45854	46522	47041
-15	40149	40681	41176	41781	42277	44265	44841	45384	46045	46562
-10	39766	40294	40784	41384	41878	43818	44390	44927	45583	46097
-5	39394	39918	40404	40999	41491	43385	43952	44484	45134	45646
0	39032	39553	40034	40624	41115	42964	43526	44053	44697	45207
4	38751	39269	39747	40333	40822	42636	43195	43718	44358	44866
8	38475	38990	39465	40047	40534	42314	42870	43389	44024	44531
12	38205	38716	39188	39767	40253	41999	42551	43067	43698	44203
16	37941	38450	38919	39494	39979	41692	42241	42753	43380	43883
20	37682	38188	38654	39225	39709	41390	41936	42445	43067	43569
24	37429	37932	38395	38963	39445	41095	41637	42143	42761	43262
28	37181	37681	38141	38706	39187	40806	41345	41847	42461	42961
32	36938	37436	37893	38454	38934	40523	41059	41558	42168	42666
36	36700	37196	37650	38208	38687	40246	40779	41275	41881	42378
40	36468	36961	37413	37967	38445	39975	40506	40998	41601	42096

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	46276	46874	47440	48129	48656	47809	48424	49007	49718	50252
-15	45794	46387	46947	47630	48154	47303	47911	48489	49193	49724
-10	45326	45914	46468	47145	47667	46810	47414	47986	48682	49212
-5	44872	45455	46004	46674	47194	46332	46931	47497	48187	48714
0	44430	45008	45553	46217	46734	45868	46461	47022	47706	48231
4	44087	44661	45201	45861	46376	45506	46096	46653	47332	47854
8	43750	44320	44857	45511	46025	45152	45738	46290	46964	47485
12	43419	43987	44519	45169	45682	44804	45386	45935	46604	47123
16	43097	43661	44190	44836	45346	44465	45044	45589	46253	46771
20	42781	43341	43866	44508	45017	44133	44708	45248	45908	46424
24	42472	43029	43550	44187	44695	43807	44379	44916	45571	46085
28	42168	42722	43240	43873	44379	43488	44056	44590	45241	45753
32	41872	42423	42937	43566	44070	43176	43741	44271	44917	45429
36	41581	42129	42640	43265	43768	42871	43432	43958	44601	45111
40	41298	41842	42350	42971	43473	42572	43131	43653	44292	44800

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 6000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	39797	40325	40816	41416	41910	43854	44427	44964	45620	46135
-15	39409	39934	40420	41014	41507	43403	43970	44502	45152	45664
-10	39033	39553	40035	40624	41115	42964	43526	44054	44697	45208
-5	38669	39186	39663	40248	40736	42540	43098	43621	44259	44767
0	38315	38827	39300	39880	40367	42127	42680	43198	43830	44336
2	38176	38687	39158	39736	40223	41965	42517	43032	43663	44168
4	38038	38548	39018	39594	40080	41805	42355	42869	43497	44001
8	37768	38275	38742	39314	39798	41490	42037	42547	43170	43673
12	37503	38008	38471	39040	39523	41182	41725	42231	42851	43352
16	37244	37746	38206	38771	39253	40880	41420	41923	42538	43038
20	36991	37490	37948	38509	38990	40585	41122	41621	42232	42731
24	36743	37239	37693	38252	38731	40295	40829	41325	41932	42429
28	36501	36994	37446	38001	38479	40013	40544	41037	41640	42135
32	36263	36753	37203	37754	38231	39735	40263	40753	41352	41846
36	36030	36518	36965	37513	37989	39464	39989	40476	41071	41564

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	45364	45952	46507	47184	47706	46850	47454	48026	48724	49253
-15	44891	45474	46023	46694	47213	46352	46951	47517	48208	48735
-10	44431	45009	45553	46217	46734	45868	46462	47023	47706	48231
-5	43987	44560	45099	45757	46272	45401	45990	46545	47222	47745
0	43553	44122	44656	45308	45821	44945	45529	46079	46750	47270
2	43384	43951	44483	45132	45645	44767	45349	45897	46565	47084
4	43216	43781	44311	44958	45470	44590	45170	45716	46382	46901
8	42886	43447	43973	44616	45126	44243	44819	45361	46022	46539
12	42562	43121	43643	44281	44790	43903	44475	45013	45670	46185
16	42246	42801	43320	43954	44460	43570	44139	44673	45325	45838
20	41937	42488	43003	43633	44138	43245	43810	44341	44988	45500
24	41633	42181	42693	43319	43822	42925	43487	44014	44657	45167
28	41337	41882	42391	43012	43514	42614	43173	43696	44335	44843
32	41047	41589	42093	42711	43211	42308	42864	43383	44018	44525
36	40762	41301	41803	42416	42915	42009	42561	43077	43708	44213

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 7000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	39059	39580	40061	40652	41142	42995	43557	44085	44729	45239
-15	38680	39197	39674	40259	40748	42553	43111	43634	44272	44780
-10	38311	38824	39297	39877	40364	42123	42677	43194	43826	44332
-5	37954	38463	38932	39507	39992	41707	42256	42769	43395	43899
0	37607	38112	38577	39147	39630	41302	41847	42354	42975	43477
2	37470	37974	38437	39006	39488	41143	41686	42192	42811	43312
4	37335	37838	38299	38866	39348	40986	41527	42031	42648	43148
8	37071	37570	38029	38591	39072	40677	41215	41716	42328	42827
12	36811	37308	37764	38323	38802	40375	40910	41407	42015	42512
16	36558	37052	37505	38060	38539	40080	40612	41105	41709	42205
20	36310	36801	37251	37803	38280	39791	40319	40809	41410	41904
24	36067	36556	37003	37552	38027	39508	40033	40520	41116	41609
28	35829	36315	36759	37305	37779	39230	39752	40236	40829	41320
32	35595	36079	36520	37063	37536	38958	39477	39958	40547	41037
36	35367	35848	36287	36826	37298	38691	39208	39686	40271	40759

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	44463	45041	45586	46250	46768	45902	46496	47057	47741	48266
-15	44000	44574	45113	45771	46286	45415	46004	46560	47237	47760
-10	43549	44118	44652	45304	45817	44941	45525	46075	46746	47266
-5	43113	43677	44206	44852	45363	44482	45061	45606	46270	46788
0	42688	43248	43772	44412	44921	44035	44609	45149	45808	46323
2	42522	43080	43602	44240	44747	43860	44432	44970	45626	46141
4	42357	42913	43433	44069	44576	43687	44257	44793	45446	45960
8	42034	42586	43103	43734	44239	43347	43913	44445	45094	45606
12	41717	42266	42779	43406	43909	43014	43577	44104	44749	45259
16	41408	41954	42463	43085	43587	42688	43248	43772	44412	44920
20	41105	41647	42153	42771	43272	42369	42925	43445	44081	44588
24	40808	41347	41849	42463	42963	42057	42610	43126	43758	44263
28	40517	41053	41552	42162	42660	41751	42300	42813	43440	43944
32	40231	40765	41260	41866	42363	41451	41997	42506	43130	43632
36	39952	40483	40975	41577	42072	41157	41700	42206	42825	43326

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 8000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	38333	38845	39319	39899	40386	42148	42702	43219	43852	44358
-15	37960	38469	38938	39513	39998	41714	42263	42776	43403	43906
-10	37599	38104	38568	39138	39622	41292	41837	42345	42966	43467
-5	37248	37749	38210	38775	39257	40884	41424	41927	42542	43042
0	36908	37405	37862	38423	38903	40487	41023	41522	42131	42629
2	36774	37270	37725	38284	38763	40331	40866	41362	41970	42467
4	36643	37137	37591	38148	38627	40178	40711	41206	41811	42307
8	36383	36875	37326	37879	38356	39876	40405	40896	41498	41993
12	36129	36618	37066	37616	38092	39580	40106	40594	41191	41684
16	35880	36367	36812	37358	37833	39290	39813	40297	40891	41382
20	35637	36121	36563	37106	37579	39006	39526	40007	40597	41087
24	35399	35880	36319	36859	37331	38728	39246	39723	40309	40798
28	35165	35644	36080	36617	37088	38456	38970	39445	40027	40515
32	34937	35413	35847	36380	36851	38190	38702	39173	39751	40238

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	43575	44144	44679	45331	45844	44968	45552	46103	46774	47294
-15	43121	43685	44214	44860	45371	44490	45069	45614	46279	46796
-10	42679	43238	43762	44402	44911	44025	44599	45138	45797	46312
-5	42250	42805	43324	43958	44465	43575	44144	44678	45330	45843
0	41835	42385	42899	43527	44032	43137	43702	44231	44877	45388
2	41671	42220	42732	43358	43862	42965	43528	44055	44699	45209
4	41511	42058	42568	43192	43695	42797	43357	43882	44524	45033
8	41194	41737	42244	42863	43365	42463	43020	43541	44178	44686
12	40883	41424	41926	42542	43041	42136	42690	43208	43840	44346
16	40579	41116	41616	42227	42725	41817	42367	42881	43509	44013
20	40282	40816	41312	41919	42416	41504	42051	42561	43185	43688
24	39991	40522	41014	41617	42113	41198	41741	42248	42867	43369
28	39706	40233	40723	41322	41815	40898	41438	41941	42557	43056
32	39427	39952	40437	41033	41525	40604	41142	41641	42253	42751

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 9000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	37613	38118	38583	39153	39637	41309	41854	42362	42983	43485
-15	37248	37749	38210	38775	39257	40884	41424	41927	42542	43042
-10	36894	37392	37848	38409	38889	40472	41008	41506	42115	42613
-5	36552	37046	37498	38054	38532	40072	40604	41097	41702	42197
0	36218	36708	37157	37708	38184	39683	40211	40700	41298	41792
2	36087	36576	37023	37572	38048	39531	40057	40544	41141	41634
4	35958	36445	36891	37438	37913	39380	39904	40390	40984	41476
8	35703	36188	36630	37174	37648	39083	39604	40086	40677	41167
12	35454	35937	36376	36917	37390	38794	39311	39790	40377	40866
16	35211	35690	36127	36664	37136	38509	39024	39500	40082	40570
20	34972	35449	35883	36417	36887	38231	38743	39215	39794	40281
24	34739	35213	35645	36176	36645	37960	38469	38938	39513	39998
28	34511	34983	35412	35940	36408	37694	38200	38666	39237	39721
32	34287	34757	35183	35707	36174	37433	37936	38399	38967	39450

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	42696	43256	43780	44420	44929	44043	44617	45157	45816	46331
-15	42251	42805	43324	43958	44465	43575	44144	44678	45330	45843
-10	41818	42369	42882	43511	44015	43120	43684	44213	44859	45370
-5	41400	41946	42454	43077	43579	42680	43239	43763	44403	44912
0	40992	41533	42037	42654	43154	42251	42805	43324	43958	44465
2	40832	41372	41874	42489	42988	42083	42636	43153	43784	44290
4	40674	41212	41713	42325	42824	41916	42468	42983	43612	44117
8	40363	40897	41394	42002	42500	41589	42137	42648	43273	43776
12	40059	40591	41084	41688	42184	41270	41814	42321	42942	43444
16	39762	40290	40780	41379	41874	40956	41497	42001	42617	43118
20	39470	39995	40482	41077	41570	40650	41187	41688	42300	42798
24	39185	39707	40191	40782	41274	40350	40885	41381	41989	42486
28	38907	39426	39906	40494	40984	40057	40589	41082	41686	42182
32	38633	39150	39626	40211	40699	39770	40298	40788	41388	41882

NOTE: Quick Turn Around Weight in lb.

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QUICK TURN AROUND WEIGHT TABLE
ALL ENGINE TYPES - FAA - FLAPS 45° - 10000 FT
LR BRAKES

Temp. (°C)	WIND									
	-10 Kt					0 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	36902	37399	37856	38416	38896	40480	41016	41515	42124	42622
-15	36547	37040	37493	38048	38527	40066	40598	41091	41695	42191
-10	36201	36691	37139	37690	38166	39663	40190	40679	41278	41771
-5	35864	36351	36795	37341	37816	39271	39794	40278	40871	41363
0	35537	36020	36461	37002	37476	38890	39409	39888	40476	40966
2	35409	35891	36330	36870	37342	38741	39258	39736	40322	40811
4	35282	35763	36200	36739	37210	38593	39109	39585	40169	40657
8	35033	35511	35945	36480	36951	38302	38815	39288	39867	40354
12	34789	35264	35696	36227	36696	38018	38527	38997	39573	40058
16	34551	35023	35453	35981	36449	37740	38247	38713	39285	39770
20	34316	34786	35213	35738	36205	37467	37971	38434	39002	39485
24	34088	34556	34980	35501	35967	37201	37702	38162	38727	39208
28	33864	34329	34750	35269	35734	36940	37438	37895	38456	38936

Temp. (°C)	WIND									
	10 Kt					20 Kt				
	SLOPE									
	-2%	-1%	0	1%	2%	-2%	-1%	0	1%	2%
-20	41827	42378	42892	43520	44024	43130	43694	44223	44869	45380
-15	41393	41939	42448	43070	43573	42673	43232	43756	44396	44905
-10	40971	41512	42016	42633	43133	42229	42783	43302	43936	44442
-5	40560	41096	41596	42206	42705	41796	42346	42860	43487	43992
0	40160	40693	41187	41793	42289	41376	41921	42430	43052	43554
2	40004	40535	41027	41631	42126	41211	41755	42262	42882	43383
4	39849	40378	40869	41470	41965	41048	41590	42095	42713	43213
8	39544	40070	40558	41154	41648	40728	41266	41768	42381	42880
12	39246	39769	40253	40845	41337	40414	40949	41447	42056	42553
16	38956	39475	39956	40544	41035	40108	40640	41134	41739	42235
20	38669	39186	39663	40248	40736	39807	40336	40826	41427	41921
24	38390	38904	39378	39959	40446	39514	40040	40527	41123	41616
28	38117	38627	39098	39675	40161	39226	39748	40232	40824	41316

NOTE: Quick Turn Around Weight in lb.

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LANDING PERFORMANCE

Refer to the Airplane Flight Manual for a complete set of charts for determination of the landing limiting weights.

EMBRAER RUNWAYS ANALYSIS SOFTWARE

Although the AFM presents all the required performance data for takeoff, the amount of options and charts presented, makes its use very difficult. In order to help operators, EMBRAER developed a runway analysis software for determination of the limiting weights.

THE LANDING OUTPUT DATA

The program outputs the limit weight, the code for the limitation detected, the approach climb speed, the reference speed and the quick turn around weight. This data is provided for several combinations of wind and temperature.

The data is calculated for four reference winds and for a range of temperatures.

Limitation codes assigned are an A for approach climb limited weight, R for runway limited weight, L for landing climb limited weight, and S for structural limited weight.

If the operation for a specific condition is considered unfeasible or outside the performance tables, the relevant data will be provided with asterisks.

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Wind (in knots)

EMB-145 LANDING ANALYSIS, ALLISON AE3007A1 ENGINES, FAA CERTIFICATION

Airport: AIRPORT NAME ICAO: ABCD Runway: 04 FLAP 45
Elevation: 1500 ft
LDA: 1900 ft
Slope: 0 %

Factoring: NORMAL

Ice Accretion: NO
A/Ice: OFF

DRY RUNWAY

LIMIT WEIGHT (Lb)/ Code/ V.Approach Climb(Kt)/ V.Ref(Kt)/ Quick T.Around Wt(Lb) versus Temperature and Wind:

Temp(C)	-10Kt	0Kt	10Kt	20Kt
0	42549/S/156/129/33539	42549/S/156/129/37414	42549/S/156/129/38782	42549/S/156/129/40247
5	42549/S/156/129/33243	42549/S/156/129/37061	42549/S/156/129/38409	42549/S/156/129/39854
10	42549/S/156/129/32952	42549/S/156/129/36715	42549/S/156/129/38044	42549/S/156/129/39469
15	42549/S/156/129/32672	42549/S/156/129/36382	42549/S/156/129/37691	42549/S/156/129/39098
20	42549/S/156/129/32399	42549/S/156/129/36057	42549/S/156/129/37347	42549/S/156/129/38736
25	42549/S/156/129/32134	42549/S/156/129/35740	42549/S/156/129/37013	42549/S/156/129/38384
30	42549/S/156/129/31874	42549/S/156/129/35432	42549/S/156/129/36686	42549/S/156/129/38041

Limitation codes: A-Approach climb; L-Landing Climb; R-Runway; S-Structural

Date: 23/06/99

Temperature (in degrees Celsius)

Limit weight (in pounds), limiting factor, approach climb speed (in knots), reference speed (in knots), and quick turn around weight (in pounds)

EXAMPLE

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SECTION 1-05
FLIGHT PLANNING

TABLE OF CONTENTS

Page Block

Introduction 1-05-00
Simplified Flight Planning 1-05-05
APU and Engine Fuel Consumption 1-05-07
Climb 1-05-10
Cruise 1-05-15
Descent 1-05-20
Holding 1-05-25
One Engine Inoperative Performance 1-05-30
Flight with Landing Gear Down (*) 1-05-35
Flight with Flaps Locked at 9° (*) 1-05-40
Inflight Diversion (*) 1-05-45
Flight with Engine Anti Ice Valve Locked Open (*) 1-05-50

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NOTE: Items marked with an asterisk (*) may not be present in this manual.

INTRODUCTION

This section presents climb, cruise, descent and holding performance data.

In addition, simplified flight planning and one engine inoperative are included.

NOTE: Airplanes equipped with Rolls Royce AE3007A1P engines should use the same simplified flight planning, climb, cruise, descent, holding, one engine inoperative performance, flight with landing gear down, flight with flaps locked at 9° and inflight diversion data applicable to airplanes equipped with Rolls Royce AE3007A1 engines.

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SIMPLIFIED FLIGHT PLANNING

Simplified flight planning charts allow quick determination of estimated trip fuel and time from brake release to landing. The following phases are included: takeoff, climb, cruise, descent, approach and landing.

Charts are provided for Long Range Cruise (LRC) and Maximum Speed Cruise (MSC) at constant altitude.

Alternate fuel, holding, reserve fuel and other allowances (APU usage and taxi) should be added to the trip fuel in order to obtain the total fuel required.

To determine trip fuel enter trip ground distance, correct for wind condition and estimated landing weight, move as far as the line indicating cruise pressure altitude, and read the trip fuel.

To determine trip time, enter trip ground distance, correct for wind condition, move as far as the referring cruise pressure altitude, and read the trip time.

For winds greater than those shown, enter in the chart, directly, corrected ground distance, ignore wind correction reference line, to obtain the corrected ground distance, apply the following equation.

$$CGD = GD \times \left(\frac{TAS}{TAS + WIND} \right)$$

Where:

CGD: Corrected ground distance;
GD: Ground distance;
Head wind is negative;
Tail wind is positive.

The alternate fuel is determined by entering the LRC Simplified Flight Planning chart with the alternate distance and wind.

The holding fuel is determined from the holding table in this section. Depending upon national regulations, the holding fuel is normally calculated so that the aircraft can hold for 30 min., at 1500 ft above the alternate airport.

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The reserve fuel is also dependant on national regulations and normally is the fuel required for flying 10% of the trip time (based on the latest fuel flow) or is equivalent to 5% of the trip fuel.

The allowances below may be used:

PHASE OF FLIGHT	FUEL CONSUMPTION (lb/min)
TAXI	15.40
APU	2.73

EXAMPLE:

Given:

DESTINATION AIRPORT

Trip Distance	400 NM
Flight Level	FL 350
Cruise Speed	LRC
Wind	30 knots (head wind)
Estimated landing weight	35000 lb

ALTERNATE AIRPORT

Distance	200 NM
Flight Level	FL 200
Speed to alternate airport	LRC
Wind	0
Estimated landing weight at alternate	33000 lb

RESERVE FUEL	5% of trip fuel

HOLDING

Time	30 min
Altitude	1500 ft
Estimated airplane weight at holding	33000 lb

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RESULTS

From Simplified Flight Planning Chart - Long Range Cruise:
Trip Fuel ..... 2900 lb

From Simplified Flight Planning Chart - Long Range Cruise:
Fuel to Alternate ..... 1600 lb
Reserve Fuel ..... 145 lb (5% of Trip Fuel)

From Holding Tables:
Fuel consumption at 1500 ft ..... 1563 lb/h
For 30 min of holding, fuel ..... 782 lb

To determine the TOTAL FUEL ON TAKEOFF, let's consider 5 minutes for taxi and an APU consumption equal to 110 lb.

TOTAL FUEL ON TAKEOFF = TRIP FUEL + FUEL TO ALTERNATE + RESERVE FUEL + HOLDING + APU + TAXI
TOTAL FUEL ON TAKEOFF = 2900 + 1600 + 145 + 782 + 110 + 77
TOTAL FUEL ON TAKEOFF = 5614 lb

From Flight Time Chart - Long Range Cruise:
TRIP TIME ..... 73 minutes

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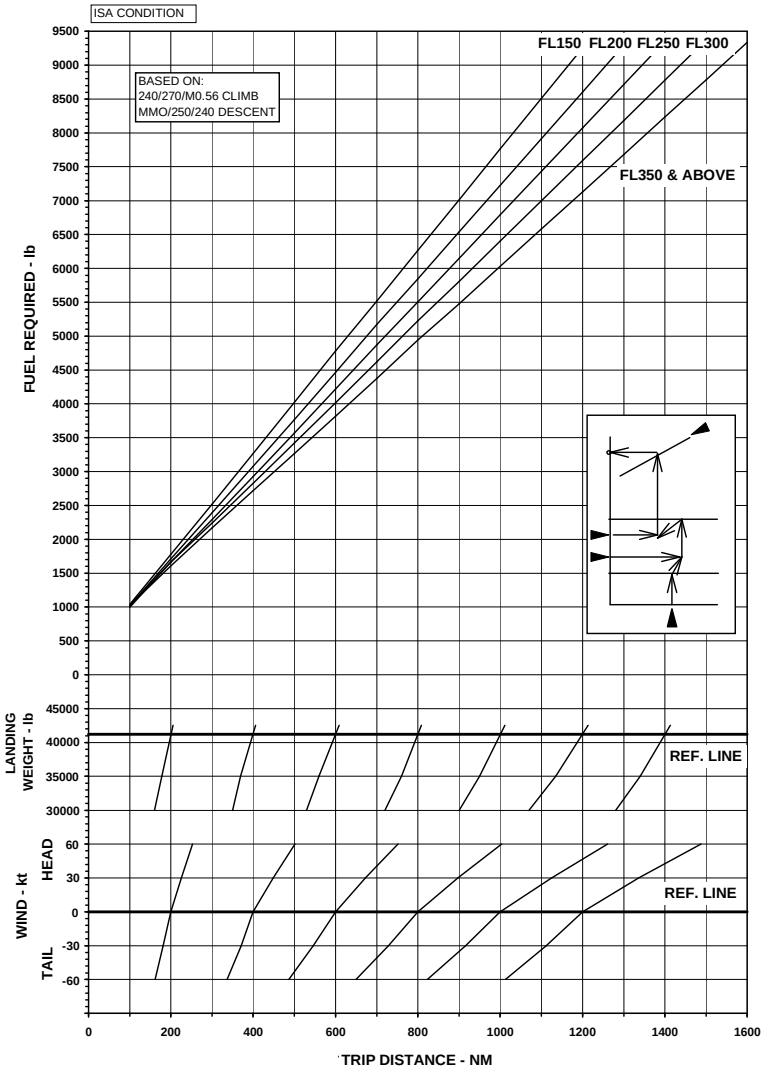
EMB-145 SIMPLIFIED FLIGHT PLANNING
AE3007A1 AND AE3007A1P ENGINES
LONG RANGE CRUISE



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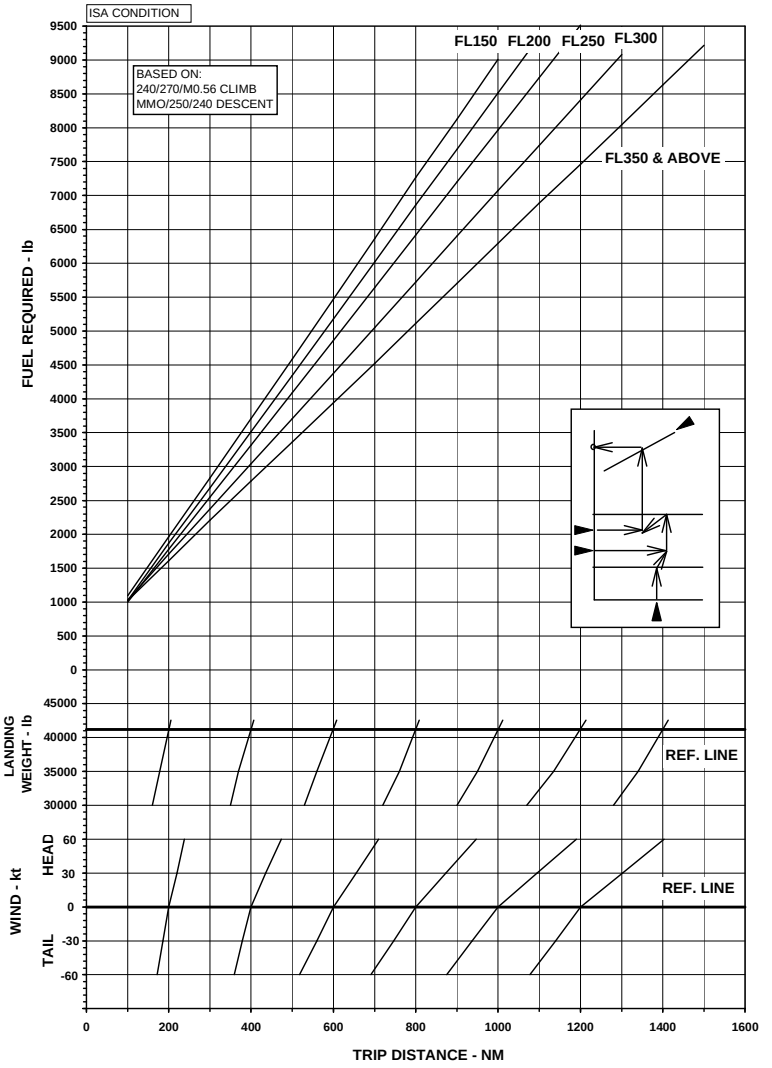
EMB-145 SIMPLIFIED FLIGHT PLANNING
AE3007A1 AND AE3007A1P ENGINES
MAXIMUM SPEED CRUISE



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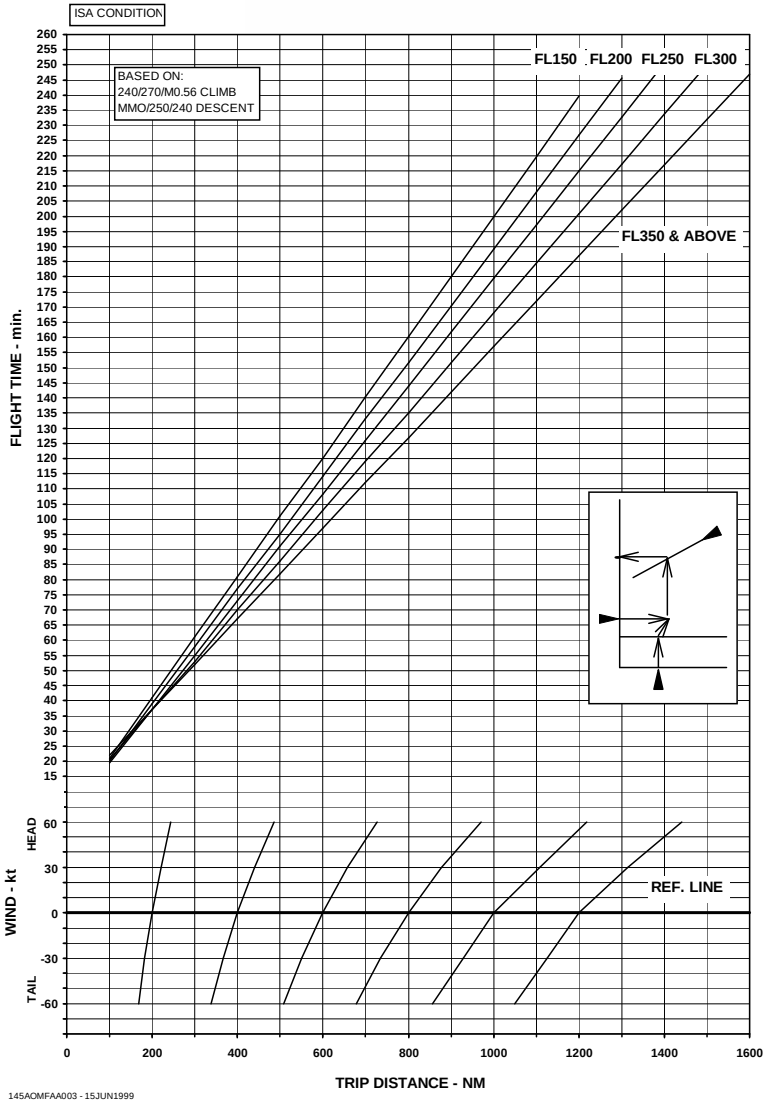
EMB-145 FLIGHT TIME
AE3007A1 AND AE3007A1P ENGINES
LONG RANGE CRUISE



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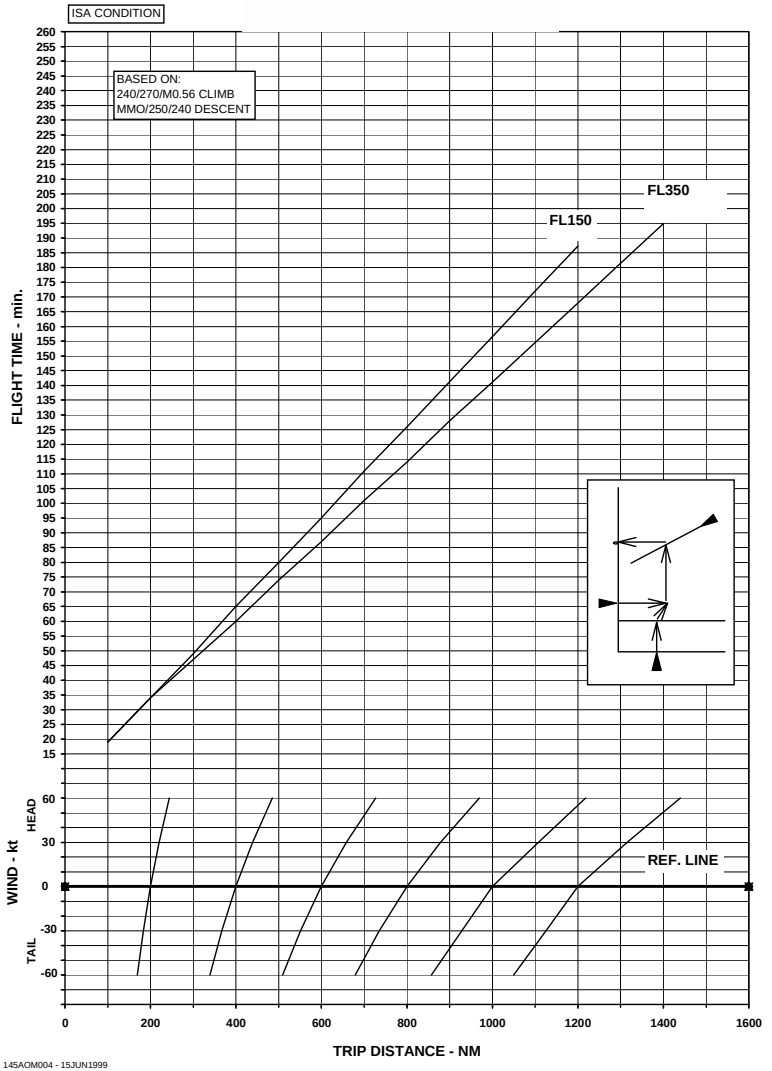
EMB-145 FLIGHT TIME
AE3007A1 AND AE3007A1P ENGINES
MAXIMUM SPEED CRUISE



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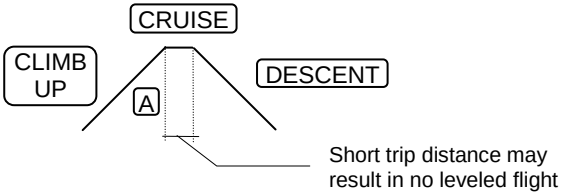
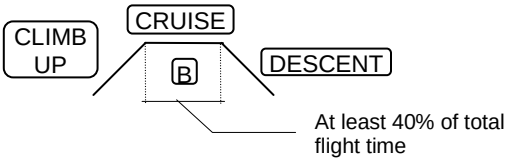
CRUISE - FLIGHT LEVEL TABLE

The table below permits quick determination of the cruise flight level for minimum fuel consumption, based on the trip distance and takeoff weight. For each takeoff weight two different flight levels are calculated (A or B) based on the following assumptions:

– Condition (A): The flight level was calculated based only on minimum fuel consumption. It may result on reduced time in leveled flight for short trip distances.



– Condition (B): The flight level was calculated based on a combination of minimum fuel consumption and at least 40% of the total flight time in cruise.



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The table data are presented for ISA condition, all engine operating and Maximum Speed Cruise schedule.

FLIGHT LEVEL - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

MAX SPEED CRUISE AND ISA CONDITIONS

		TRIP DISTANCE (NM)							
TOW (LB)		50	75	100	150	200	250	300	400
48501 (1)	-	-	-	-	-	-	-	-	-
46000 (2)	-	-	-	-	-	-	-	-	-
44000 (3)	A	-	-	-	-	360	370	370	370
	B	-	-	-	-	200	240	280	370
42000	A	80	170	220	280	360	370	370	370
	B	60	110	120	160	200	250	290	370
40000	A	80	180	230	320	370	370	370	370
	B	60	110	130	160	210	250	300	370
38000	A	70	170	240	330	370	370	370	370
	B	80	100	120	170	220	260	330	370
36000	A	140	190	250	340	370	370	370	370
	B	80	100	120	170	220	270	350	370

(1) Due to MLW restrictions, it is only possible to takeoff with 48501 lb TOW if the trip distance is greater than 700 NM (for airplanes with 42549 lb MLW).

(2) Due to MLW restrictions, it is only possible to takeoff with 46000 lb TOW if the trip distance is greater than 500 NM (for airplanes with 42549 lb MLW).

(3) Due to MLW restrictions, it is only possible to takeoff with 44000 lb TOW if the trip distance is greater than 150 NM (for airplanes with 42549 lb MLW) or 300 NM (for airplanes with 41226 lb MLW).

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CRUISE - ALTITUDE CAPABILITY TABLE

The table below permits quick determination of the altitude capability, based on the initial cruise weight. The table data are presented for various ISA conditions, all engines operating and Maximum Speed Cruise schedule.

The estabilished associated conditions are:

- Flaps ..... UP
- Gears ..... UP
- Bleeds ..... OPEN

CRUISE ALTITUDE CAPABILITY
ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

MAX SPEED CRUISE, CRUISE THRUST LIMITED

	ISA + ºC									
Weight (lb)	**-10**	**-5**	**0**	**5**	**10**	**15**	**20**	**25**	**30**	**35**
50000	370	370	370	370	370	360	340	320	290	280
48000	370	370	370	370	370	370	360	340	310	290
46000	370	370	370	370	370	370	370	360	340	300
44000	370	370	370	370	370	370	370	370	360	330
42000	370	370	370	370	370	370	370	370	370	360
40000	370	370	370	370	370	370	370	370	370	360
38000	370	370	370	370	370	370	370	370	370	370
36000	370	370	370	370	370	370	370	370	370	370
34000	370	370	370	370	370	370	370	370	370	370
32000	370	370	370	370	370	370	370	370	370	370
30000	370	370	370	370	370	370	370	370	370	370
28000	370	370	370	370	370	370	370	370	370	370

NOTE: The weight values refers to the initial cruise weight.

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CRUISE - WIND ALTITUDE TRADE

The following tables allow the determination of the break-even wind in order to maintain the same ground specific range at another altitude than the one planned initially. Long Range Cruise or Maximum Speed Cruise tables are provided.

These tables are based on the comparison between ground specific range at the new and actual altitudes. They do not consider climb/descent time, fuel and distances. The tables may be used in-flight, where the wind information is available and more accurate.

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Evaluation Method

1. Check the wind factors for actual and new altitudes.
2. Calculate the difference between new and actual wind factors. This number may be negative or positive.
3. The BREAK-EVEN WIND at the new altitude is the wind component at actual altitude plus the difference calculated on step (2).

Example:

40000 lb of actual cruise weight, LRC:

Actual Flight Level: FL 280, -10 kt (headwind)
New Flight Level: FL 350, -20 kt (headwind)

1. Wind factor FL 280 = 52, Wind factor FL 350 = 12
2. Difference = 12 (new FL) - 52 (actual FL) = -40
3. Break Even Wind = -10 (Wind actual FL) + (-40) (difference) = -50 kt Wind on FL 350.
   (20 kt headwind) is more favorable than Break-Even Wind (50 kt headwind). Therefore, climb to FL 350.

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CRUISE WIND ALTITUDE TRADE
LONG RANGE CRUISE SPEED

AE3007A1 AND AE3007A1P ENGINES, ALL ENGINES OPERATING

WEIGHT (LB)	PRESSURE ALTITUDE (x 1000 FT)										
	37	36	35	34	33	32	31	30	29	28	27
26000	0	6	11	16	22	27	33	38	44	50	56
28000	0	6	12	18	23	28	33	39	45	50	56
30000	0	6	12	18	24	29	34	40	45	50	56
32000	0	6	12	18	24	30	35	40	45	51	56
34000	0	6	12	18	24	30	36	41	46	51	57
36000	0	6	12	17	23	29	35	41	47	52	57
38000	0	6	12	17	23	29	35	41	47	53	58
40000	0	6	12	17	23	29	35	40	46	52	58
42000	0	6	12	17	23	29	34	40	46	52	58
44000	0	6	12	17	23	29	34	40	46	51	57
46000	0	6	12	17	23	29	34	40	46	51	57
48000	0	7	13	19	24	30	35	41	47	52	58
49000	0	9	15	21	27	32	38	43	49	54	60

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CRUISE WIND ALTITUDE TRADE MAXIMUM SPEED CRUISE

AE3007A1 AND AE3007A1P ENGINES, ALL ENGINES OPERATING

WEIGHT (LB)	PRESSURE ALTITUDE (x 1000 FT)										
	37	36	35	34	33	32	31	30	29	28	27
26000	0	19	33	49	67	85	104	124	145	168	191
28000	0	18	37	54	71	89	108	127	148	170	193
30000	0	17	36	55	76	92	111	130	150	172	194
32000	0	17	34	53	73	95	113	132	152	173	195
34000	0	16	33	51	70	91	113	133	153	173	194
36000	0	15	31	49	67	87	108	131	155	173	194
38000	0	14	30	46	64	83	104	125	149	169	189
40000	0	13	28	44	61	79	99	119	138	158	180
42000	0	13	26	42	58	75	94	110	129	148	168
44000	0	12	25	39	54	71	86	100	119	138	157
46000	0	11	23	36	51	65	77	90	108	126	144
48000	0	11	23	35	47	58	70	83	99	117	134
49000	0	12	23	33	44	54	66	79	95	113	130

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FLIGHT PLANNING – FUEL TANKERING

Fuel price variations at different airports may require carrying more fuel than the minimum required on a flight leg. The procedure of loading this extra amount of fuel (or surplus fuel) in order to minimize fuel costs is known as Fuel Tankering.

Since the surplus fuel tankered results in additional fuel burnoff (due to the weight increase) it is important to analyze the costs of the extra fuel transportation operation.

The following tables are designed to determine the break-even fuel price on departure airport and it may be used whenever there is difference on fuel price comparing to destination. Tables are provided for LRC and MSC cruise schedule.

Enter the trip distance on the table and read the fuel surplus ratio according to cruise altitude. The break-even fuel price is the price at departure multiplied by the fuel surplus ratio. If break-even fuel price is lower than destination price, it is economically feasible to execute fuel tankering.

The additional maintenance costs involved with increased weight operations (additional brakes and tires wearing) are not considered. It is important to remind that whenever fuel tankering is considered, the estimated landing weight at destination should be lower than the Maximum Landing Weight.

Example

Analyze the possibility to proceed with fuel tankering between two airports distant 600 NM from each other, using LRC speed schedule cruising on FL350. Consider the following fuel prices:

Departure Airport: 1.80 US$/Gal.
Destination Airport: 2.00 US$/Gal.

- Enter the LONG RANGE CRUISE table for 600 NM trip distance and FL350, the FUEL SURPLUS RATIO is 1.06.
- The BREAK-EVEN PRICE is 1.80 (price at departure) multiplied by 1.06 = 1.908 US$/Gal.

Since fuel price on destination airport (2.00 US$/Gal) is greater than break-even fuel price (1.908 US$/Gal), it is economically feasible the fuel tankering operation between these two airports.

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FUEL TANKERING
LONG RANGE CRUISE SPEED

AE3007A1 AND AE3007A1P ENGINES, ALL ENGINES OPERATING

	FUEL SURPLUS RATIO	
TRIP DISTANCE (NM)	32000 FT AND BELOW	33000 FT AND ABOVE
200	1.02	1.02
400	1.04	1.04
600	1.06	1.06
800	1.08	1.08
1000	1.10	1.10
1200	1.12	1.12
1400	1.14	1.13
1600	1.16	1.16
1800	1.19	1.18
2000	-	1.20

FUEL TANKERING
MAXIMUM SPEED CRUISE

AE3007A1 AND AE3007A1P ENGINES, ALL ENGINES OPERATING

	FUEL SURPLUS RATIO	
TRIP DISTANCE (NM)	32000 FT AND BELOW	33000 FT AND ABOVE
200	1.01	1.02
400	1.02	1.03
600	1.03	1.03
800	1.04	1.04
1000	1.05	1.05
1200	1.05	1.06
1400	1.06	1.07
1600	1.07	1.08
1800	-	1.09
2000	-	1.11

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APU AND ENGINE FUEL CONSUMPTION

APU FUEL CONSUMPTION

The table below shows the APU fuel consumption on the ground and during level flight at 5000 ft, 25000 ft and 37000 ft altitudes. The data is calculated for different airspeeds, APU air bleeds, and electrical loads.

APU FUEL CONSUMPTION

Applicable to Sundstrand APU T-62T-40C11 or T-62T-40C14 (500R)

ALTITUDE (ft)	AIRSPEED (KIAS)	APU AIR BLEED	APU GEN. LOAD	APU FUEL FLOW (lb/min)
0	0	No Load	No Load	1.59
			Max Load	1.70
		2 Packs	No Load	2.49
			Max Load	2.73
5000	140	No Load	No Load	1.82
			Max Load	1.94
		2 Packs	No Load	2.59
			Max Load	2.85
	220	No Load	No Load	1.82
			Max Load	1.94
		2 Packs	No Load	2.59
			Max Load	2.85
25000	140	No Load	No Load	1.04
			Max Load	1.17
		2 Packs	No Load	1.29
			Max Load	1.55
	220	No Load	No Load	1.04
			Max Load	1.17
		2 Packs	No Load	1.29
			Max Load	1.55
37000	140	No Load	No Load	0.55
			Max Load	0.74
		2 Packs	Max Load	0.96
	220	No Load	No Load	0.55
			Max Load	0.69
		2 Packs	Max Load	0.93

NOTE: Fuel density may range from 6.550 to 6.770 lb/US Gal. The values above have been determined for an adopted fuel density of 6.767 lb/US Gal.

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ENGINE FUEL CONSUMPTION

The following values established for taxi, take-off, approach and go around fuel consumption should be considered when calculating detailed flight plans.

FUEL CONSUMPTION

ENGINE	PHASE OF FLIGHT	FUEL CONSUMPTION lb/min
AE3007A	TAXI	14.6
	TAKE-OFF	93.9
	APPROACH AND LANDING	36.5
	GO AROUND	93.9
AE3007A1/1 A1, A3, A1/3, A1P, A1E	TAXI	15.4
	TAKE-OFF	99.2
	APPROACH AND LANDING	38.6
	GO AROUND	100.2

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CLIMB

CLIMB SPEEDS

MAXIMUM ANGLE SPEED

This speed is recommended for obstacle clearance in order to reach an altitude on minimum ground distance. The recommended maximum angle speed is related to flaps up, all engines operating and is approximately VFS for all gross weights and altitudes (see Final Segment Speed table on section 1-04-15).

MAXIMUM RATE OF CLIMB SPEED

This speed is recommended when maximum rate of climb is desired in order to reach an altitude on minimum climb time. The recommended maximum rate of climb speed is related to flaps up, all engines operating and is function of gross weights and altitudes as shown in the table below:

ALT (ft)	WEIGHT (lb)									
	30000	32000	34000	36000	38000	40000	42000	44000	46000	48000
5000	213	214	214	215	216	217	218	219	220	221
10000	204	204	205	206	207	208	209	211	212	213
15000	199	200	201	202	203	204	204	207	208	208
20000	194	195	196	197	198	200	201	203	204	206
25000	187	188	189	191	192	194	196	198	200	202

NOTE: Speeds presented in KIAS.

Maintain the speeds above until intercepting Mach 0.56. Then fly with this Mach number until level off.

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CLIMB TABLES

The climb planning tables show fuel consumption, distance, and time considering the airplane in climb configuration from the Sea Level up to the top of climb. Data are shown for various takeoff weights, ISA deviations and cruise altitudes.

The takeoff fuel consumption is not considered in the following tables.

Tables presents the scheduled climb speed according to the autopilot climb mode, i.e.:

- 240 KIAS for altitudes up to 10000 ft, increasing linearly to 270 KIAS from 10000 to 12000 ft, maintaining 270 KIAS from 12000 to 17400 ft and 0.56 Mach above 17400 ft.

The associated conditions are:

- Thrust Mode ..... CLB
- Flaps..... UP
- Gear..... UP
- Bleeds..... OPEN
- Anti-Ice ..... OFF

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EXAMPLE:

Given:

Departure Airport Elevation ..... 2100 ft
Takeoff weight ..... 40000 lb
ISA Condition
Cruise Altitude ..... 33000 ft

RESULTS

Data for 3600 ft (2100 ft + 1500 ft above departure airport) obtained from interpolation from the Sea Level to 5000 ft climb table:

Fuel: 93.6 lb
Distance: 4.3 NM
Time: 1.4 min

Data provided from the Sea Level to 33000 ft (Top of Climb) table:

Fuel: 967 lb
Distance: 79 NM
Time: 15 min

The fuel, distance and time spent during the climb phase (from 3600 ft to 33000 ft) are:

Fuel: 967 - 93.6 = 873.4 lb
Distance: 79 - 4.3 = 74.7 NM
Time: 15 - 1.4 = 13.6 min

NOTE: The fuel consumption related to the takeoff phase is provided on the Section 1-05-07.

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 5000 AND 6000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			5000 FT ISA + °C					6000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	164	171	177	186	213	198	205	214	224	258
	DISTANCE	NM	8	8	9	9	12	10	10	11	11	15
	TIME	MIN	2	2	2	2	3	2	3	3	3	3
48000	FUEL	LB	154	160	167	175	200	186	193	201	211	241
	DISTANCE	NM	8	8	8	9	11	9	10	10	11	14
	TIME	MIN	2	2	2	2	3	2	2	2	3	3
46000	FUEL	LB	146	152	158	165	188	176	182	190	198	227
	DISTANCE	NM	7	8	8	8	11	9	9	10	10	13
	TIME	MIN	2	2	2	2	2	2	2	2	2	3
44000	FUEL	LB	137	143	148	155	176	165	171	178	186	212
	DISTANCE	NM	7	7	7	8	10	8	9	9	9	12
	TIME	MIN	2	2	2	2	2	2	2	2	2	3
42000	FUEL	LB	129	134	139	145	164	155	161	167	174	198
	DISTANCE	NM	6	7	7	7	9	8	8	8	9	11
	TIME	MIN	2	2	2	2	2	2	2	2	2	3
40000	FUEL	LB	121	125	130	136	154	145	151	157	163	185
	DISTANCE	NM	6	6	6	7	9	7	8	8	8	11
	TIME	MIN	2	2	2	2	2	2	2	2	2	2
38000	FUEL	LB	113	117	122	127	143	136	141	147	153	172
	DISTANCE	NM	6	6	6	6	8	7	7	7	8	10
	TIME	MIN	1	1	1	2	2	2	2	2	2	2
36000	FUEL	LB	106	110	114	119	133	127	132	137	143	161
	DISTANCE	NM	5	5	6	6	7	6	7	7	7	9
	TIME	MIN	1	1	1	1	2	2	2	2	2	2
34000	FUEL	LB	98	102	106	111	124	118	123	128	133	149
	DISTANCE	NM	5	5	5	6	7	6	6	6	7	8
	TIME	MIN	1	1	1	1	2	1	2	2	2	2
32000	FUEL	LB	92	95	99	103	115	110	114	119	124	138
	DISTANCE	NM	5	5	5	5	6	5	6	6	6	8
	TIME	MIN	1	1	1	1	2	1	1	1	1	2
30000	FUEL	LB	85	88	91	95	106	102	106	110	114	128
	DISTANCE	NM	4	4	4	5	6	5	5	5	6	7
	TIME	MIN	1	1	1	1	1	1	1	1	1	2
28000	FUEL	LB	78	81	84	88	98	94	98	101	106	118
	DISTANCE	NM	4	4	4	4	5	5	5	5	5	7
	TIME	MIN	1	1	1	1	1	1	1	1	1	2

ANTI ICE ON CORRECTIONS
FUEL — BELOW ISA INCREASE 8% — ISA INCREASE 8% — ABOVE ISA INCREASE 15%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 7000 AND 8000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			7000 FT ISA + °C					8000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
	FUEL	LB	231	240	250	263	303	265	276	287	302	349
50000	DISTANCE	NM	12	12	13	14	18	14	14	15	16	21
	TIME	MIN	3	3	3	3	4	3	3	4	4	5
	FUEL	LB	217	226	235	247	283	249	259	270	283	326
48000	DISTANCE	NM	11	12	12	13	16	13	14	14	15	19
	TIME	MIN	3	3	3	3	4	3	3	3	3	4
	FUEL	LB	205	213	222	232	266	236	245	254	266	306
46000	DISTANCE	NM	11	11	11	12	16	12	13	13	14	18
	TIME	MIN	3	3	3	3	4	3	3	3	3	4
	FUEL	LB	193	200	208	218	249	221	230	239	249	286
44000	DISTANCE	NM	10	10	11	11	14	12	12	13	13	17
	TIME	MIN	2	3	3	3	3	3	3	3	3	4
	FUEL	LB	181	188	195	204	232	207	215	224	234	267
42000	DISTANCE	NM	9	10	10	11	14	11	11	12	12	16
	TIME	MIN	2	2	2	2	3	3	3	3	3	4
	FUEL	LB	170	176	183	191	217	194	202	210	219	249
40000	DISTANCE	NM	9	9	9	10	13	10	11	11	12	15
	TIME	MIN	2	2	2	2	3	2	3	3	3	3
	FUEL	LB	159	165	171	179	202	182	189	196	205	232
38000	DISTANCE	NM	8	8	9	9	12	9	10	10	11	14
	TIME	MIN	2	2	2	2	3	2	2	2	3	3
	FUEL	LB	148	154	160	167	188	169	176	183	191	216
36000	DISTANCE	NM	8	8	8	9	11	9	9	10	10	13
	TIME	MIN	2	2	2	2	3	2	2	2	2	3
	FUEL	LB	138	143	149	155	174	158	164	170	178	200
34000	DISTANCE	NM	7	7	8	8	10	8	9	9	9	12
	TIME	MIN	2	2	2	2	2	2	2	2	2	3
	FUEL	LB	128	133	138	144	162	147	152	158	165	185
32000	DISTANCE	NM	7	7	7	7	9	8	8	8	9	11
	TIME	MIN	2	2	2	2	2	2	2	2	2	3
	FUEL	LB	119	123	128	134	149	136	141	147	153	171
30000	DISTANCE	NM	6	6	7	7	9	7	7	8	8	10
	TIME	MIN	2	2	2	2	2	2	2	2	2	2
	FUEL	LB	110	114	118	123	137	125	130	135	141	157
28000	DISTANCE	NM	6	6	6	6	8	6	7	7	7	9
	TIME	MIN	1	1	1	2	2	2	2	2	2	2

ANTI ICE ON CORRECTIONS
FUEL — BELOW ISA INCREASE 8% — ISA INCREASE 8% — ABOVE ISA INCREASE 15%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 9000 AND 10000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			9000 FT ISA + °C					10000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	300	312	324	341	396	335	348	362	381	444
	DISTANCE	NM	16	17	17	18	24	18	19	20	21	27
	TIME	MIN	4	4	4	4	5	4	4	5	5	6
48000	FUEL	LB	282	293	305	320	369	314	327	340	357	414
	DISTANCE	NM	15	16	16	17	22	17	18	18	20	25
	TIME	MIN	4	4	4	4	5	4	4	4	4	6
46000	FUEL	LB	266	276	287	300	347	296	308	320	335	388
	DISTANCE	NM	14	15	15	16	21	16	17	17	18	24
	TIME	MIN	3	4	4	4	5	4	4	4	4	5
44000	FUEL	LB	249	259	270	282	324	278	289	301	314	362
	DISTANCE	NM	13	14	14	15	20	15	16	16	17	22
	TIME	MIN	3	3	3	4	4	4	4	4	4	5
42000	FUEL	LB	234	243	253	264	302	261	271	282	294	338
	DISTANCE	NM	12	13	13	14	18	14	15	15	16	21
	TIME	MIN	3	3	3	3	4	3	3	4	4	5
40000	FUEL	LB	219	227	237	247	282	244	253	264	275	315
	DISTANCE	NM	12	12	13	13	17	13	14	14	15	19
	TIME	MIN	3	3	3	3	4	3	3	3	3	4
38000	FUEL	LB	205	213	221	231	262	228	237	246	257	293
	DISTANCE	NM	11	11	12	12	16	12	13	13	14	18
	TIME	MIN	3	3	3	3	4	3	3	3	3	4
36000	FUEL	LB	191	198	206	215	244	213	221	230	240	272
	DISTANCE	NM	10	11	11	12	15	11	12	12	13	17
	TIME	MIN	2	3	3	3	3	3	3	3	3	4
34000	FUEL	LB	178	185	192	200	226	198	206	214	223	252
	DISTANCE	NM	9	10	10	11	14	11	11	12	12	16
	TIME	MIN	2	2	2	2	3	3	3	3	3	3
32000	FUEL	LB	165	172	178	186	209	184	191	198	207	233
	DISTANCE	NM	9	9	9	10	13	10	10	11	11	14
	TIME	MIN	2	2	2	2	3	2	2	3	3	3
30000	FUEL	LB	153	159	165	172	193	170	177	184	192	215
	DISTANCE	NM	8	8	9	9	12	9	9	10	10	13
	TIME	MIN	2	2	2	2	3	2	2	2	2	3
28000	FUEL	LB	141	146	152	159	178	157	163	169	177	198
	DISTANCE	NM	7	8	8	8	11	8	9	9	10	12
	TIME	MIN	2	2	2	2	2	2	2	2	2	3

ANTI ICE ON CORRECTIONS
FUEL — BELOW ISA INCREASE 8% — ISA INCREASE 8% — ABOVE ISA INCREASE 15%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 11000 AND 12000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			11000 FT ISA + °C					12000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
	FUEL	LB	371	386	402	423	495	411	427	445	469	554
50000	DISTANCE	NM	21	21	22	24	31	23	24	25	27	36
	TIME	MIN	5	5	5	5	7	5	6	6	6	8
	FUEL	LB	348	362	377	396	461	385	401	417	439	516
48000	DISTANCE	NM	19	20	21	22	29	22	23	24	26	34
	TIME	MIN	5	5	5	5	6	5	5	5	6	7
	FUEL	LB	328	341	355	371	433	363	377	392	411	483
46000	DISTANCE	NM	18	19	20	21	27	21	22	23	24	32
	TIME	MIN	4	4	5	5	6	5	5	5	5	7
	FUEL	LB	308	320	333	348	403	340	353	368	385	450
44000	DISTANCE	NM	17	18	18	20	26	19	20	21	22	29
	TIME	MIN	4	4	4	4	6	5	5	5	5	6
	FUEL	LB	288	300	312	326	376	318	331	344	360	419
42000	DISTANCE	NM	16	17	17	18	24	18	19	20	21	27
	TIME	MIN	4	4	4	4	5	4	4	4	5	6
	FUEL	LB	270	280	292	305	350	298	309	322	336	389
40000	DISTANCE	NM	15	16	16	17	22	17	18	18	19	25
	TIME	MIN	4	4	4	4	5	4	4	4	4	6
	FUEL	LB	252	262	272	284	325	278	289	300	314	362
38000	DISTANCE	NM	14	14	15	16	21	16	16	17	18	24
	TIME	MIN	3	3	3	4	5	4	4	4	4	5
	FUEL	LB	235	244	254	265	302	259	269	280	292	336
36000	DISTANCE	NM	13	13	14	15	19	15	15	16	17	22
	TIME	MIN	3	3	3	3	4	3	4	4	4	5
	FUEL	LB	219	227	236	247	280	241	250	260	272	311
34000	DISTANCE	NM	12	13	13	14	18	14	14	15	16	20
	TIME	MIN	3	3	3	3	4	3	3	3	3	4
	FUEL	LB	203	211	219	229	259	223	232	241	252	287
32000	DISTANCE	NM	11	12	12	13	16	13	13	14	14	19
	TIME	MIN	3	3	3	3	4	3	3	3	3	4
	FUEL	LB	188	195	203	212	239	207	215	223	233	265
30000	DISTANCE	NM	10	11	11	12	15	12	12	13	13	17
	TIME	MIN	2	3	3	3	3	3	3	3	3	4
	FUEL	LB	173	180	187	195	219	190	198	206	215	243
28000	DISTANCE	NM	9	10	10	11	14	11	11	12	12	16
	TIME	MIN	2	2	2	2	3	3	3	3	3	3

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 9%	INCREASE 9%	INCREASE 15%
DISTANCE	NA	INCREASE 10%	INCREASE 20%
TIME	NA	INCREASE 10%	INCREASE 20%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 13000 AND 14000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			13000 FT ISA + °C					14000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	454	472	491	519	622	498	518	539	570	694
	DISTANCE	NM	27	28	29	31	42	30	32	33	36	49
	TIME	MIN	6	6	6	7	9	7	7	7	8	10
48000	FUEL	LB	425	442	460	485	577	466	485	505	533	642
	DISTANCE	NM	25	26	27	29	39	28	29	31	33	45
	TIME	MIN	6	6	6	6	8	6	6	7	7	9
46000	FUEL	LB	400	416	433	453	540	438	455	474	497	600
	DISTANCE	NM	24	25	26	27	37	27	28	29	31	42
	TIME	MIN	5	6	6	6	8	6	6	6	7	9
44000	FUEL	LB	374	389	405	424	502	410	426	443	465	557
	DISTANCE	NM	22	23	24	25	34	25	26	27	29	39
	TIME	MIN	5	5	5	6	7	6	6	6	6	8
42000	FUEL	LB	350	364	379	396	466	383	398	414	434	516
	DISTANCE	NM	21	21	22	24	32	23	24	25	27	36
	TIME	MIN	5	5	5	5	7	5	5	5	6	8
40000	FUEL	LB	327	340	354	370	433	358	372	387	405	479
	DISTANCE	NM	19	20	21	22	29	22	23	24	25	34
	TIME	MIN	4	5	5	5	6	5	5	5	5	7
38000	FUEL	LB	305	317	330	345	402	333	347	361	378	444
	DISTANCE	NM	18	19	19	21	27	20	21	22	23	31
	TIME	MIN	4	4	4	4	6	5	5	5	5	6
36000	FUEL	LB	284	296	308	322	372	310	323	336	351	411
	DISTANCE	NM	17	17	18	19	25	19	20	20	22	29
	TIME	MIN	4	4	4	4	5	4	4	4	5	6
34000	FUEL	LB	264	275	286	299	344	288	300	312	326	379
	DISTANCE	NM	15	16	17	18	23	17	18	19	20	26
	TIME	MIN	4	4	4	4	5	4	4	4	4	6
32000	FUEL	LB	245	255	265	277	318	267	278	289	302	350
	DISTANCE	NM	14	15	16	16	21	16	17	17	18	24
	TIME	MIN	3	3	3	4	5	4	4	4	4	5
30000	FUEL	LB	226	235	245	256	293	247	257	267	279	322
	DISTANCE	NM	13	14	14	15	20	15	15	16	17	22
	TIME	MIN	3	3	3	3	4	3	3	4	4	5
28000	FUEL	LB	209	217	226	236	269	227	236	246	257	295
	DISTANCE	NM	12	13	13	14	18	14	14	15	16	20
	TIME	MIN	3	3	3	3	4	3	3	3	3	4

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 9%	INCREASE 9%	INCREASE 15%
DISTANCE	NA	INCREASE 10%	INCREASE 20%
TIME	NA	INCREASE 10%	INCREASE 20%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 15000 AND 16000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			15000 FT ISA + °C					16000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
	FUEL	LB	544	566	589	624	770	592	616	641	680	853
50000	DISTANCE	NM	34	36	37	40	56	38	40	42	45	64
	TIME	MIN	8	8	8	8	11	8	8	9	9	13
	FUEL	LB	508	529	551	583	711	552	575	598	634	785
48000	DISTANCE	NM	32	33	35	37	52	36	37	39	42	59
	TIME	MIN	7	7	7	8	10	8	8	8	9	12
	FUEL	LB	477	497	517	543	664	518	539	561	590	731
46000	DISTANCE	NM	30	31	33	35	48	33	35	36	39	55
	TIME	MIN	7	7	7	7	10	7	7	8	8	11
	FUEL	LB	446	464	483	507	614	484	503	524	550	675
44000	DISTANCE	NM	28	29	30	32	45	31	32	34	36	51
	TIME	MIN	6	6	6	7	9	7	7	7	7	10
	FUEL	LB	417	433	451	473	569	451	470	489	513	624
42000	DISTANCE	NM	26	27	28	30	41	29	30	32	34	47
	TIME	MIN	6	6	6	6	8	6	6	7	7	9
	FUEL	LB	389	404	421	441	527	421	438	456	478	577
40000	DISTANCE	NM	24	25	26	28	38	27	28	29	31	43
	TIME	MIN	5	5	6	6	8	6	6	6	6	9
	FUEL	LB	362	377	392	411	487	392	408	424	445	533
38000	DISTANCE	NM	23	24	25	26	35	25	26	27	29	40
	TIME	MIN	5	5	5	5	7	5	6	6	6	8
	FUEL	LB	337	351	365	382	450	364	379	394	413	492
36000	DISTANCE	NM	21	22	23	24	32	23	24	25	27	37
	TIME	MIN	5	5	5	5	7	5	5	5	6	7
	FUEL	LB	313	325	339	354	416	338	352	366	383	453
34000	DISTANCE	NM	19	20	21	22	30	22	22	23	25	34
	TIME	MIN	4	4	5	5	6	5	5	5	5	7
	FUEL	LB	290	301	314	328	383	313	325	339	355	417
32000	DISTANCE	NM	18	19	20	21	28	20	21	22	23	31
	TIME	MIN	4	4	4	4	6	4	4	5	5	6
	FUEL	LB	267	278	290	303	352	289	300	312	327	383
30000	DISTANCE	NM	17	17	18	19	25	18	19	20	21	28
	TIME	MIN	4	4	4	4	5	4	4	4	4	6
	FUEL	LB	246	256	266	279	322	265	276	287	301	350
28000	DISTANCE	NM	15	16	17	17	23	17	18	18	19	26
	TIME	MIN	3	3	4	4	5	4	4	4	4	5

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 9%	INCREASE 9%	INCREASE 15%
DISTANCE	NA	INCREASE 10%	INCREASE 20%
TIME	NA	INCREASE 10%	INCREASE 20%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 17000 AND 18000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			17000 FT ISA + °C					18000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	641	667	695	739	942	686	714	744	793	1024
	DISTANCE	NM	43	44	46	50	73	47	49	51	55	82
	TIME	MIN	9	9	9	10	14	10	10	10	11	16
48000	FUEL	LB	597	622	648	688	864	638	665	693	737	936
	DISTANCE	NM	40	41	43	47	67	43	45	47	51	75
	TIME	MIN	8	9	9	9	13	9	9	10	10	14
46000	FUEL	LB	560	583	607	639	803	598	622	648	684	869
	DISTANCE	NM	37	39	40	43	63	41	42	44	47	69
	TIME	MIN	8	8	8	9	12	9	9	9	9	13
44000	FUEL	LB	522	543	566	595	740	557	580	604	637	799
	DISTANCE	NM	35	36	38	40	57	38	39	41	44	64
	TIME	MIN	7	8	8	8	11	8	8	8	9	12
42000	FUEL	LB	487	507	528	555	683	519	540	563	593	736
	DISTANCE	NM	32	34	35	37	53	35	37	38	41	58
	TIME	MIN	7	7	7	8	10	7	8	8	8	11
40000	FUEL	LB	453	472	491	516	630	483	503	524	551	678
	DISTANCE	NM	30	31	33	35	49	33	34	35	38	54
	TIME	MIN	6	7	7	7	10	7	7	7	8	10
38000	FUEL	LB	422	439	457	480	581	449	467	487	512	624
	DISTANCE	NM	28	29	30	32	45	30	32	33	35	49
	TIME	MIN	6	6	6	7	9	6	7	7	7	10
36000	FUEL	LB	392	408	425	446	535	417	434	452	475	574
	DISTANCE	NM	26	27	28	30	41	28	29	31	33	45
	TIME	MIN	6	6	6	6	8	6	6	6	7	9
34000	FUEL	LB	363	378	394	413	492	386	402	419	440	528
	DISTANCE	NM	24	25	26	28	38	26	27	28	30	41
	TIME	MIN	5	5	5	6	7	6	6	6	6	8
32000	FUEL	LB	336	350	364	382	453	357	372	387	406	485
	DISTANCE	NM	22	23	24	25	35	24	25	26	28	38
	TIME	MIN	5	5	5	5	7	5	5	5	6	7
30000	FUEL	LB	310	322	336	352	415	329	343	357	374	444
	DISTANCE	NM	20	21	22	23	32	22	23	24	25	35
	TIME	MIN	4	4	5	5	6	5	5	5	5	7
28000	FUEL	LB	285	296	309	323	379	302	315	328	344	405
	DISTANCE	NM	19	19	20	21	29	20	21	22	23	32
	TIME	MIN	4	4	4	4	6	4	4	5	5	6

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 10%	INCREASE 10%	INCREASE 20%
DISTANCE	NA	INCREASE 10%	INCREASE 20%
TIME	NA	INCREASE 10%	INCREASE 20%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 19000 AND 20000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			19000 FT ISA + °C					20000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	726	756	787	841	1095	764	795	829	886	1161
	DISTANCE	NM	50	52	55	60	90	54	56	59	64	97
	TIME	MIN	10	11	11	12	17	11	11	12	12	18
48000	FUEL	LB	675	703	732	781	1000	710	740	771	823	1059
	DISTANCE	NM	47	49	51	55	81	50	52	54	59	88
	TIME	MIN	10	10	10	11	15	10	11	11	12	17
46000	FUEL	LB	632	658	685	724	926	664	692	721	763	979
	DISTANCE	NM	44	46	48	51	75	47	49	51	55	81
	TIME	MIN	9	9	10	10	14	10	10	10	11	15
44000	FUEL	LB	588	612	638	674	851	618	644	671	709	898
	DISTANCE	NM	41	42	44	47	69	43	45	47	51	74
	TIME	MIN	8	9	9	9	13	9	9	9	10	14
42000	FUEL	LB	548	570	594	627	782	575	599	624	659	825
	DISTANCE	NM	38	39	41	44	63	40	42	44	47	68
	TIME	MIN	8	8	8	9	12	8	9	9	9	13
40000	FUEL	LB	509	530	552	582	719	535	557	580	612	758
	DISTANCE	NM	35	37	38	41	58	37	39	41	44	62
	TIME	MIN	7	7	8	8	11	8	8	8	9	12
38000	FUEL	LB	473	493	513	541	662	497	517	539	568	697
	DISTANCE	NM	33	34	35	38	53	35	36	38	40	57
	TIME	MIN	7	7	7	7	10	7	7	8	8	11
36000	FUEL	LB	439	457	476	501	608	461	480	500	527	641
	DISTANCE	NM	30	31	33	35	49	32	33	35	37	52
	TIME	MIN	6	6	7	7	9	7	7	7	7	10
34000	FUEL	LB	407	423	441	464	559	426	444	463	487	588
	DISTANCE	NM	28	29	30	32	45	30	31	32	34	48
	TIME	MIN	6	6	6	6	9	6	6	6	7	9
32000	FUEL	LB	376	391	407	428	513	394	410	427	450	539
	DISTANCE	NM	26	27	28	30	41	27	28	30	32	44
	TIME	MIN	5	6	6	6	8	6	6	6	6	8
30000	FUEL	LB	346	361	375	395	469	363	378	393	414	493
	DISTANCE	NM	24	25	26	27	37	25	26	27	29	40
	TIME	MIN	5	5	5	5	7	5	5	5	6	8
28000	FUEL	LB	318	331	345	362	428	333	347	361	380	450
	DISTANCE	NM	22	22	23	25	34	23	24	25	27	36
	TIME	MIN	5	5	5	5	7	5	5	5	5	7

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 10%	INCREASE 10%	INCREASE 20%
DISTANCE	NA	INCREASE 10%	INCREASE 20%
TIME	NA	INCREASE 10%	INCREASE 20%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 21000 AND 22000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			21000 FT ISA + °C					22000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	801	835	870	931	1225	839	874	911	976	1291
	DISTANCE	NM	57	60	62	68	103	61	63	66	73	111
	TIME	MIN	12	12	12	13	19	12	13	13	14	21
48000	FUEL	LB	745	776	808	864	1116	779	812	846	905	1174
	DISTANCE	NM	53	55	58	63	94	56	59	61	67	100
	TIME	MIN	11	11	11	12	18	11	12	12	13	19
46000	FUEL	LB	696	725	755	801	1031	728	758	790	838	1084
	DISTANCE	NM	50	52	54	58	87	53	55	57	62	92
	TIME	MIN	10	10	11	11	16	11	11	11	12	17
44000	FUEL	LB	647	674	702	744	945	676	705	734	778	992
	DISTANCE	NM	46	48	50	54	79	49	51	53	57	84
	TIME	MIN	9	10	10	10	15	10	10	10	11	16
42000	FUEL	LB	602	627	653	691	867	629	655	682	723	909
	DISTANCE	NM	43	45	46	50	72	45	47	49	53	77
	TIME	MIN	9	9	9	10	14	9	9	10	10	14
40000	FUEL	LB	559	583	607	641	796	584	608	634	670	835
	DISTANCE	NM	40	41	43	46	66	42	44	46	49	70
	TIME	MIN	8	8	9	9	12	9	9	9	9	13
38000	FUEL	LB	519	541	564	595	732	542	565	588	622	766
	DISTANCE	NM	37	38	40	43	61	39	40	42	45	64
	TIME	MIN	8	8	8	8	11	8	8	8	9	12
36000	FUEL	LB	482	502	522	551	672	502	523	545	575	703
	DISTANCE	NM	34	35	37	40	56	36	37	39	42	59
	TIME	MIN	7	7	7	8	11	7	8	8	8	11
34000	FUEL	LB	446	464	483	510	616	465	484	504	532	645
	DISTANCE	NM	31	33	34	37	51	33	35	36	39	54
	TIME	MIN	7	7	7	7	10	7	7	7	8	10
32000	FUEL	LB	411	429	446	470	565	429	447	465	491	590
	DISTANCE	NM	29	30	31	34	46	31	32	33	36	49
	TIME	MIN	6	6	6	7	9	6	6	7	7	9
30000	FUEL	LB	379	395	411	433	516	395	411	428	451	539
	DISTANCE	NM	27	28	29	31	42	28	29	30	33	45
	TIME	MIN	6	6	6	6	8	6	6	6	6	8
28000	FUEL	LB	348	362	377	397	471	362	377	393	414	492
	DISTANCE	NM	24	25	26	28	38	26	27	28	30	41
	TIME	MIN	5	5	5	6	7	5	5	6	6	8

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 10%	INCREASE 10%	INCREASE 20%
DISTANCE	NA	INCREASE 10%	INCREASE 20%
TIME	NA	INCREASE 10%	INCREASE 20%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 23000 AND 24000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			23000 FT ISA + °C					24000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	877	913	952	1022	1358	915	953	994	1068	1426
	DISTANCE	NM	64	67	70	77	118	68	71	74	82	126
	TIME	MIN	13	13	14	15	22	14	14	14	15	23
48000	FUEL	LB	814	848	884	946	1234	849	884	922	988	1295
	DISTANCE	NM	60	62	65	71	107	63	66	69	75	114
	TIME	MIN	12	12	13	14	20	13	13	13	14	21
46000	FUEL	LB	759	791	824	876	1137	791	825	859	915	1191
	DISTANCE	NM	56	58	60	66	98	59	61	64	69	105
	TIME	MIN	11	12	12	13	18	12	12	12	13	19
44000	FUEL	LB	705	735	766	813	1039	735	766	798	848	1088
	DISTANCE	NM	52	54	56	61	90	54	57	59	64	95
	TIME	MIN	10	11	11	12	17	11	11	12	12	18
42000	FUEL	LB	655	683	711	754	952	682	711	741	786	995
	DISTANCE	NM	48	50	52	56	82	50	52	55	59	87
	TIME	MIN	10	10	10	11	15	10	10	11	11	16
40000	FUEL	LB	608	634	660	699	873	633	660	687	729	911
	DISTANCE	NM	44	46	48	52	75	47	49	51	55	79
	TIME	MIN	9	9	9	10	14	9	10	10	10	15
38000	FUEL	LB	564	588	613	648	801	587	611	637	675	835
	DISTANCE	NM	41	43	45	48	68	43	45	47	51	72
	TIME	MIN	8	9	9	9	13	9	9	9	10	13
36000	FUEL	LB	523	545	567	600	734	543	566	590	624	765
	DISTANCE	NM	38	39	41	44	62	40	42	43	47	66
	TIME	MIN	8	8	8	9	12	8	8	8	9	12
34000	FUEL	LB	483	504	525	554	673	502	523	545	576	701
	DISTANCE	NM	35	36	38	41	57	37	38	40	43	60
	TIME	MIN	7	7	7	8	11	7	8	8	8	11
32000	FUEL	LB	446	465	484	511	616	463	483	503	531	641
	DISTANCE	NM	32	34	35	38	52	34	35	37	40	55
	TIME	MIN	7	7	7	7	10	7	7	7	8	10
30000	FUEL	LB	411	428	446	470	562	426	444	463	488	585
	DISTANCE	NM	30	31	32	35	47	31	32	34	36	50
	TIME	MIN	6	6	6	7	9	6	6	7	7	9
28000	FUEL	LB	377	392	409	431	512	391	407	424	447	533
	DISTANCE	NM	27	28	29	32	43	28	30	31	33	45
	TIME	MIN	6	6	6	6	8	6	6	6	6	9

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 10%	INCREASE 10%	INCREASE 20%
DISTANCE	NA	INCREASE 10%	INCREASE 20%
TIME	NA	INCREASE 10%	INCREASE 20%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 25000 AND 26000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			25000 FT ISA + °C					26000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	956	994	1036	1114	1494	1000	1035	1079	1161	1562
	DISTANCE	NM	72	75	78	86	134	77	79	83	91	142
	TIME	MIN	14	15	15	16	24	15	16	16	17	26
48000	FUEL	LB	886	921	960	1031	1355	927	959	1000	1073	1415
	DISTANCE	NM	67	69	72	80	121	71	73	76	84	128
	TIME	MIN	13	14	14	15	22	14	14	15	16	23
46000	FUEL	LB	824	858	895	954	1246	857	893	931	992	1299
	DISTANCE	NM	62	65	67	73	111	65	68	71	77	117
	TIME	MIN	12	13	13	14	20	13	13	14	15	21
44000	FUEL	LB	764	797	830	884	1136	795	828	863	919	1184
	DISTANCE	NM	57	60	62	68	101	60	63	66	72	107
	TIME	MIN	12	12	12	13	19	12	12	13	14	20
42000	FUEL	LB	709	739	770	818	1038	737	768	800	851	1081
	DISTANCE	NM	53	55	58	63	92	56	58	61	66	97
	TIME	MIN	11	11	11	12	17	11	11	12	12	18
40000	FUEL	LB	658	685	714	758	950	683	712	742	787	988
	DISTANCE	NM	49	51	53	58	84	52	54	56	61	88
	TIME	MIN	10	10	10	11	15	10	11	11	12	16
38000	FUEL	LB	609	635	662	701	870	632	659	687	728	904
	DISTANCE	NM	45	47	49	53	76	48	50	52	56	80
	TIME	MIN	9	9	10	10	14	10	10	10	11	15
36000	FUEL	LB	564	588	613	649	796	585	610	635	673	827
	DISTANCE	NM	42	44	46	49	70	44	46	48	52	73
	TIME	MIN	8	9	9	9	13	9	9	9	10	14
34000	FUEL	LB	521	543	566	599	729	540	563	587	621	756
	DISTANCE	NM	39	40	42	45	64	41	42	44	48	67
	TIME	MIN	8	8	8	9	12	8	8	9	9	12
32000	FUEL	LB	481	501	522	551	666	498	519	541	571	691
	DISTANCE	NM	36	37	39	42	58	37	39	41	44	61
	TIME	MIN	7	7	8	8	11	8	8	8	8	11
30000	FUEL	LB	442	461	480	507	608	458	477	497	525	630
	DISTANCE	NM	33	34	35	38	53	34	36	37	40	55
	TIME	MIN	7	7	7	7	10	7	7	7	8	10
28000	FUEL	LB	405	422	440	464	553	419	437	455	481	573
	DISTANCE	NM	30	31	32	35	48	31	33	34	37	50
	TIME	MIN	6	6	6	7	9	6	6	7	7	9

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 10%	INCREASE 10%	INCREASE 20%
DISTANCE	NA	INCREASE 10%	INCREASE 20%
TIME	NA	INCREASE 10%	INCREASE 20%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 27000 AND 28000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			27000 FT ISA + °C					28000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	1046	1078	1124	1209	1629	1095	1124	1171	1258	1697
	DISTANCE	NM	81	84	87	96	150	86	89	93	102	158
	TIME	MIN	16	16	17	18	27	17	17	18	19	29
48000	FUEL	LB	969	998	1041	1116	1474	1012	1039	1083	1161	1533
	DISTANCE	NM	75	77	81	89	135	80	82	85	94	142
	TIME	MIN	15	15	15	17	25	16	16	16	17	26
46000	FUEL	LB	891	929	968	1031	1352	926	965	1006	1071	1404
	DISTANCE	NM	69	72	75	82	124	73	76	79	86	130
	TIME	MIN	14	14	14	15	23	14	15	15	16	24
44000	FUEL	LB	826	861	897	954	1231	857	894	932	990	1277
	DISTANCE	NM	64	66	69	75	112	67	70	73	79	118
	TIME	MIN	13	13	13	14	21	13	14	14	15	21
42000	FUEL	LB	765	797	831	883	1123	794	828	863	916	1164
	DISTANCE	NM	59	61	64	69	102	62	65	68	73	107
	TIME	MIN	12	12	12	13	19	12	13	13	14	20
40000	FUEL	LB	708	739	770	817	1025	735	766	798	846	1062
	DISTANCE	NM	54	57	59	64	93	57	60	62	67	97
	TIME	MIN	11	11	11	12	17	11	12	12	13	18
38000	FUEL	LB	656	683	712	755	937	679	708	738	782	970
	DISTANCE	NM	50	52	55	59	84	53	55	57	62	88
	TIME	MIN	10	10	11	11	16	11	11	11	12	16
36000	FUEL	LB	606	632	658	697	857	627	654	682	721	886
	DISTANCE	NM	46	48	50	54	77	49	51	53	57	80
	TIME	MIN	9	10	10	10	14	10	10	10	11	15
34000	FUEL	LB	559	583	608	643	783	579	603	629	665	809
	DISTANCE	NM	43	44	46	50	70	45	47	49	52	73
	TIME	MIN	9	9	9	9	13	9	9	9	10	13
32000	FUEL	LB	515	537	560	591	715	533	556	579	612	739
	DISTANCE	NM	39	41	43	46	64	41	43	45	48	67
	TIME	MIN	8	8	8	9	12	8	8	9	9	12
30000	FUEL	LB	473	494	514	543	651	489	510	532	561	673
	DISTANCE	NM	36	37	39	42	58	38	39	41	44	61
	TIME	MIN	7	7	8	8	11	8	8	8	8	11
28000	FUEL	LB	434	452	471	497	592	448	467	487	513	611
	DISTANCE	NM	33	34	36	38	52	34	36	37	40	55
	TIME	MIN	7	7	7	7	10	7	7	7	8	10

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 10%	INCREASE 10%	INCREASE 20%
DISTANCE	NA	INCREASE 10%	INCREASE 20%
TIME	NA	INCREASE 10%	INCREASE 20%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 29000 AND 30000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			29000 FT ISA + °C					30000 FT ISA + °C				
			-15	-10	0	10	20	-15	-10	0	10	20
50000	FUEL	LB	1146	1171	1221	1310	1767	1199	1219	1271	1364	1842
	DISTANCE	NM	92	94	98	108	167	98	99	104	114	177
	TIME	MIN	18	18	19	20	30	19	19	20	21	32
48000	FUEL	LB	1058	1081	1127	1207	1594	1104	1123	1171	1255	1658
	DISTANCE	NM	85	86	90	99	150	90	91	95	104	158
	TIME	MIN	17	17	17	18	27	18	18	18	19	29
46000	FUEL	LB	982	1019	1062	1133	1457	1019	1075	1118	1196	1512
	DISTANCE	NM	78	80	84	91	137	83	85	88	96	144
	TIME	MIN	15	16	16	17	25	16	16	17	18	26
44000	FUEL	LB	908	942	982	1046	1324	942	992	1032	1102	1372
	DISTANCE	NM	72	74	77	84	124	76	78	81	88	130
	TIME	MIN	14	14	15	16	22	15	15	15	16	24
42000	FUEL	LB	840	871	908	965	1206	870	916	953	1016	1248
	DISTANCE	NM	67	68	71	77	112	70	72	75	81	118
	TIME	MIN	13	13	14	14	20	14	14	14	15	21
40000	FUEL	LB	777	806	839	891	1100	804	846	880	937	1138
	DISTANCE	NM	61	63	66	71	102	65	66	69	75	107
	TIME	MIN	12	12	13	13	19	13	13	13	14	19
38000	FUEL	LB	718	744	775	823	1004	743	780	812	864	1038
	DISTANCE	NM	57	58	60	65	93	59	61	64	69	97
	TIME	MIN	11	11	12	12	17	12	12	12	13	18
36000	FUEL	LB	663	687	715	758	916	685	720	749	796	946
	DISTANCE	NM	52	53	56	60	84	55	56	58	63	88
	TIME	MIN	10	10	11	11	15	11	11	11	12	16
34000	FUEL	LB	611	633	659	698	836	631	662	690	732	863
	DISTANCE	NM	48	49	51	55	77	50	51	54	58	80
	TIME	MIN	10	10	10	10	14	10	10	10	11	15
32000	FUEL	LB	562	582	606	641	762	580	609	634	672	786
	DISTANCE	NM	44	45	47	50	70	46	47	49	53	73
	TIME	MIN	9	9	9	10	13	9	9	9	10	13
30000	FUEL	LB	516	534	556	588	694	532	558	581	615	716
	DISTANCE	NM	40	41	43	46	63	42	43	45	48	66
	TIME	MIN	8	8	8	9	12	8	8	9	9	12
28000	FUEL	LB	472	489	509	538	630	487	510	531	562	650
	DISTANCE	NM	37	38	39	42	57	38	39	41	44	60
	TIME	MIN	7	7	8	8	11	8	8	8	8	11

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 15%	INCREASE 15%	INCREASE 30%
DISTANCE	INCREASE 20%	INCREASE 20%	INCREASE 30%
TIME	INCREASE 20%	INCREASE 20%	INCREASE 30%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 31000 AND 32000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			31000 FT ISA + °C					32000 FT ISA + °C				
			-15	-10	0	10	20	-15	-10	0	10	20
50000	FUEL	LB	1253	1268	1322	1421	1925	1308	1319	1374	1482	2020
	DISTANCE	NM	104	105	110	121	188	110	111	116	128	201
	TIME	MIN	20	20	21	22	34	21	21	22	24	36
48000	FUEL	LB	1152	1167	1216	1304	1728	1201	1210	1262	1356	1804
	DISTANCE	NM	95	96	100	110	167	100	101	106	116	178
	TIME	MIN	18	19	19	20	30	19	20	20	22	32
46000	FUEL	LB	1057	1113	1158	1239	1571	1095	1152	1199	1284	1635
	DISTANCE	NM	87	89	93	101	151	91	94	98	106	160
	TIME	MIN	17	17	18	19	27	18	18	18	20	29
44000	FUEL	LB	975	1026	1068	1140	1423	1009	1060	1104	1180	1477
	DISTANCE	NM	80	82	85	93	136	84	86	90	97	144
	TIME	MIN	16	16	16	17	25	16	17	17	18	26
42000	FUEL	LB	900	947	985	1051	1293	931	977	1017	1086	1339
	DISTANCE	NM	74	75	79	85	123	77	79	82	89	130
	TIME	MIN	14	15	15	16	22	15	15	16	17	23
40000	FUEL	LB	831	873	909	968	1177	858	901	938	999	1217
	DISTANCE	NM	68	69	72	78	112	71	72	76	82	117
	TIME	MIN	13	13	14	15	20	14	14	14	15	21
38000	FUEL	LB	767	805	839	892	1072	792	830	864	920	1108
	DISTANCE	NM	62	64	66	72	101	65	67	69	75	106
	TIME	MIN	12	12	13	13	18	13	13	13	14	19
36000	FUEL	LB	707	742	773	821	977	729	765	796	846	1009
	DISTANCE	NM	57	59	61	66	92	60	61	64	69	96
	TIME	MIN	11	11	12	12	17	12	12	12	13	18
34000	FUEL	LB	651	683	711	754	891	671	703	732	777	919
	DISTANCE	NM	52	54	56	60	84	55	56	59	63	87
	TIME	MIN	10	10	11	11	15	11	11	11	12	16
32000	FUEL	LB	598	627	653	692	811	616	645	672	713	836
	DISTANCE	NM	48	49	51	55	76	50	51	54	58	79
	TIME	MIN	10	10	10	10	14	10	10	10	11	14
30000	FUEL	LB	549	575	598	634	737	565	591	615	652	759
	DISTANCE	NM	44	45	47	50	69	46	47	49	53	72
	TIME	MIN	9	9	9	9	13	9	9	9	10	13
28000	FUEL	LB	501	525	547	579	669	516	540	562	595	688
	DISTANCE	NM	40	41	43	46	62	42	43	45	48	65
	TIME	MIN	8	8	8	9	11	8	8	9	9	12

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 15%	INCREASE 15%	INCREASE 30%
DISTANCE	INCREASE 20%	INCREASE 20%	INCREASE 30%
TIME	INCREASE 20%	INCREASE 20%	INCREASE 30%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 33000 AND 34000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			33000 FT ISA + °C					34000 FT ISA + °C				
			-15	-10	0	10	20	-10	-5	0	10	20
50000	FUEL	LB	1367	1372	1430	1547	2127	1432	1460	1491	1618	2248
	DISTANCE	NM	117	117	122	136	215	125	127	130	145	232
	TIME	MIN	23	23	23	25	39	24	24	24	27	42
48000	FUEL	LB	1252	1256	1309	1411	1889	1307	1333	1361	1471	1980
	DISTANCE	NM	106	107	111	123	189	113	115	118	131	202
	TIME	MIN	21	21	21	23	34	22	22	22	24	36
46000	FUEL	LB	1134	1192	1240	1331	1703	1228	1260	1252	1340	1803
	DISTANCE	NM	96	98	102	112	170	104	106	108	118	180
	TIME	MIN	19	19	19	21	31	20	20	20	22	32
44000	FUEL	LB	1044	1096	1140	1221	1535	1127	1156	1150	1227	1617
	DISTANCE	NM	88	90	94	102	152	95	97	98	107	160
	TIME	MIN	17	17	18	19	27	18	19	19	20	29
42000	FUEL	LB	961	1009	1050	1122	1388	1036	1062	1058	1127	1457
	DISTANCE	NM	81	83	86	94	136	87	89	90	98	144
	TIME	MIN	16	16	16	17	25	17	17	17	18	26
40000	FUEL	LB	886	929	967	1032	1259	953	977	973	1035	1318
	DISTANCE	NM	74	76	79	86	123	80	81	83	90	129
	TIME	MIN	15	15	15	16	22	15	16	16	17	23
38000	FUEL	LB	816	855	891	949	1145	876	899	896	951	1196
	DISTANCE	NM	68	70	73	79	111	73	74	76	82	117
	TIME	MIN	13	14	14	15	20	14	14	14	15	21
36000	FUEL	LB	751	787	820	872	1041	806	826	824	874	1086
	DISTANCE	NM	62	64	67	72	101	67	68	69	75	105
	TIME	MIN	12	12	13	13	18	13	13	13	14	19
34000	FUEL	LB	691	723	753	800	947	740	759	757	802	986
	DISTANCE	NM	57	58	61	66	91	61	62	64	69	95
	TIME	MIN	11	11	12	12	17	12	12	12	13	17
32000	FUEL	LB	634	664	691	734	861	679	696	695	735	896
	DISTANCE	NM	52	53	56	60	83	56	57	58	63	86
	TIME	MIN	10	10	11	11	15	11	11	11	12	16
30000	FUEL	LB	581	608	633	671	782	621	637	636	672	812
	DISTANCE	NM	48	49	51	55	75	51	52	53	57	78
	TIME	MIN	9	10	10	10	14	10	10	10	11	14
28000	FUEL	LB	530	555	578	612	708	566	581	580	613	735
	DISTANCE	NM	43	44	46	50	68	46	47	48	52	70
	TIME	MIN	9	9	9	9	12	9	9	9	10	13

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 15%	INCREASE 15%	INCREASE 30%
DISTANCE	INCREASE 20%	INCREASE 20%	INCREASE 30%
TIME	INCREASE 20%	INCREASE 20%	INCREASE 30%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 35000 AND 36000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			35000 FT ISA + °C					36000 FT ISA + °C				
			-9	-5	0	10	20	-8	-5	0	10	20
50000	FUEL	LB	1507	1529	1561	1696	-	1596	1613	1645	1786	-
	DISTANCE	NM	134	136	138	155	-	145	146	149	167	-
	TIME	MIN	26	26	26	29	-	28	28	28	31	-
48000	FUEL	LB	1369	1390	1419	1535	2082	1440	1455	1485	1605	2198
	DISTANCE	NM	120	122	125	139	217	129	131	133	148	234
	TIME	MIN	23	23	24	26	39	25	25	25	27	42
46000	FUEL	LB	1276	1308	1301	1395	1913	1328	1361	1356	1455	2001
	DISTANCE	NM	110	112	114	125	191	117	119	121	133	204
	TIME	MIN	21	21	21	23	34	22	23	23	25	37
44000	FUEL	LB	1167	1197	1192	1274	1705	1212	1242	1238	1324	1773
	DISTANCE	NM	100	102	104	113	169	106	108	110	120	180
	TIME	MIN	19	19	20	21	31	20	21	21	22	32
42000	FUEL	LB	1071	1098	1094	1167	1530	1108	1136	1133	1209	1586
	DISTANCE	NM	91	93	95	103	151	96	98	100	109	159
	TIME	MIN	18	18	18	19	27	19	19	19	20	29
40000	FUEL	LB	983	1008	1005	1070	1380	1016	1041	1039	1107	1426
	DISTANCE	NM	83	85	87	94	136	88	89	91	99	142
	TIME	MIN	16	16	16	17	25	17	17	17	18	26
38000	FUEL	LB	903	926	924	982	1248	932	955	954	1014	1287
	DISTANCE	NM	76	78	79	86	122	80	82	83	90	128
	TIME	MIN	15	15	15	16	22	15	16	16	17	23
36000	FUEL	LB	830	851	849	901	1131	855	876	875	929	1165
	DISTANCE	NM	70	71	73	79	110	73	75	76	82	115
	TIME	MIN	14	14	14	15	20	14	14	14	15	21
34000	FUEL	LB	761	781	780	826	1026	783	803	803	851	1056
	DISTANCE	NM	64	65	66	72	100	67	68	69	75	104
	TIME	MIN	12	13	13	13	18	13	13	13	14	19
32000	FUEL	LB	698	715	715	757	931	717	735	735	779	956
	DISTANCE	NM	58	60	61	65	90	61	62	63	68	94
	TIME	MIN	11	11	12	12	16	12	12	12	13	17
30000	FUEL	LB	638	654	654	692	843	655	672	672	711	866
	DISTANCE	NM	53	54	55	60	81	55	57	58	62	85
	TIME	MIN	10	10	11	11	15	11	11	11	12	15
28000	FUEL	LB	582	596	596	630	762	597	612	613	647	782
	DISTANCE	NM	48	49	50	54	73	50	51	52	56	76
	TIME	MIN	9	10	10	10	13	10	10	10	11	14

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 15%	INCREASE 15%	INCREASE 30%
DISTANCE	INCREASE 20%	INCREASE 20%	INCREASE 30%
TIME	INCREASE 20%	INCREASE 20%	INCREASE 30%

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CLIMB PLANNING - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: SEA LEVEL TO 37000 FT

SPEED SCHEDULE : 240 KIAS UP TO 10000 FT, INCREASING LINEARLY TO 270 KIAS AT 12000 FT, MAINTAINING 270 KIAS UP TO 17400 FT AND M = 0.56 ABOVE 17400 FT
CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT LB			ISA + °C				
			-8	-5	0	10	20
	FUEL	LB	-	-	-	-	-
50000	DISTANCE	NM	-	-	-	-	-
	TIME	MIN	-	-	-	-	-
	FUEL	LB	1519	1539	1570	1693	-
48000	DISTANCE	NM	140	142	145	160	-
	TIME	MIN	27	27	27	29	-
	FUEL	LB	1393	1427	1422	1525	2112
46000	DISTANCE	NM	125	128	130	143	221
	TIME	MIN	24	24	25	26	40
	FUEL	LB	1263	1294	1291	1381	1855
44000	DISTANCE	NM	113	115	117	128	192
	TIME	MIN	22	22	22	24	35
	FUEL	LB	1151	1180	1178	1256	1650
42000	DISTANCE	NM	102	104	106	115	169
	TIME	MIN	20	20	20	21	31
	FUEL	LB	1052	1078	1077	1146	1478
40000	DISTANCE	NM	93	94	96	104	150
	TIME	MIN	18	18	18	19	27
	FUEL	LB	963	987	986	1048	1331
38000	DISTANCE	NM	84	86	87	95	134
	TIME	MIN	16	16	17	18	24
	FUEL	LB	882	904	903	959	1202
36000	DISTANCE	NM	77	78	80	86	121
	TIME	MIN	15	15	15	16	22
	FUEL	LB	807	827	827	877	1087
34000	DISTANCE	NM	70	71	73	79	109
	TIME	MIN	14	14	14	15	20
	FUEL	LB	738	756	757	801	984
32000	DISTANCE	NM	64	65	66	72	98
	TIME	MIN	12	13	13	13	18
	FUEL	LB	674	691	691	731	890
30000	DISTANCE	NM	58	59	60	65	88
	TIME	MIN	11	11	11	12	16
	FUEL	LB	614	629	630	665	803
28000	DISTANCE	NM	52	54	55	59	79
	TIME	MIN	10	10	10	11	14

ANTI ICE ON CORRECTIONS	BELOW ISA	ISA	ABOVE ISA
FUEL	INCREASE 15%	INCREASE 15%	INCREASE 30%
DISTANCE	INCREASE 20%	INCREASE 20%	INCREASE 30%
TIME	INCREASE 20%	INCREASE 20%	INCREASE 30%

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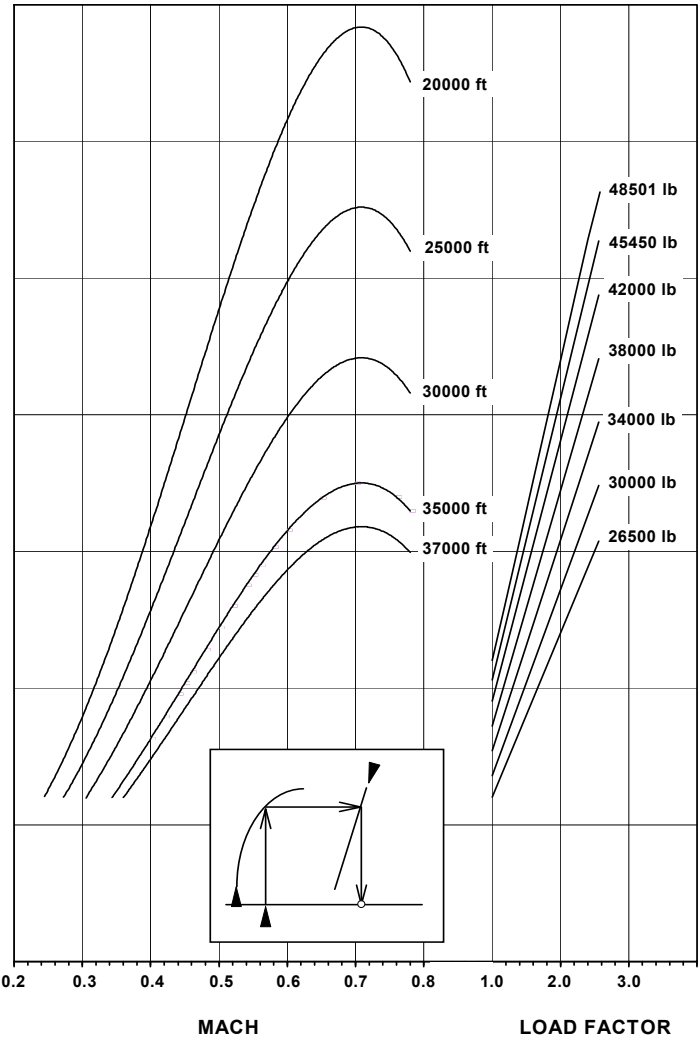
CRUISE

MANEUVER CAPABILITY

NOTE: The recommended cruise altitude must ensure a maneuver load factor of 1.3 g before buffet onset.



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CRUISE TABLES

The long range cruise and maximum speed cruise tables show N1, fuel flow, indicated airspeed, true airspeed, indicated Mach number, buffet margin and specific range. Data are presented for various weights ISA conditions and corrections for ISA deviation.

In the long range cruise schedule, all engines operating or one engine inoperative, the airplane is flown at a speed corresponding to a specific range equal to 99% of maximum specific range. It is used when range is the principal factor.

In the maximum speed schedule, the airplane is flown in a speed resulting from maximum cruise power setting. It is used when minimum flight time is desired.

Thrust selection in cruise condition is adjusted to CRZ mode. The climb to cruise transition should be made as follows:

- After reaching the cruise level, allow the airplane to accelerate past 0.60M, before selecting cruise mode.
- When in cruise mode, adjust thrust to keep N1 or cruise speed constant (whichever occurs first).

The associated conditions are:

- Flaps .....UP
- Gear .....UP
- Bleeds .....OPEN
- Anti-Ice .....OFF

NOTE: The corrections (N1, Fuel Flow and TAS) given in the Long Range Cruise and Maximum Speed Cruise tables are applicable only to ISA-15°C to ISA+15°C range.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE : 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
50000	N1	%	66.7	71.6	72.2	72.8	73.5	74.1	74.7	75.4	76.1	76.9
	Fuel Flow	LB/H/ENG	1285	1317	1308	1299	1291	1281	1274	1268	1263	1258
	IAS	KT	250	261	260	259	258	256	255	254	253	252
	TAS	KT	269	301	305	308	311	314	318	321	325	329
	INDICATED MACH		0.414	0.471	0.478	0.485	0.492	0.499	0.506	0.514	0.522	0.530
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.52
	SR	NM/LB	0.105	0.114	0.116	0.118	0.120	0.123	0.125	0.127	0.129	0.131
48000	N1	%	66.1	70.7	71.3	71.9	72.5	73.1	73.8	74.5	75.2	75.9
	Fuel Flow	LB/H/ENG	1259	1270	1259	1250	1242	1234	1226	1220	1215	1208
	IAS	KT	250	257	256	255	254	253	252	251	250	248
	TAS	KT	269	296	300	303	306	310	313	317	321	324
	INDICATED MACH		0.413	0.464	0.471	0.478	0.485	0.492	0.500	0.507	0.515	0.523
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.107	0.117	0.119	0.121	0.123	0.126	0.128	0.130	0.132	0.134
46000	N1	%	65.3	69.7	70.1	70.6	71.1	71.7	72.3	72.9	73.6	74.3
	F FLOW	LB/H/ENG	1232	1224	1213	1203	1194	1186	1178	1171	1165	1159
	IAS	KT	248	252	251	250	249	248	247	246	245	244
	TAS	KT	267	292	295	298	301	305	308	312	315	319
	INDICATED MACH		0.41	0.457	0.463	0.47	0.477	0.484	0.491	0.499	0.506	0.514
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.108	0.119	0.122	0.124	0.126	0.129	0.131	0.133	0.135	0.138
44000	N1	%	64.9	68.8	69.4	69.8	70.2	70.7	71.3	71.9	72.5	73.2
	F FLOW	LB/H/ENG	1214	1180	1169	1158	1147	1138	1130	1122	1115	1109
	IAS	KT	249	249	248	246	245	244	243	242	241	240
	TAS	KT	268	288	291	294	297	300	303	306	310	314
	INDICATED MACH		0.411	0.45	0.457	0.463	0.469	0.476	0.483	0.49	0.498	0.506
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.11	0.122	0.124	0.127	0.129	0.132	0.134	0.137	0.139	0.141

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.6 % AND FUEL FLOW BY 8%.
DECREASE SR BY 9%.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE : 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
	N1	%	64.6	67.8	68.4	69	69.4	69.9	70.4	70.9	71.5	72.1
	F FLOW	LB/H/ENG	1196	1133	1122	1112	1102	1093	1084	1076	1068	1061
	IAS	KT	250	245	243	242	241	240	239	238	237	236
42000	TAS	KT	268	283	285	289	292	295	298	301	305	308
	INDICATED MACH		0.413	0.443	0.449	0.455	0.462	0.469	0.476	0.483	0.49	0.498
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.112	0.125	0.127	0.13	0.132	0.135	0.138	0.14	0.143	0.145
	N1	%	63.7	66.7	67.3	67.9	68.5	69	69.4	70	70.5	71.1
	F FLOW	LB/H/ENG	1158	1090	1078	1066	1056	1046	1037	1029	1021	1013
	IAS	KT	247	241	239	238	237	236	235	234	233	232
40000	TAS	KT	265	278	281	283	286	289	293	296	299	303
	INDICATED MACH		0.408	0.436	0.442	0.448	0.454	0.461	0.468	0.475	0.482	0.489
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.114	0.127	0.13	0.133	0.136	0.138	0.141	0.144	0.147	0.149
	N1	%	62.5	65.6	66.2	66.8	67.4	68	68.5	69	69.5	70
	F FLOW	LB/H/ENG	1116	1046	1035	1023	1012	1002	992	983	974	967
	IAS	KT	243	237	235	234	233	232	231	230	229	228
38000	TAS	KT	260	273	276	279	281	284	287	290	294	297
	INDICATED MACH		0.401	0.428	0.434	0.44	0.447	0.453	0.459	0.466	0.473	0.48
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.117	0.13	0.133	0.136	0.139	0.142	0.145	0.148	0.151	0.154
	N1	%	61.4	64.4	65	65.6	66.2	66.9	67.5	68.1	68.5	69
	F FLOW	LB/H/ENG	1075	1002	990	978	968	957	947	938	930	921
	IAS	KT	239	232	231	230	229	228	227	226	225	223
36000	TAS	KT	256	268	270	273	276	279	282	285	288	291
	INDICATED MACH		0.395	0.42	0.426	0.432	0.438	0.445	0.451	0.458	0.465	0.472
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.119	0.134	0.137	0.14	0.143	0.146	0.149	0.152	0.155	0.158

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.6 % AND FUEL FLOW BY 8%.
DECREASE SR BY 9%.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE : 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
34000	N1	%	60.1	63.2	63.8	64.4	65	65.6	66.2	66.9	67.5	68
	F FLOW	LB/H/ENG	1032	961	948	935	924	913	903	893	884	876
	IAS	KT	234	228	227	225	224	223	222	221	220	219
	TAS	KT	251	263	265	268	270	273	276	279	282	285
	INDICATED MACH		0.387	0.413	0.418	0.424	0.43	0.436	0.442	0.449	0.455	0.462
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.121	0.137	0.14	0.143	0.146	0.15	0.153	0.156	0.159	0.163
31000	N1	%	58.3	61.2	61.8	62.4	63	63.6	64.3	64.9	65.5	66.2
	F FLOW	LB/H/ENG	971	898	884	872	860	849	839	828	819	809
	IAS	KT	228	221	220	219	217	216	215	214	213	212
	TAS	KT	243	255	257	259	262	264	267	270	273	276
	INDICATED MACH		0.377	0.401	0.406	0.411	0.417	0.423	0.429	0.435	0.441	0.448
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.125	0.142	0.145	0.149	0.152	0.156	0.159	0.163	0.167	0.17
28000	N1	%	56.3	59	59.6	60.2	60.9	61.5	62.1	62.7	63.4	64
	F FLOW	LB/H/ENG	911	836	823	810	798	786	775	765	755	745
	IAS	KT	221	214	213	211	210	209	208	207	206	205
	TAS	KT	236	246	248	250	253	255	258	261	263	266
	INDICATED MACH		0.365	0.388	0.393	0.398	0.403	0.409	0.415	0.42	0.426	0.433
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.129	0.147	0.151	0.155	0.159	0.162	0.166	0.17	0.174	0.178

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.6 % AND FUEL FLOW BY 8%.
DECREASE SR BY 9%.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE : 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)									
		19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
50000	N1 %	77.7	78.5	79.3	80.1	80.8	81.5	82.1	82.8	83.5	84.2
	F FLOW LB/H/ENG	1255	1252	1252	1246	1246	1243	1243	1244	1245	1248
	IAS KT	251	250	250	249	249	248	248	248	249	249
	TAS KT	333	337	341	345	351	356	362	368	374	380
	INDICATED MACH	0.539	0.548	0.557	0.566	0.577	0.588	0.600	0.612	0.625	0.638
	BUFFET MARGIN G	2.47	2.43	2.38	2.33	2.29	2.24	2.20	2.15	2.10	2.04
	SR NM/LB	0.133	0.135	0.136	0.139	0.141	0.143	0.145	0.148	0.150	0.152
48000	N1 %	76.6	77.4	78.2	79.0	79.8	80.5	81.2	81.9	82.6	83.2
	F FLOW LB/H/ENG	1203	1200	1199	1195	1192	1189	1189	1189	1190	1192
	IAS KT	247	247	246	245	244	244	244	244	244	244
	TAS KT	328	332	336	340	344	349	355	361	367	373
	INDICATED MACH	0.531	0.540	0.549	0.557	0.567	0.578	0.589	0.601	0.614	0.627
	BUFFET MARGIN G	2.51	2.47	2.43	2.38	2.33	2.28	2.24	2.19	2.14	2.09
	SR NM/LB	0.136	0.138	0.140	0.142	0.144	0.147	0.149	0.152	0.154	0.157
46000	N1 %	75	75.8	76.7	77.6	78.4	79.2	80	80.6	81.2	81.9
	F FLOW LB/H/ENG	1154	1150	1146	1144	1141	1138	1136	1135	1135	1135
	IAS KT	243	242	241	240	239	239	238	238	238	238
	TAS KT	323	326	330	334	339	343	348	354	359	365
	INDICATED MACH	0.522	0.53	0.539	0.548	0.557	0.566	0.577	0.589	0.601	0.613
	BUFFET MARGIN G	2.56	2.52	2.47	2.42	2.38	2.33	2.28	2.24	2.19	2.14
	SR NM/LB	0.14	0.142	0.144	0.146	0.148	0.151	0.153	0.156	0.158	0.161
44000	N1 %	73.9	74.7	75.5	76.3	77.2	78.1	78.9	79.6	80.3	80.9
	F FLOW LB/H/ENG	1104	1099	1095	1091	1089	1088	1084	1082	1081	1081
	IAS KT	239	238	237	236	235	235	234	234	233	233
	TAS KT	317	321	325	329	333	337	341	347	352	358
	INDICATED MACH	0.514	0.522	0.53	0.539	0.548	0.557	0.566	0.577	0.589	0.601
	BUFFET MARGIN G	2.56	2.56	2.52	2.47	2.43	2.38	2.33	2.28	2.24	2.19
	SR NM/LB	0.144	0.146	0.148	0.151	0.153	0.155	0.157	0.16	0.163	0.166

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.6 % AND FUEL FLOW BY 8%.
DECREASE SR BY 9%.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE : 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
	N1	%	72.8	73.5	74.3	75.1	75.9	76.8	77.7	78.5	79.2	79.9
	F FLOW	LB/H/ENG	1055	1049	1045	1041	1038	1035	1034	1029	1028	1027
	IAS	KT	235	234	233	232	231	231	230	229	228	228
42000	TAS	KT	312	315	319	323	327	331	335	339	345	350
	INDICATED	MACH	0.505	0.513	0.521	0.53	0.539	0.548	0.557	0.566	0.577	0.589
	BUFFET MARGIN	G	2.56	2.56	2.56	2.52	2.48	2.43	2.38	2.33	2.28	2.24
	SR	NM/LB	0.148	0.15	0.153	0.155	0.158	0.16	0.162	0.165	0.168	0.17
	N1	%	71.7	72.4	73.1	73.9	74.7	75.5	76.4	77.3	78	78.8
	F FLOW	LB/H/ENG	1007	1001	996	992	988	985	983	979	976	975
	IAS	KT	231	230	229	228	227	226	226	224	223	223
40000	TAS	KT	306	310	313	317	321	325	329	333	337	343
	INDICATED	MACH	0.497	0.504	0.512	0.521	0.529	0.538	0.547	0.556	0.565	0.577
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.53	2.49	2.44	2.38	2.33	2.29
	SR	NM/LB	0.152	0.155	0.157	0.16	0.163	0.165	0.168	0.17	0.173	0.176
	N1	%	70.6	71.2	71.9	72.6	73.3	74.1	75	75.9	76.8	77.6
	F FLOW	LB/H/ENG	960	953	947	942	937	933	930	928	926	924
	IAS	KT	227	226	225	224	223	222	221	220	219	218
38000	TAS	KT	300	304	307	311	315	318	322	327	331	335
	INDICATED	MACH	0.488	0.495	0.503	0.511	0.519	0.528	0.537	0.546	0.555	0.564
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.54	2.49	2.44	2.39	2.34
	SR	NM/LB	0.156	0.159	0.162	0.165	0.168	0.171	0.173	0.176	0.179	0.181
	N1	%	69.5	70.1	70.7	71.4	72.1	72.8	73.6	74.4	75.3	76.2
	F FLOW	LB/H/ENG	914	907	900	895	890	885	881	878	875	873
	IAS	KT	222	221	220	219	219	218	217	216	215	214
36000	TAS	KT	294	298	301	305	309	312	316	320	324	328
	INDICATED	MACH	0.479	0.486	0.494	0.502	0.51	0.518	0.527	0.535	0.544	0.554
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.55	2.5	2.45	2.4
	SR	NM/LB	0.161	0.164	0.167	0.17	0.173	0.176	0.179	0.182	0.185	0.188

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.6 % AND FUEL FLOW BY 8%.
DECREASE SR BY 9%.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE : 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)									
		19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
	N1 %	68.4	69	69.5	70.1	70.8	71.5	72.2	73	73.8	74.7
	F FLOW LB/H/ENG	868	860	854	848	842	838	833	830	825	822
	IAS KT	218	217	216	215	214	213	212	211	210	209
34000	TAS KT	288	292	295	298	302	306	310	313	317	321
	INDICATED MACH	0.469	0.476	0.484	0.492	0.500	0.508	0.516	0.525	0.533	0.542
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.52	2.47
	SR NM/LB	0.166	0.169	0.173	0.176	0.179	0.183	0.186	0.189	0.192	0.195
	N1 %	66.8	67.3	67.8	68.3	68.9	69.5	70.1	70.8	71.5	72.3
	F FLOW LB/H/ENG	801	793	786	780	773	768	763	758	752	748
	IAS KT	211	210	209	208	207	206	205	204	203	202
31000	TAS KT	279	282	285	289	292	296	299	303	306	310
	INDICATED MACH	0.454	0.461	0.469	0.476	0.484	0.492	0.500	0.508	0.515	0.524
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.174	0.178	0.181	0.185	0.189	0.192	0.196	0.200	0.203	0.207
	N1 %	64.6	65.3	66	66.5	67	67.5	68.1	68.6	69.2	69.9
	F FLOW LB/H/ENG	737	729	721	713	706	700	694	688	682	677
	IAS KT	203	202	202	200	199	199	198	197	195	194
28000	TAS KT	269	272	275	278	281	285	288	291	294	298
	INDICATED MACH	0.439	0.446	0.453	0.46	0.467	0.474	0.482	0.489	0.497	0.505
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.183	0.187	0.191	0.195	0.199	0.203	0.208	0.212	0.216	0.220

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.6 % AND FUEL FLOW BY 8%.
DECREASE SR BY 9%.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE : 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)								
		29000	30000	31000	32000	33000	34000	35000	36000	37000
	N1 %	84.9	85.6	86.3	87.1	88.2	89.3	90.2	90.7	91.2
	F FLOW LB/H/ENG	1251	1255	1261	1268	1275	1284	1293	1314	1214
	IAS KT	249	250	250	251	252	253	255	258	237
50000	TAS KT	387	394	401	409	417	426	435	448	424
	INDICATED MACH	0.652	0.667	0.683	0.699	0.716	0.734	0.754	0.779	0.738
	BUFFET MARGIN G	1.98	1.92	1.85	1.78	1.70	1.61	1.51	1.39	1.39
	SR NM/LB	0.155	0.157	0.159	0.161	0.164	0.166	0.168	0.170	0.174
	N1 %	83.9	84.6	85.3	86.1	86.9	88.0	89.1	90.0	91.0
	F FLOW LB/H/ENG	1194	1197	1202	1207	1212	1221	1229	1238	1233
	IAS KT	244	245	245	246	246	248	249	250	248
48000	TAS KT	379	386	393	401	408	417	426	435	440
	INDICATED MACH	0.641	0.655	0.670	0.685	0.701	0.720	0.738	0.757	0.767
	BUFFET MARGIN G	2.04	1.98	1.91	1.84	1.77	1.68	1.59	1.49	1.41
	SR NM/LB	0.159	0.161	0.164	0.166	0.168	0.171	0.173	0.176	0.178
	N1 %	82.7	83.4	84.2	84.8	85.4	86.2	87.1	88.5	90.1
	F FLOW LB/H/ENG	1137	1139	1143	1148	1152	1158	1165	1174	1188
	IAS KT	239	239	239	240	240	241	242	243	245
46000	TAS KT	371	378	385	392	399	407	416	424	436
	INDICATED MACH	0.627	0.64	0.655	0.67	0.685	0.702	0.72	0.738	0.759
	BUFFET MARGIN G	2.09	2.03	1.97	1.91	1.84	1.76	1.68	1.58	1.48
	SR NM/LB	0.163	0.166	0.168	0.171	0.173	0.176	0.178	0.181	0.183
	N1 %	81.6	82.3	83.1	83.8	84.5	85.1	85.9	86.9	88.6
	F FLOW LB/H/ENG	1082	1084	1086	1088	1092	1097	1103	1111	1124
	IAS KT	234	234	234	234	235	235	236	237	239
44000	TAS KT	364	370	377	383	391	398	406	415	425
	INDICATED MACH	0.614	0.628	0.641	0.656	0.671	0.687	0.704	0.722	0.741
	BUFFET MARGIN G	2.14	2.09	2.03	1.97	1.9	1.83	1.76	1.67	1.58
	SR NM/LB	0.168	0.171	0.173	0.176	0.179	0.181	0.184	0.187	0.189

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.6 % AND FUEL FLOW BY 8%.
DECREASE SR BY 9%.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE : 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)								
		29000	30000	31000	32000	33000	34000	35000	36000	37000
42000	N1 %	80.5	81.2	82	82.8	83.5	84.1	84.8	85.6	86.9
	F FLOW LB/H/ENG	1027	1029	1031	1032	1035	1039	1044	1050	1061
	IAS KT	229	229	229	229	229	230	231	232	232
	TAS KT	356	362	369	375	382	389	397	405	415
	INDICATED MACH	0.602	0.615	0.628	0.642	0.657	0.672	0.688	0.706	0.724
	BUFFET MARGIN G	2.19	2.14	2.09	2.03	1.97	1.9	1.83	1.75	1.67
	SR NM/LB	0.173	0.176	0.179	0.182	0.185	0.187	0.19	0.193	0.196
40000	N1 %	79.5	80.2	80.8	81.6	82.4	83.1	83.7	84.4	85.5
	F FLOW LB/H/ENG	975	975	976	977	979	982	986	991	1000
	IAS KT	223	224	224	224	224	225	225	226	226
	TAS KT	348	354	360	367	373	380	388	395	405
	INDICATED MACH	0.589	0.602	0.615	0.628	0.642	0.657	0.673	0.689	0.706
	BUFFET MARGIN G	2.25	2.2	2.15	2.09	2.04	1.97	1.91	1.83	1.75
	SR NM/LB	0.179	0.182	0.185	0.188	0.191	0.194	0.197	0.199	0.202
38000	N1 %	78.4	79.1	79.7	80.4	81.1	81.9	82.7	83.3	84.3
	F FLOW LB/H/ENG	923	922	922	922	923	925	928	931	939
	IAS KT	218	218	218	218	218	219	219	219	220
	TAS KT	341	346	352	358	364	371	378	385	394
	INDICATED MACH	0.576	0.588	0.601	0.614	0.627	0.641	0.656	0.672	0.688
	BUFFET MARGIN G	2.30	2.25	2.2	2.15	2.1	2.04	1.98	1.91	1.84
	SR NM/LB	0.184	0.188	0.191	0.194	0.197	0.200	0.204	0.207	0.21
36000	N1 %	77	77.8	78.5	79.2	79.8	80.6	81.4	82.1	83.1
	F FLOW LB/H/ENG	870	869	868	867	868	869	871	873	880
	IAS KT	213	213	213	213	213	213	213	213	214
	TAS KT	332	337	343	349	355	361	368	374	383
	INDICATED MACH	0.562	0.574	0.586	0.598	0.611	0.625	0.639	0.654	0.67
	BUFFET MARGIN G	2.35	2.3	2.26	2.21	2.16	2.11	2.05	1.99	1.92
	SR NM/LB	0.191	0.194	0.198	0.201	0.204	0.208	0.211	0.214	0.218

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.6 % AND FUEL FLOW BY 8%.
DECREASE SR BY 9%.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE : 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)								
			29000	30000	31000	32000	33000	34000	35000	36000	37000
34000	N1	%	75.6	76.4	77.2	78	78.6	79.3	80	80.8	81.9
	F FLOW	LB/H/ENG	820	819	816	815	814	815	815	817	823
	IAS	KT	209	208	207	207	207	207	207	207	208
	TAS	KT	325	329	334	339	345	351	358	364	372
	INDICATED MACH		0.552	0.561	0.571	0.583	0.596	0.609	0.623	0.637	0.652
	BUFFET MARGIN	G	2.42	2.37	2.31	2.27	2.22	2.17	2.12	2.06	2.00
	SR	NM/LB	0.198	0.201	0.205	0.208	0.212	0.216	0.219	0.223	0.226
31000	N1	%	73.1	74	74.9	75.8	76.6	77.4	78	78.7	79.7
	F FLOW	LB/H/ENG	745	743	741	740	738	737	737	738	742
	IAS	KT	201	200	200	199	198	198	198	198	199
	TAS	KT	314	318	322	327	331	337	343	349	357
	INDICATED MACH		0.533	0.542	0.552	0.562	0.573	0.585	0.598	0.612	0.626
	BUFFET MARGIN	G	2.52	2.47	2.42	2.37	2.32	2.27	2.22	2.17	2.12
	SR	NM/LB	0.21	0.214	0.217	0.221	0.224	0.229	0.233	0.237	0.241
28000	N1	%	70.7	71.4	72.3	73.2	74.1	75	75.8	76.5	77.5
	F FLOW	LB/H/ENG	673	670	668	666	665	664	661	660	662
	IAS	KT	194	193	192	191	191	190	189	189	189
	TAS	KT	302	306	310	314	319	323	327	333	340
	INDICATED MACH		0.513	0.522	0.532	0.541	0.552	0.562	0.572	0.584	0.597
	BUFFET MARGIN	G	2.56	2.56	2.53	2.48	2.43	2.38	2.33	2.28	2.23
	SR	NM/LB	0.224	0.228	0.232	0.236	0.24	0.243	0.248	0.252	0.257

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.6 % AND FUEL FLOW BY 8%.
DECREASE SR BY 9%.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

PRESSURE ALTITUDE: 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)									
		5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
50000	N1 %	66.7	78.1	78.9	79.8	80.5	81.3	82.2	83.0	83.7	84.4
	F FLOW LB/H/ENG	1285	1776	1776	1777	1778	1781	1784	1788	1793	1799
	IAS KT	250	318	318	318	318	318	318	318	318	318
	TAS KT	269	368	373	379	384	390	395	401	407	413
	INDICATED MACH	0.414	0.574	0.584	0.595	0.606	0.617	0.628	0.640	0.652	0.664
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.105	0.104	0.105	0.106	0.108	0.109	0.111	0.112	0.114	0.115
48000	N1 %	66.1	77.7	78.5	79.4	80.2	81.0	81.8	82.7	83.4	84.1
	F FLOW LB/H/ENG	1259	1756	1755	1755	1757	1759	1761	1765	1769	1774
	IAS KT	250	319	319	319	319	319	319	319	319	319
	TAS KT	269	368	373	379	384	390	395	401	407	413
	INDICATED MACH	0.413	0.575	0.585	0.596	0.607	0.618	0.629	0.641	0.653	0.665
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.107	0.105	0.106	0.108	0.109	0.111	0.112	0.114	0.115	0.116
46000	N1 %	65.7	77.4	78.2	79	79.8	80.7	81.6	83.3	83.2	83.9
	F FLOW LB/H/ENG	1240	1747	1746	1746	1747	1748	1751	1771	1758	1762
	IAS KT	250	320	320	320	320	320	320	320	320	320
	TAS KT	269	369	374	380	385	391	397	406	408	414
	INDICATED MACH	0.413	0.576	0.587	0.598	0.608	0.62	0.631	0.643	0.655	0.667
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.108	0.106	0.107	0.109	0.11	0.112	0.113	0.115	0.116	0.118
44000	N1 %	65.2	77	77.8	78.6	79.4	80.3	81.2	82.8	82.8	83.6
	F FLOW LB/H/ENG	1218	1722	1721	1721	1721	1722	1724	1743	1730	1734
	IAS KT	250	320	320	320	320	320	320	320	320	320
	TAS KT	269	369	374	379	385	390	396	406	408	414
	INDICATED MACH	0.413	0.576	0.587	0.598	0.608	0.62	0.631	0.643	0.655	0.667
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.110	0.107	0.109	0.110	0.112	0.113	0.115	0.116	0.118	0.119

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW STD ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW STD ISA CONDITIONS.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

PRESSURE ALTITUDE: 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITIONS

WEIGHT (LB)		ALTITUDE (FT)									
		5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
42000	N1 %	64.6	76.7	77.4	78.2	79	79.8	80.7	82.4	82.4	83.1
	F FLOW LB/H/ENG	1197	1699	1697	1696	1696	1696	1697	1716	1702	1706
	IAS KT	250	320	320	320	320	320	320	320	320	320
	TAS KT	268	368	373	379	384	390	395	405	407	413
	INDICATED MACH	0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.112	0.108	0.110	0.112	0.113	0.115	0.116	0.118	0.120	0.121
40000	N1 %	64.1	76.3	77	77.8	78.6	79.4	80.3	81.9	81.9	82.7
	F FLOW LB/H/ENG	1177	1675	1673	1672	1671	1671	1672	1689	1675	1678
	IAS KT	250	320	320	320	320	320	320	320	320	320
	TAS KT	268	367	373	378	384	389	395	404	406	412
	INDICATED MACH	0.413	0.576	0.587	0.598	0.608	0.62	0.631	0.643	0.655	0.667
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.114	0.110	0.111	0.113	0.115	0.116	0.118	0.12	0.121	0.123
38000	N1 %	63.6	76.0	76.7	77.4	78.2	79.0	79.8	80.7	81.5	82.3
	F FLOW LB/H/ENG	1157	1653	1650	1648	1647	1647	1647	1648	1650	1652
	IAS KT	250	320	320	320	320	320	320	320	320	320
	TAS KT	268	367	372	377	383	389	394	400	406	412
	INDICATED MACH	0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.116	0.111	0.113	0.115	0.116	0.118	0.120	0.121	0.123	0.125
36000	N1 %	63.1	75.6	76.3	77.0	77.8	78.6	79.4	80.3	81.1	81.9
	F FLOW LB/H/ENG	1138	1631	1628	1626	1624	1623	1623	1623	1624	1626
	IAS KT	250	320	320	320	320	320	320	320	320	320
	TAS KT	268	366	372	377	382	388	394	399	405	411
	INDICATED MACH	0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.118	0.112	0.114	0.116	0.118	0.120	0.121	0.123	0.125	0.126

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW STD ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW STD ISA CONDITIONS.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

PRESSURE ALTITUDE: 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITIONS

WEIGHT (LB)			ALTITUDE (FT)									
			5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
34000	N1	%	62.5	75.3	76.0	76.7	77.4	78.2	79.0	79.8	80.7	81.5
	F FLOW	LB/H/ENG	1119	1610	1606	1604	1602	1600	1599	1599	1600	1601
	IAS	KT	250	320	320	320	320	320	320	320	320	320
	TAS	KT	267	366	371	376	382	387	393	399	405	411
	INDICATED MACH		0.413	0.576	0.587	0.598	0.608	0.62	0.631	0.643	0.655	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.119	0.114	0.116	0.117	0.119	0.121	0.123	0.125	0.126	0.128
31000	N1	%	61.8	74.8	75.4	76.1	76.8	77.6	78.4	79.2	80.0	80.8
	F FLOW	LB/H/ENG	1093	1578	1574	1571	1568	1566	1564	1563	1563	1563
	IAS	KT	250	320	320	320	320	320	320	320	320	320
	TAS	KT	267	365	370	375	381	386	392	398	404	410
	INDICATED MACH		0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.122	0.116	0.118	0.120	0.121	0.123	0.125	0.127	0.129	0.131
28000	N1	%	61.0	74.3	74.9	75.6	76.3	77.0	77.7	78.5	79.3	80.2
	F FLOW	LB/H/ENG	1068	1547	1542	1538	1535	1532	1530	1528	1527	1526
	IAS	KT	250	320	320	320	320	320	320	320	320	320
	TAS	KT	266	364	369	375	380	386	391	397	403	409
	INDICATED MACH		0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.125	0.118	0.120	0.122	0.124	0.126	0.128	0.130	0.132	0.134

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW STD ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW STD ISA CONDITIONS.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

PRESSURE ALTITUDE: 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITIONS

WEIGHT (LB)		ALTITUDE (FT)									
		19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
50000	N1 %	85.2	85.9	86.5	86.8	87.1	87.4	87.6	87.9	87.9	87.9
	F FLOW LB/H/ENG	1806	1813	1816	1789	1762	1733	1709	1685	1632	1579
	IAS KT	318	318	317	314	312	309	307	305	299	293
	TAS KT	419	425	430	433	436	439	442	446	445	444
	INDICATED MACH	0.676	0.689	0.700	0.707	0.716	0.723	0.732	0.742	0.743	0.745
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.44	2.32	2.21	2.11
	SR NM/LB	0.116	0.117	0.118	0.121	0.124	0.127	0.129	0.132	0.136	0.141
48000	N1 %	84.9	85.6	86.2	86.8	87.1	87.3	87.6	87.9	87.9	87.9
	F FLOW LB/H/ENG	1780	1787	1795	1794	1763	1735	1711	1688	1635	1581
	IAS KT	319	319	319	318	314	312	309	307	302	296
	TAS KT	419	425	432	437	438	441	445	449	449	447
	INDICATED MACH	0.677	0.690	0.703	0.715	0.719	0.728	0.738	0.747	0.751	0.750
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.53	2.40	2.29	2.19
	SR NM/LB	0.118	0.119	0.120	0.122	0.124	0.127	0.130	0.133	0.137	0.141
46000	N1 %	84.5	85.2	85.9	86.6	87	87.3	87.6	87.9	87.9	87.9
	F FLOW LB/H/ENG	1768	1774	1781	1789	1765	1738	1714	1691	1638	1585
	IAS KT	320	320	320	320	317	314	311	309	304	299
	TAS KT	421	427	433	440	442	444	448	452	452	451
	INDICATED MACH	0.68	0.692	0.706	0.719	0.726	0.733	0.742	0.752	0.755	0.757
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.48	2.36	2.25
	SR NM/LB	0.119	0.120	0.122	0.123	0.125	0.128	0.131	0.134	0.138	0.142
44000	N1 %	84.2	84.8	85.5	86.2	87	87.3	87.6	87.9	87.9	87.9
	F FLOW LB/H/ENG	1738	1744	1750	1757	1765	1740	1715	1693	1640	1587
	IAS KT	320	320	320	320	320	317	314	311	306	301
	TAS KT	420	426	432	439	445	448	450	454	454	454
	INDICATED MACH	0.680	0.692	0.706	0.719	0.733	0.740	0.747	0.756	0.760	0.762
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.46	2.35
	SR NM/LB	0.121	0.122	0.124	0.125	0.126	0.129	0.131	0.134	0.139	0.143

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW STD ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW STD ISA CONDITIONS.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

PRESSURE ALTITUDE: 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT (LB)			ALTITUDE (FT)									
			19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
42000	N1	%	83.8	84.4	85.1	85.8	86.5	87.3	87.6	87.9	87.9	87.8
	F FLOW	LB/H/ENG	1710	1715	1720	1727	1734	1741	1717	1695	1641	1589
	IAS	KT	320	320	320	320	320	320	317	313	309	303
	TAS	KT	419	425	432	438	445	452	454	456	457	456
	INDICATED	MACH	0.680	0.692	0.706	0.719	0.733	0.747	0.754	0.761	0.765	0.767
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.44
	SR	NM/LB	0.123	0.124	0.126	0.127	0.128	0.13	0.132	0.135	0.139	0.143
40000	N1	%	83.5	84.1	84.7	85.4	86.1	86.9	87.6	87.9	87.8	87.8
	F FLOW	LB/H/ENG	1682	1686	1691	1697	1703	1710	1717	1698	1643	1590
	IAS	KT	320	320	320	320	320	320	320	317	311	305
	TAS	KT	419	425	431	438	444	451	458	460	459	458
	INDICATED	MACH	0.68	0.692	0.706	0.719	0.733	0.747	0.761	0.769	0.770	0.772
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.55
	SR	NM/LB	0.124	0.126	0.127	0.129	0.13	0.132	0.133	0.135	0.14	0.144
38000	N1	%	83.1	83.7	84.3	85	85.7	86.4	87.2	87.8	87.8	87.8
	F FLOW	LB/H/ENG	1655	1658	1663	1668	1673	1679	1686	1693	1646	1592
	IAS	KT	320	320	320	320	320	320	320	320	314	307
	TAS	KT	418	424	431	437	444	450	457	464	463	461
	INDICATED	MACH	0.68	0.692	0.706	0.719	0.733	0.747	0.761	0.776	0.778	0.777
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.126	0.128	0.129	0.131	0.133	0.134	0.136	0.137	0.141	0.145
36000	N1	%	82.7	83.4	84	84.6	85.2	86	86.7	87.4	87.5	87.5
	F FLOW	LB/ /ENG	1628	1631	1635	1639	1644	1649	1655	1662	1621	1565
	IAS	KT	320	320	320	320	320	320	320	320	315	309
	TAS	KT	417	424	430	436	443	450	456	463	464	462
	INDICATED	MACH	0.68	0.692	0.706	0.719	0.733	0.747	0.761	0.776	0.78	0.78
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.128	0.13	0.131	0.133	0.135	0.136	0.138	0.139	0.143	0.148

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW STD ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW STD ISA CONDITIONS.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

PRESSURE ALTITUDE: 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT (LB)			ALTITUDE (FT)									
			19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
	N1	%	82.3	83	83.6	84.2	84.8	85.5	86.3	87	87.1	87
	F FLOW	LB/ /ENG	1603	1605	1608	1611	1616	1620	1625	1631	1590	1534
	IAS	KT	320	320	320	320	320	320	320	320	315	309
34000	TAS	KT	417	423	429	436	442	449	456	463	463	461
	INDICATED	MACH	0.68	0.692	0.706	0.719	0.733	0.747	0.761	0.776	0.78	0.78
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.13	0.132	0.133	0.135	0.137	0.139	0.14	0.142	0.146	0.15
	N1	%	81.6	82.4	83.1	83.7	84.3	84.9	85.6	86.3	86.5	86.4
	F FLOW	LB/ /ENG	1564	1565	1567	1570	1573	1577	1581	1585	1544	1488
	IAS	KT	320	320	320	320	320	320	320	320	315	309
31000	TAS	KT	416	422	428	435	441	448	455	462	462	460
	INDICATED	MACH	0.68	0.692	0.706	0.719	0.733	0.747	0.761	0.776	0.78	0.78
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.133	0.135	0.137	0.138	0.14	0.142	0.144	0.146	0.15	0.155
	N1	%	81	81.7	82.5	83.1	83.7	84.3	84.9	85.6	85.7	85.7
	F FLOW	LB/ /ENG	1526	1527	1528	1529	1531	1534	1537	1540	1499	1443
	IAS	KT	320	320	320	320	320	320	320	320	315	309
28000	TAS	KT	415	421	427	434	440	447	454	460	461	459
	INDICATED	MACH	0.68	0.692	0.706	0.719	0.733	0.747	0.761	0.776	0.78	0.78
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.136	0.138	0.14	0.142	0.144	0.146	0.148	0.149	0.154	0.159

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW STD ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW STD ISA CONDITIONS.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

PRESSURE ALTITUDE: 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT (LB)			ALTITUDE (FT)								
			29000	30000	31000	32000	33000	34000	35000	36000	37000
50000	N1	%	87.9	87.9	88.3	88.7	89.2	89.7	90.2	90.7	91.2
	F FLOW	LB/H/ENG	1525	1472	1438	1406	1380	1355	1337	1314	1214
	IAS	KT	287	281	276	272	268	264	262	258	237
	TAS	KT	441	439	440	441	442	443	446	448	424
	INDICATED MACH		0.744	0.744	0.748	0.753	0.759	0.764	0.773	0.779	0.738
	BUFFET MARGIN	G	2.02	1.93	1.84	1.74	1.65	1.57	1.47	1.39	1.39
	SR	NM/LB	0.145	0.149	0.153	0.157	0.160	0.164	0.167	0.170	0.174
48000	N1	%	87.8	87.8	88.2	88.6	89.1	89.5	89.7	90.1	91.0
	F FLOW	LB/H/ENG	1529	1476	1443	1412	1389	1364	1323	1286	1233
	IAS	KT	291	284	280	276	273	270	264	258	248
	TAS	KT	446	444	445	446	449	452	450	448	440
	INDICATED MACH		0.753	0.752	0.757	0.762	0.771	0.779	0.780	0.780	0.767
	BUFFET MARGIN	G	2.08	1.99	1.89	1.79	1.69	1.59	1.52	1.44	1.41
	SR	NM/LB	0.146	0.150	0.154	0.158	0.162	0.166	0.170	0.174	0.178
46000	N1	%	87.9	87.9	88	88.5	88.9	89.2	89.6	90.1	90.8
	F FLOW	LB/H/ENG	1530	1479	1428	1416	1390	1344	1302	1263	1232
	IAS	KT	292	287	280	280	277	271	264	258	252
	TAS	KT	449	448	446	452	454	452	450	448	448
	INDICATED MACH		0.757	0.759	0.758	0.772	0.78	0.78	0.78	0.78	0.78
	BUFFET MARGIN	G	2.16	2.06	1.97	1.84	1.73	1.65	1.58	1.5	1.43
	SR	NM/LB	0.147	0.151	0.156	0.159	0.163	0.168	0.173	0.177	0.182
44000	N1	%	87.8	87.8	87.9	88.3	88.4	88.5	88.9	89.3	90.1
	F FLOW	LB/H/ENG	1533	1482	1431	1418	1367	1320	1277	1236	1204
	IAS	KT	295	290	284	283	277	271	264	258	252
	TAS	KT	453	452	450	456	454	452	450	448	448
	INDICATED MACH		0.764	0.767	0.766	0.78	0.78	0.78	0.78	0.78	0.78
	BUFFET MARGIN	G	2.24	2.13	2.04	1.9	1.81	1.73	1.65	1.57	1.5
	SR	NM/LB	0.148	0.153	0.157	0.161	0.166	0.171	0.176	0.181	0.186

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW STD ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW STD ISA CONDITIONS.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

PRESSURE ALTITUDE: 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT (LB)			ALTITUDE (FT)								
			29000	30000	31000	32000	33000	34000	35000	36000	37000
42000	N1	%	87.8	87.8	87.8	87.9	87.9	88	88.2	88.5	89.3
	F FLOW	LB/H/ENG	1535	1484	1433	1397	1345	1297	1253	1211	1177
	IAS	KT	298	292	287	283	277	271	264	258	252
	TAS	KT	455	455	454	456	454	452	450	448	447
	INDICATED MACH		0.769	0.772	0.775	0.78	0.78	0.78	0.78	0.78	0.78
	BUFFET MARGIN	G	2.33	2.22	2.11	1.99	1.9	1.82	1.73	1.65	1.57
	SR	NM/LB	0.148	0.153	0.159	0.163	0.169	0.174	0.179	0.185	0.19
40000	N1	%	87.8	87.7	87.7	87.6	87.5	87.5	87.6	87.7	88.5
	F FLOW	LB/H/ENG	1536	1485	1432	1377	1324	1276	1230	1187	1152
	IAS	KT	300	294	289	283	277	271	264	258	252
	TAS	KT	458	458	457	455	453	451	449	447	447
	INDICATED MACH		0.775	0.777	0.78	0.78	0.78	0.78	0.78	0.78	0.78
	BUFFET MARGIN	G	2.43	2.31	2.19	2.1	2	1.91	1.82	1.73	1.65
	SR	NM/LB	0.149	0.154	0.16	0.165	0.171	0.177	0.183	0.188	0.194
38000	N1	%	87.7	87.5	87.4	87.2	87.1	87.1	87.1	87.2	87.6
	F FLOW	LB/H/ENG	1534	1472	1413	1357	1304	1254	1208	1164	1127
	IAS	KT	302	296	289	283	277	271	264	258	252
	TAS	KT	461	459	457	455	453	451	449	447	447
	INDICATED MACH		0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
	BUFFET MARGIN	G	2.54	2.42	2.31	2.21	2.11	2.01	1.92	1.83	1.74
	SR	NM/LB	0.15	0.156	0.162	0.168	0.174	0.18	0.186	0.192	0.198
36000	N1	%	87.5	87.3	87.1	86.9	86.8	86.7	86.6	86.6	87
	F FLOW	LB/H/ENG	1517	1454	1395	1338	1284	1234	1186	1141	1104
	IAS	KT	302	296	289	283	277	271	264	258	252
	TAS	KT	460	458	456	454	452	450	448	446	446
	INDICATED MACH		0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
	BUFFET MARGIN	G	2.56	2.56	2.45	2.34	2.23	2.13	2.03	1.93	1.84
	SR	NM/LB	0.152	0.158	0.163	0.17	0.176	0.182	0.189	0.196	0.202

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW STD ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW STD ISA CONDITIONS.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

PRESSURE ALTITUDE: 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN

WEIGHT (LB)			ALTITUDE (FT)								
			29000	30000	31000	32000	33000	34000	35000	36000	37000
34000	N1	%	87	86.9	86.8	86.7	86.5	86.3	86.2	86.2	86.5
	F FLOW	LB/H/ENG	1481	1431	1378	1320	1266	1215	1166	1121	1082
	IAS	KT	302	296	289	283	277	271	264	258	252
	TAS	KT	459	458	456	454	452	450	448	446	446
	INDICATED MACH		0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
	BUFFET MARGIN	G	2.56	2.56	2.56	2.48	2.37	2.26	2.15	2.05	1.95
	SR	NM/LB	0.155	0.16	0.165	0.172	0.178	0.185	0.192	0.199	0.206
31000	N1	%	86.3	86.3	86.2	86.2	86.1	85.8	85.7	85.5	85.8
	F FLOW	LB/H/ENG	1435	1384	1335	1289	1240	1188	1138	1092	1052
	IAS	KT	302	296	289	283	277	271	264	258	252
	TAS	KT	458	457	455	453	451	449	447	445	445
	INDICATED MACH		0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.48	2.37	2.26	2.15
	SR	NM/LB	0.16	0.165	0.17	0.176	0.182	0.189	0.196	0.204	0.211
28000	N1	%	85.6	85.6	85.5	85.4	85.4	85.3	85.2	85	85.2
	F FLOW	LB/H/ENG	1390	1339	1290	1243	1199	1156	1113	1066	1025
	IAS	KT	302	296	289	283	277	271	264	258	252
	TAS	KT	457	455	454	452	450	448	446	444	444
	INDICATED MACH		0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.5	2.38
	SR	NM/LB	0.164	0.17	0.176	0.182	0.188	0.194	0.2	0.208	0.217

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW STD ISA CONDITIONS.
INCREASE / DECREASE TAS BY 5 KT PER 5°C ABOVE / BELOW STD ISA CONDITIONS.

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DESCENT

The descent table shows fuel consumption, distance and time from the top of descent to sea level for various cruise altitudes. The data are calculated for flight idle thrust setting, maintaining 250 KIAS up to 10000 ft and 240 KIAS below 10000 ft.

The approach and landing fuel consumption is not considered in the following tables.

The associated conditions are:

- Flaps.....UP
- Gear.....UP
- Bleeds .....OPEN
- Anti-Ice .....OFF

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EXAMPLE:

Given:

Arrival Airport Elevation .....3500 ft
Top of Descent Weight .....38000 lb
ISA Condition
Cruise Altitude.....35000 ft

RESULTS

Data provided from 35000 ft (Top of Descent) to Sea Level table:

Fuel: 227 lb
Distance: 87 NM
Time: 16 min

Data for 5000 ft (3500 ft + 1500 ft above arrival airport) obtained from the 5000 ft descent table:

Fuel: 53 lb
Distance: 12 NM
Time: 3 min

The fuel, distance and time spent during the descent phase (from 35000 ft to 5000 ft) are:

Fuel: 227 - 53 = 174 lb
Distance: 87 - 12 = 75 NM
Time: 16 - 3 = 13 min

NOTE: The fuel consumption related to the approach and landing phase is provided on the Section 1-05-07.

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DESCENT - ALL ENGINES OPERATING

AE3007A1 AND AE3007A1P ENGINES

CRUISE CONFIGURATION
BLEED : OPEN
FLIGHT IDLE
AIRSPEED : MMO / 250 KIAS / 240 KIAS
ISA CONDITIONS

WEIGHT (LB)			TOP OF DESCENT (FT)							
			5000	10000	15000	20000	25000	30000	35000	37000
49000	FUEL	LB	57	102	142	176	204	228	251	260
	DIST	NM	13	26	40	53	67	81	96	102
	TIME	MIN	3	6	9	11	14	16	18	19
48000	FUEL	LB	57	102	141	175	203	227	249	258
	DIST	NM	13	26	39	53	66	80	95	101
	TIME	MIN	3	6	9	11	14	16	18	19
46000	FUEL	LB	56	101	139	173	200	224	246	254
	DIST	NM	13	26	39	52	66	79	94	100
	TIME	MIN	3	6	9	11	13	15	17	18
44000	FUEL	LB	55	99	137	171	198	220	242	250
	DIST	NM	13	26	38	52	65	78	92	98
	TIME	MIN	3	6	9	11	13	15	17	18
42000	FUEL	LB	55	98	135	168	194	216	237	246
	DIST	NM	13	25	38	51	64	77	90	96
	TIME	MIN	3	6	8	11	13	15	17	18
40000	FUEL	LB	54	96	133	165	191	212	233	241
	DIST	NM	12	25	37	50	62	75	89	94
	TIME	MIN	3	6	8	11	13	15	17	17
38000	FUEL	LB	53	94	130	162	187	208	227	235
	DIST	NM	12	24	36	49	61	73	87	92
	TIME	MIN	3	6	8	10	13	14	16	17
36000	FUEL	LB	52	92	127	158	182	203	222	229
	DIST	NM	12	24	35	48	60	72	84	90
	TIME	MIN	3	6	8	10	12	14	16	17
34000	FUEL	LB	50	90	124	154	178	197	216	223
	DIST	NM	12	23	34	46	58	70	82	87
	TIME	MIN	3	5	8	10	12	14	15	16
32000	FUEL	LB	49	87	120	149	172	191	209	216
	DIST	NM	11	22	33	45	56	68	79	84
	TIME	MIN	3	5	8	10	12	13	15	16
30000	FUEL	LB	47	84	116	144	166	185	202	208
	DIST	NM	11	21	32	43	54	65	77	81
	TIME	MIN	3	5	7	9	11	13	14	15

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HOLDING

The holding tables show indicated airspeed, Mach number, N1, fuel flow and fuel consumption for various weights, altitudes, anti-ice on (with and without ice accretion) and off condition. Data are presented in ISA condition for all engines operating configuration.

The associated conditions are:

- Flaps .....UP
- Gear .....UP
- Bleeds .....OPEN
- Airspeed.....1.3 V_S or 200 KIAS
- Anti-Ice.....ON or OFF

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HOLDING - ALL ENGINES

AE3007A1 AND AE3007A1P ENGINES

CRUISE CONFIGURATION
BLEED: OPEN
ANTI-ICE: OFF
MINIMUM FUEL CONSUMPTION SPEED
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)								
			0	1500	5000	10000	15000	20000	25000	30000	37000
	IAS	KT	180	179	176	173	171	171	174	179	184
	TAS	KT	180	182	189	200	214	232	256	287	333
50000	MACH		0.272	0.277	0.290	0.313	0.342	0.379	0.426	0.487	0.581
	N1	%	57.7	58.8	61.6	65.8	69.7	73.9	78.2	82.4	90.3
	FF	LB/H/ENG	1104	1090	1061	1032	1016	1013	1014	1027	1078
	FC	LB/H	2209	2180	2123	2065	2032	2026	2029	2055	2157
	IAS	KT	178	176	173	170	168	168	170	174	184
	TAS	KT	177.6	179.8	185.8	196.3	209.9	227.4	250.1	279.6	333.6
48000	MACH		0.268	0.273	0.286	0.308	0.336	0.371	0.416	0.475	0.581
	N1	%	56.7	57.8	60.4	64.7	68.6	72.6	77.4	81.5	88.9
	FF	LB/H/ENG	1054	1039	1009	977	959	952	952	961	1003
	FC	LB/H	2108	2078	2018	1955	1917	1904	1904	1921	2007
	IAS	KT	175	174	170	167	165	164	166	170	180
	TAS	KT	175.1	177.2	182.8	192.8	205.8	222.4	244.0	272.1	327.9
46000	MACH		0.265	0.270	0.282	0.303	0.329	0.363	0.406	0.462	0.572
	N1	%	55.6	56.6	59.3	63.5	67.7	71.4	76.2	80.3	87.4
	FF	LB/H/ENG	1018	1003	972	939	918	909	908	914	952
	FC	LB/H	2036	2005	1943	1877	1836	1818	1817	1829	1904
	IAS	KT	173	171	168	164	161	161	162	165	175
	TAS	KT	172.5	174.5	179.8	189.3	201.6	217.4	237.9	264.6	317.8
44000	MACH		0.261	0.266	0.277	0.297	0.323	0.355	0.397	0.450	0.555
	N1	%	54.5	55.5	58.1	62.3	66.6	70.2	74.9	79.2	85.7
	FF	LB/H/ENG	983	967	935	900	878	867	866	869	900
	FC	LB/H	1966	1934	1870	1800	1756	1733	1731	1738	1801
	IAS	KT	170	169	165	161	158	157	158	161	169
	TAS	KT	170.0	171.8	176.9	185.8	197.4	212.4	231.9	257.2	307.7
42000	MACH		0.258	0.262	0.273	0.292	0.316	0.347	0.387	0.438	0.538
	N1	%	53.3	54.3	56.8	61.0	65.3	69.1	73.6	78.1	84.2
	FF	LB/H/ENG	948	932	898	862	838	825	823	824	850
	FC	LB/H	1896	1863	1797	1725	1676	1650	1647	1649	1700
	IAS	KT	168	166	162	158	155	153	154	156	164
	TAS	KT	167.4	169.2	173.9	182.4	193.3	207.4	225.8	249.9	297.7
40000	MACH		0.254	0.258	0.269	0.287	0.310	0.339	0.377	0.426	0.521
	N1	%	52.2	53.1	55.6	59.6	64.0	67.9	72.2	76.9	82.9
	FF	LB/H/ENG	914	897	863	825	799	784	780	780	801
	FC	LB/H	1827	1794	1725	1650	1598	1569	1560	1561	1602

NOTE: MACH setting and FF LB/H/ENG remain constant, regardless of the temperature change.

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HOLDING - ALL ENGINES

AE3007A1 AND AE3007A1P ENGINES

CRUISE CONFIGURATION
BLEED: OPEN
ANTI-ICE: OFF
MINIMUM FUEL CONSUMPTION SPEED
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)								
			0	1500	5000	10000	15000	20000	25000	30000	37000
	IAS	KT	166	164	160	155	152	150	150	151	158
	TAS	KT	164.9	166.6	171.0	178.9	189.0	202.3	219.6	242.3	287.7
38000	MACH		0.250	0.254	0.264	0.282	0.304	0.331	0.367	0.414	0.504
	N1	%	50.9	51.9	54.3	58.2	62.6	66.8	70.7	75.6	81.7
	FF	LB/H/ENG	880	863	827	788	761	744	738	737	753
	FC	LB/H	1760	1725	1655	1576	1522	1488	1475	1475	1506
	IAS	KT	163	161	157	152	148	146	145	147	152
	TAS	KT	162.4	163.9	168.0	175.3	184.9	197.3	213.6	234.9	277.6
36000	MACH		0.247	0.250	0.260	0.276	0.297	0.324	0.357	0.401	0.487
	N1	%	49.7	50.6	53.0	56.8	61.1	65.5	69.3	74.1	80.5
	FF	LB/H/ENG	847	829	793	752	723	705	696	695	707
	FC	LB/H	1694	1658	1585	1504	1446	1409	1392	1390	1413
	IAS	KT	161	159	154	149	145	142	141	142	147
	TAS	KT	159.9	161.2	165.0	171.8	180.7	192.4	207.7	227.6	267.6
34000	MACH		0.243	0.247	0.256	0.271	0.291	0.316	0.348	0.389	0.470
	N1	%	48.5	49.3	51.6	55.4	59.6	64.0	67.9	72.5	79.0
	FF	LB/H/ENG	814	796	759	716	686	666	655	654	661
	FC	LB/H	1629	1592	1517	1433	1372	1332	1310	1308	1322
	IAS	KT	158	156	152	146	142	139	137	138	141
	TAS	KT	157.3	158.6	162.1	168.4	176.7	187.6	201.8	220.4	257.9
32000	MACH		0.239	0.243	0.251	0.266	0.284	0.308	0.338	0.377	0.453
	N1	%	47.2	48.0	50.2	53.8	57.9	62.4	66.4	70.8	77.4
	FF	LB/H/ENG	782	764	725	682	650	628	615	611	616
	FC	LB/H	1565	1527	1451	1363	1299	1255	1230	1223	1233
	IAS	KT	156	154	149	143	139	135	133	133	136
	TAS	KT	154.9	156.1	159.3	165.0	172.7	182.7	195.9	213.2	248.1
30000	MACH		0.236	0.239	0.247	0.261	0.278	0.300	0.328	0.365	0.436
	N1	%	45.9	46.7	48.7	52.3	56.2	60.7	65.0	69.0	75.9
	FF	LB/H/ENG	751	732	693	647	614	590	576	570	573
	FC	LB/H	1503	1465	1385	1295	1227	1180	1151	1139	1146
	IAS	KT	154	151	146	140	135	132	129	128	130
	TAS	KT	152.5	153.6	156.4	161.7	168.7	177.8	189.9	205.9	238.3
28000	MACH		0.232	0.235	0.242	0.255	0.271	0.292	0.318	0.352	0.419
	N1	%	44.6	45.3	47.3	50.6	54.5	58.8	63.3	67.3	74.2
	FF	LB/H/ENG	721	702	661	614	579	554	537	529	530
	FC	LB/H	1442	1403	1322	1228	1157	1107	1074	1058	1061

NOTE: MACH setting and FF LB/H/ENG remain constant, regardless of the temperature change.

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HOLDING - ALL ENGINES

AE3007A1 AND AE3007A1P ENGINES

CRUISE CONFIGURATION
BLEED: OPEN
ANTI-ICE: ON (WITHOUT ICE ACCRETION)
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)								
			0	1500	5000	10000	15000	20000	25000	30000	37000
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	200.4	204.7	215.4	232.0	250.4	271.0	293.9	319.5	361.8
49000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	58.4	59.4	62.2	66.4	69.9	74.0	78.8	83.0	91.4
	FF	LB/H/ENG	1227	1208	1171	1128	1099	1087	1083	1092	1141
	FC	LB/H	2453	2417	2341	2256	2198	2173	2165	2183	2282
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	200.4	204.7	215.4	232.0	250.4	271.0	293.9	319.5	361.8
48000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	57.9	59.0	61.7	65.9	69.5	73.5	78.4	82.5	90.8
	FF	LB/H/ENG	1212	1194	1155	1112	1082	1069	1065	1072	1117
	FC	LB/H	2424	2387	2311	2224	2165	2137	2129	2143	2235
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	200.3	204.7	215.3	231.9	250.4	271.0	293.9	319.4	361.7
46000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	57.1	58.2	60.8	65.0	68.8	72.6	77.4	81.5	89.3
	FF	LB/H/ENG	1183	1165	1126	1081	1050	1034	1030	1033	1073
	FC	LB/H	2367	2329	2252	2163	2100	2067	2059	2067	2145
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	200.1	204.5	215.1	231.7	250.2	270.7	293.6	319.1	361.4
44000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	56.3	57.3	59.9	64.1	68.1	71.6	76.5	80.6	87.6
	FF	LB/H/ENG	1155	1137	1097	1051	1019	1000	996	997	1030
	FC	LB/H	2311	2273	2194	2103	2037	2000	1992	1993	2059
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.9	204.3	214.9	231.5	249.9	270.4	293.3	318.8	361.1
42000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	55.5	56.5	59.1	63.3	67.3	70.8	75.4	79.7	85.9
	FF	LB/H/ENG	1129	1110	1070	1023	989	968	963	962	989
	FC	LB/H	2257	2219	2139	2046	1977	1936	1927	1924	1979
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.7	204.1	214.7	231.3	249.7	270.2	293.0	318.5	360.8
40000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	54.6	55.7	58.3	62.4	66.5	69.9	74.4	78.9	84.8
	FF	LB/H/ENG	1103	1084	1043	996	960	937	930	929	951
	FC	LB/H	2206	2168	2087	1991	1920	1875	1860	1859	1903

NOTE: MACH setting and FF LB/H/ENG remain constant, regardless of the temperature change.

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HOLDING - ALL ENGINES

AE3007A1 AND AE3007A1P ENGINES

CRUISE CONFIGURATION
BLEED: OPEN
ANTI-ICE: ON (WITHOUT ICE ACCRETION)
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)								
			0	1500	5000	10000	15000	20000	25000	30000	37000
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.5	203.9	214.5	231.1	249.5	269.9	292.8	318.2	360.4
38000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	53.8	54.9	57.4	61.5	65.6	69.1	73.3	78.2	84.0
	FF	LB/H/ENG	1079	1059	1018	970	933	908	899	899	916
	FC	LB/H	2157	2119	2037	1940	1866	1817	1797	1798	1831
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.4	203.7	214.3	230.8	249.2	269.7	292.5	318.0	360.1
36000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	53.1	54.1	56.6	60.6	64.8	68.4	72.4	77.3	83.1
	FF	LB/H/ENG	1055	1036	995	945	907	881	869	870	882
	FC	LB/H	2111	2072	1989	1890	1814	1762	1738	1740	1765
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.2	203.5	214.1	230.6	249.0	269.5	292.3	317.7	359.8
34000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	52.3	53.3	55.8	59.7	63.9	67.7	71.4	76.4	82.3
	FF	LB/H/ENG	1033	1014	972	922	883	855	841	842	851
	FC	LB/H	2067	2027	1944	1844	1765	1710	1681	1685	1703
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.0	203.3	213.9	230.5	248.8	269.2	292.0	317.4	359.6
32000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	51.6	52.6	55.0	58.9	63.1	67.0	70.6	75.3	81.4
	FF	LB/H/ENG	1012	993	951	900	859	830	814	813	823
	FC	LB/H	2025	1985	1901	1799	1719	1661	1628	1626	1646
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	198.9	203.2	213.8	230.3	248.6	269.0	291.8	317.2	359.3
30000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	50.9	51.8	54.3	58.1	62.3	66.3	69.7	74.3	80.5
	FF	LB/H/ENG	993	973	930	879	838	807	789	785	796
	FC	LB/H	1986	1946	1861	1758	1675	1615	1578	1570	1593
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	198.7	203.0	213.6	230.1	248.4	268.8	291.6	317.0	359.0
28000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	50.2	51.1	53.6	57.4	61.5	65.5	68.9	73.3	79.8
	FF	LB/H/ENG	974	954	911	859	817	785	765	759	772
	FC	LB/H	1948	1908	1823	1718	1634	1571	1531	1518	1544

NOTE: MACH setting and FF LB/H/ENG remain constant, regardless of the temperature change.

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HOLDING - ALL ENGINES

AE3007A1 AND AE3007A1P ENGINES

CRUISE CONFIGURATION
BLEED: OPEN
ANTI-ICE: ON (WITH ICE ACCRETION)
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)								
			0	1500	5000	10000	15000	20000	25000	30000	37000
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	200.4	204.7	215.4	232.0	250.4	271.0	293.9	319.5	361.8
49000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	58.4	59.4	62.2	66.4	69.9	74.0	78.8	83.0	91.4
	FF	LB/H/ENG	1358	1335	1286	1227	1184	1159	1145	1148	1195
	FC	LB/H	2717	2670	2571	2454	2369	2318	2291	2296	2390
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	200.4	204.7	215.4	232.0	250.4	271.0	293.9	319.5	361.8
48000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	57.9	59.0	61.7	65.9	69.5	73.5	78.4	82.5	90.8
	FF	LB/H/ENG	1344	1320	1271	1212	1168	1141	1127	1127	1170
	FC	LB/H	2688	2641	2541	2423	2335	2282	2254	2255	2340
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	200.3	204.7	215.3	231.9	250.4	271.0	293.9	319.4	361.7
46000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	57.1	58.2	60.8	65.0	68.8	72.6	77.4	81.5	89.3
	FF	LB/H/ENG	1316	1292	1241	1181	1135	1106	1092	1088	1123
	FC	LB/H	2631	2584	2483	2362	2271	2212	2184	2176	2246
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	200.1	204.5	215.1	231.7	250.2	270.7	293.6	319.1	361.4
44000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	56.3	57.3	59.9	64.1	68.1	71.6	76.5	80.6	87.6
	FF	LB/H/ENG	1288	1264	1213	1152	1104	1073	1058	1050	1078
	FC	LB/H	2576	2528	2426	2303	2208	2145	2116	2101	2156
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.9	204.3	214.9	231.5	249.9	270.4	293.3	318.8	361.1
42000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	55.5	56.5	59.1	63.3	67.3	70.8	75.4	79.7	85.9
	FF	LB/H/ENG	1262	1237	1186	1123	1074	1040	1025	1015	1036
	FC	LB/H	2523	2475	2372	2247	2149	2081	2050	2030	2072
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.7	204.1	214.7	231.3	249.7	270.2	293.0	318.5	360.8
40000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	54.6	55.7	58.3	62.4	66.5	69.9	74.4	78.9	84.8
	FF	LB/H/ENG	1236	1212	1160	1097	1046	1010	991	982	996
	FC	LB/H	2473	2424	2320	2193	2092	2020	1983	1963	1993

NOTE: MACH setting and FF LB/H/ENG remain constant, regardless of the temperature change.

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HOLDING - ALL ENGINES

AE3007A1 AND AE3007A1P ENGINES

CRUISE CONFIGURATION
BLEED: OPEN
ANTI-ICE: ON (WITH ICE ACCRETION)
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)								
			0	1500	5000	10000	15000	20000	25000	30000	37000
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.5	203.9	214.5	231.1	249.5	269.9	292.8	318.2	360.4
38000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	53.8	54.9	57.4	61.5	65.6	69.1	73.3	78.2	84.0
	FF	LB/H/ENG	1212	1188	1135	1071	1019	981	960	951	960
	FC	LB/H	2425	2376	2271	2142	2039	1963	1919	1901	1919
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.4	203.7	214.3	230.8	249.2	269.7	292.5	318.0	360.1
36000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	53.1	54.1	56.6	60.6	64.8	68.4	72.4	77.3	83.1
	FF	LB/H/ENG	1189	1165	1112	1047	994	954	930	922	925
	FC	LB/H	2379	2330	2224	2093	1988	1908	1860	1843	1850
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.2	203.5	214.1	230.6	249.0	269.5	292.3	317.7	359.8
34000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	52.3	53.3	55.8	59.7	63.9	67.7	71.4	76.4	82.3
	FF	LB/H/ENG	1168	1143	1090	1024	970	928	902	893	893
	FC	LB/H	2335	2286	2179	2047	1939	1856	1803	1787	1786
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	199.0	203.3	213.9	230.5	248.8	269.2	292.0	317.4	359.6
32000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	51.6	52.6	55.0	58.9	63.1	67.0	70.6	75.3	81.4
	FF	LB/H/ENG	1147	1122	1068	1002	947	904	875	864	864
	FC	LB/H	2294	2244	2137	2004	1894	1808	1750	1727	1727
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	198.9	203.2	213.8	230.3	248.6	269.0	291.8	317.2	359.3
30000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	50.9	51.8	54.3	58.1	62.3	66.3	69.7	74.3	80.5
	FF	LB/H/ENG	1128	1103	1049	981	925	881	850	836	836
	FC	LB/H	2255	2205	2097	1963	1851	1762	1700	1671	1673
	IAS	KT	200	200	200	200	200	200	200	200	200
	TAS	KT	198.7	203.0	213.6	230.1	248.4	268.8	291.6	317.0	359.0
28000	MACH		0.302	0.311	0.331	0.363	0.399	0.440	0.487	0.541	0.630
	N1	%	50.2	51.1	53.6	57.4	61.5	65.5	68.9	73.3	79.8
	FF	LB/H/ENG	1109	1084	1030	962	905	860	827	809	811
	FC	LB/H	2219	2168	2060	1924	1810	1719	1653	1619	1623

NOTE: MACH setting and FF LB/H/ENG remain constant, regardless of the temperature change.

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ONE ENGINE INOPERATIVE PERFORMANCE

CRUISE TABLES

The one engine inoperative long range cruise tables show N1, fuel flow, indicated airspeed, true airspeed, indicated Mach number, buffet margin and specific range. Data are presented for various weights, altitudes, and corrections for ISA deviation.

The associated conditions are:

- Flaps .....UP
- Gear .....UP
- Bleeds .....OPEN
- Anti-Ice .....OFF

NOTE: The corrections (N1, Fuel Flow and TAS) given in the tables are applicable only to ISA-15°C to ISA+15°C range.

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LONG RANGE CRUISE - ONE ENGINE INOPERATIVE

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: 5000 FT TO 14000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)							
		5000	7000	9000	10000	11000	12000	13000	14000
49000	N1 %	83.7	85.1	86.4	87.3	88.1	88.7	88.3	88.2
	F FLOW LB/H/ENG	2382	2377	2373	2376	2378	2364	2294	2233
	IAS KT	249	247	245	245	244	242	234	227
	TAS KT	268	274	280	283	287	288	284	280
	INDICATED MACH	0.411	0.423	0.436	0.443	0.450	0.454	0.449	0.444
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.53	2.38	2.24
	SR NM/LB	0.112	0.115	0.118	0.119	0.121	0.122	0.123	0.124
46000	N1 %	81.9	83.4	84.7	85.6	86.3	87.1	87.9	88.6
	F FLOW LB/H/ENG	2231	2223	2215	2216	2215	2216	2219	2224
	IAS KT	243	241	239	239	238	237	236	236
	TAS KT	261	267	273	276	280	283	286	290
	INDICATED MACH	0.401	0.413	0.425	0.432	0.439	0.445	0.452	0.460
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.54
	SR NM/LB	0.117	0.120	0.123	0.125	0.126	0.128	0.129	0.130
44000	N1 %	80.6	82.2	83.6	84.4	85.1	85.8	86.6	87.5
	F FLOW LB/H/ENG	2133	2120	2114	2111	2108	2111	2113	2114
	IAS KT	239	237	236	235	234	233	232	232
	TAS KT	257	262	269	272	275	278	281	285
	INDICATED MACH	0.394	0.406	0.419	0.425	0.431	0.438	0.445	0.452
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.120	0.124	0.127	0.129	0.130	0.132	0.133	0.135
42000	N1 %	79.3	80.8	82.4	83.2	83.9	84.6	85.3	86.1
	F FLOW LB/H/ENG	2038	2022	2012	2007	2008	2006	2004	2005
	IAS KT	235	233	231	230	230	229	228	227
	TAS KT	252	258	264	266	270	273	276	279
	INDICATED MACH	0.388	0.399	0.411	0.417	0.424	0.431	0.437	0.444
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.124	0.127	0.131	0.133	0.134	0.136	0.138	0.139
40000	N1 %	77.9	79.4	81.0	81.9	82.6	83.3	84.0	84.8
	F FLOW LB/H/ENG	1942	1927	1912	1909	1906	1901	1901	1902
	IAS KT	230	229	227	226	226	225	224	223
	TAS KT	247	253	258	262	265	268	271	274
	INDICATED MACH	0.381	0.392	0.404	0.410	0.417	0.423	0.429	0.437
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.127	0.131	0.135	0.137	0.139	0.141	0.142	0.144

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 3 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.7 % AND FUEL FLOW BY 8%.
DECREASE SR BY 7%.

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LONG RANGE CRUISE - ONE ENGINE INOPERATIVE

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: 5000 FT TO 14000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)							
		5000	7000	9000	10000	11000	12000	13000	14000
38000	N1 %	76.5	78.0	79.6	80.5	81.2	82.0	82.8	83.4
	F FLOW LB/H/ENG	1849	1830	1815	1812	1804	1801	1801	1796
	IAS KT	226	224	223	222	221	220	220	219
	TAS KT	243	248	253	257	259	262	266	268
	INDICATED MACH	0.374	0.385	0.396	0.403	0.408	0.415	0.422	0.428
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.131	0.135	0.140	0.142	0.144	0.146	0.148	0.149
36000	N1 %	75.2	76.5	78.0	78.9	79.7	80.6	81.3	82.1
	F FLOW LB/H/ENG	1758	1738	1721	1715	1707	1705	1698	1695
	IAS KT	222	220	218	218	217	216	215	214
	TAS KT	238	243	248	251	254	257	260	263
	INDICATED MACH	0.367	0.377	0.389	0.395	0.400	0.407	0.413	0.419
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.135	0.140	0.144	0.146	0.149	0.151	0.153	0.155
34000	N1 %	73.8	75.1	76.5	77.3	78.1	79.0	79.8	80.6
	F FLOW LB/H/ENG	1668	1647	1629	1619	1613	1608	1600	1599
	IAS KT	217	216	214	213	212	212	210	210
	TAS KT	233	238	243	245	248	251	254	257
	INDICATED MACH	0.359	0.370	0.381	0.386	0.392	0.398	0.404	0.411
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.139	0.144	0.149	0.152	0.154	0.156	0.159	0.161
32000	N1 %	72.5	73.6	74.9	75.6	76.5	77.2	78.1	78.9
	F FLOW LB/H/ENG	1578	1556	1536	1526	1522	1512	1508	1501
	IAS KT	213	211	209	208	208	207	206	205
	TAS KT	227	232	237	240	243	245	248	251
	INDICATED MACH	0.351	0.362	0.372	0.377	0.384	0.389	0.395	0.401
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.144	0.149	0.154	0.157	0.160	0.162	0.165	0.167
30000	N1 %	71.1	72.1	73.3	74.0	74.7	75.5	76.3	77.0
	F FLOW LB/H/ENG	1492	1467	1445	1438	1429	1421	1415	1406
	IAS KT	208	206	204	203	203	202	201	200
	TAS KT	222	226	231	234	237	239	242	245
	INDICATED MACH	0.344	0.353	0.363	0.369	0.375	0.380	0.386	0.391
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.149	0.154	0.160	0.163	0.166	0.169	0.171	0.174
28000	N1 %	69.8	70.7	71.8	72.5	73.0	73.7	74.4	75.2
	F FLOW LB/H/ENG	1407	1381	1358	1351	1338	1332	1321	1316
	IAS KT	203	201	199	199	197	197	196	195
	TAS KT	217	221	226	228	230	233	236	239
	INDICATED MACH	0.335	0.345	0.354	0.360	0.365	0.371	0.376	0.382
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.154	0.160	0.166	0.169	0.172	0.175	0.178	0.181

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 3 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.7 % AND FUEL FLOW BY 8%.
DECREASE SR BY 7%.

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LONG RANGE CRUISE - ONE ENGINE INOPERATIVE

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: 15000 FT TO 22000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)							
		15000	16000	17000	18000	19000	20000	21000	22000
	N1 %	89.1	89.0	89.0	-	-	-	-	-
	F FLOW LB/H/ENG	2192	2112	2030	-	-	-	-	-
	IAS KT	221	210	192	-	-	-	-	-
49000	TAS KT	277	267	248	-	-	-	-	-
	INDICATED MACH	0.441	0.427	0.398	-	-	-	-	-
	BUFFET MARGIN G	2.12	1.92	1.61	-	-	-	-	-
	SR NM/LB	0.126	0.126	0.122	-	-	-	-	-
	N1 %	88.7	88.1	88.9	89.1	89.6	90.2	-	-
	F FLOW LB/H/ENG	2191	2103	2048	1994	1956	1908	-	-
	IAS KT	231	222	214	206	198	183	-	-
46000	TAS KT	289	282	277	270	263	248	-	-
	INDICATED MACH	0.461	0.450	0.444	0.436	0.426	0.404	-	-
	BUFFET MARGIN G	2.45	2.26	2.12	1.96	1.80	1.56	-	-
	SR NM/LB	0.132	0.133	0.135	0.135	0.135	0.130	-	-
	N1 %	88.2	88.9	88.1	89.0	89.5	89.9	90.3	-
	F FLOW LB/H/ENG	2118	2125	2034	2001	1965	1922	1859	-
	IAS KT	231	230	220	216	210	203	190	-
44000	TAS KT	288	292	284	282	280	274	262	-
	INDICATED MACH	0.460	0.467	0.456	0.456	0.453	0.446	0.428	-
	BUFFET MARGIN G	2.55	2.52	2.32	2.22	2.11	1.97	1.74	-
	SR NM/LB	0.136	0.137	0.139	0.141	0.142	0.143	0.141	-
	N1 %	87.0	87.7	88.4	88.6	88.7	88.8	90.1	90.4
	F FLOW LB/H/ENG	2011	2013	2016	1993	1952	1908	1873	1810
	IAS KT	227	226	225	222	216	210	204	194
42000	TAS KT	283	286	290	290	288	284	280	272
	INDICATED MACH	0.452	0.459	0.466	0.468	0.466	0.463	0.458	0.446
	BUFFET MARGIN G	2.56	2.55	2.52	2.44	2.32	2.20	2.07	1.89
	SR NM/LB	0.141	0.142	0.144	0.145	0.146	0.148	0.150	0.150
	N1 %	85.5	86.4	87.2	87.8	88.6	89.5	89.2	90.2
	F FLOW LB/H/ENG	1901	1903	1909	1910	1918	1925	1860	1823
	IAS KT	223	222	221	220	220	219	211	205
40000	TAS KT	277	281	285	288	292	296	290	286
	INDICATED MACH	0.443	0.450	0.458	0.465	0.473	0.481	0.474	0.470
	BUFFET MARGIN G	2.56	2.56	2.56	2.53	2.50	2.47	2.30	2.17
	SR NM/LB	0.146	0.148	0.149	0.151	0.152	0.153	0.155	0.157

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 3 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.7 % AND FUEL FLOW BY 8%.
DECREASE SR BY 7%.

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LONG RANGE CRUISE - ONE ENGINE INOPERATIVE

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: 15000 FT TO 22000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)							
		15000	16000	17000	18000	19000	20000	21000	22000
38000	N1 %	84.1	84.9	85.7	86.6	87.2	88.0	88.9	90.0
	F FLOW LB/H/ENG	1796	1797	1797	1805	1805	1811	1820	1831
	IAS KT	218	217	217	216	215	215	214	214
	TAS KT	272	275	278	283	286	289	293	298
	INDICATED MACH	0.435	0.442	0.449	0.457	0.464	0.472	0.480	0.489
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.53	2.50	2.48	2.45
	SR NM/LB	0.151	0.153	0.155	0.157	0.158	0.160	0.161	0.163
36000	N1 %	82.8	83.5	84.2	85.0	85.9	86.6	87.3	88.2
	F FLOW LB/H/ENG	1696	1695	1695	1693	1698	1699	1704	1711
	IAS KT	214	213	212	211	211	210	209	209
	TAS KT	266	270	273	276	280	283	287	291
	INDICATED MACH	0.427	0.433	0.440	0.447	0.455	0.462	0.470	0.478
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.54	2.51	2.48
	SR NM/LB	0.157	0.159	0.161	0.163	0.165	0.167	0.168	0.170
34000	N1 %	81.3	82.0	82.7	83.5	84.3	85.1	86.0	86.6
	F FLOW LB/H/ENG	1594	1590	1589	1592	1590	1593	1599	1599
	IAS KT	209	208	207	207	206	206	205	204
	TAS KT	260	263	266	270	273	277	281	284
	INDICATED MACH	0.417	0.423	0.430	0.438	0.444	0.452	0.461	0.467
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.52
	SR NM/LB	0.163	0.165	0.168	0.170	0.172	0.174	0.176	0.177
32000	N1 %	79.7	80.5	81.3	81.9	82.7	83.4	84.3	85.2
	F FLOW LB/H/ENG	1496	1493	1492	1489	1488	1488	1489	1494
	IAS KT	204	204	203	202	201	201	200	200
	TAS KT	254	257	261	263	267	270	273	278
	INDICATED MACH	0.407	0.414	0.421	0.427	0.435	0.442	0.449	0.458
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.170	0.172	0.175	0.177	0.179	0.181	0.184	0.186
30000	N1 %	77.9	78.8	79.6	80.3	81.1	81.8	82.6	83.4
	F FLOW LB/H/ENG	1403	1399	1394	1389	1389	1387	1389	1386
	IAS KT	200	199	198	197	196	196	195	194
	TAS KT	248	251	254	257	260	263	267	270
	INDICATED MACH	0.398	0.405	0.411	0.417	0.424	0.431	0.439	0.446
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.177	0.179	0.182	0.185	0.187	0.190	0.192	0.195
28000	N1 %	76.0	76.8	77.7	78.6	79.3	80.1	80.8	81.6
	F FLOW LB/H/ENG	1310	1302	1297	1296	1290	1290	1285	1287
	IAS KT	194	193	193	192	191	191	190	189
	TAS KT	241	244	247	250	253	257	259	263
	INDICATED MACH	0.388	0.394	0.400	0.407	0.413	0.421	0.427	0.434
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.184	0.187	0.190	0.193	0.196	0.199	0.202	0.204

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 3 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.7 % AND FUEL FLOW BY 8%.
DECREASE SR BY 7%.

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LONG RANGE CRUISE - ONE ENGINE INOPERATIVE

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: 23000 FT TO 30000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)							
		23000	24000	25000	26000	27000	28000	29000	30000
	N1 %	-	-	-	-	-	-	-	-
	F FLOW LB/H/ENG	-	-	-	-	-	-	-	-
	IAS KT	-	-	-	-	-	-	-	-
49000	TAS KT	-	-	-	-	-	-	-	-
	INDICATED MACH	-	-	-	-	-	-	-	-
	BUFFET MARGIN G	-	-	-	-	-	-	-	-
	SR NM/LB	-	-	-	-	-	-	-	-
	N1 %	-	-	-	-	-	-	-	-
	F FLOW LB/H/ENG	-	-	-	-	-	-	-	-
	IAS KT	-	-	-	-	-	-	-	-
46000	TAS KT	-	-	-	-	-	-	-	-
	INDICATED MACH	-	-	-	-	-	-	-	-
	BUFFET MARGIN G	-	-	-	-	-	-	-	-
	SR NM/LB	-	-	-	-	-	-	-	-
	N1 %	-	-	-	-	-	-	-	-
	F FLOW LB/H/ENG	-	-	-	-	-	-	-	-
	IAS KT	-	-	-	-	-	-	-	-
44000	TAS KT	-	-	-	-	-	-	-	-
	INDICATED MACH	-	-	-	-	-	-	-	-
	BUFFET MARGIN G	-	-	-	-	-	-	-	-
	SR NM/LB	-	-	-	-	-	-	-	-
	N1 %	-	-	-	-	-	-	-	-
	F FLOW LB/H/ENG	-	-	-	-	-	-	-	-
	IAS KT	-	-	-	-	-	-	-	-
42000	TAS KT	-	-	-	-	-	-	-	-
	INDICATED MACH	-	-	-	-	-	-	-	-
	BUFFET MARGIN G	-	-	-	-	-	-	-	-
	SR NM/LB	-	-	-	-	-	-	-	-
	N1 %	90.5	90.8	-	-	-	-	-	-
	F FLOW LB/H/ENG	1761	1691	-	-	-	-	-	-
	IAS KT	196	183	-	-	-	-	-	-
40000	TAS KT	279	264	-	-	-	-	-	-
	INDICATED MACH	0.460	0.438	-	-	-	-	-	-
	BUFFET MARGIN G	2.00	1.75	-	-	-	-	-	-
	SR NM/LB	0.158	0.156	-	-	-	-	-	-

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 3 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.7 % AND FUEL FLOW BY 8%.
DECREASE SR BY 7%.

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LONG RANGE CRUISE - ONE ENGINE INOPERATIVE

AE3007A1 AND AE3007A1P ENGINES

ALTITUDE: 23000 FT TO 30000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)							
		23000	24000	25000	26000	27000	28000	29000	30000
	N1 %	89.7	90.7	90.9	91.3	-	-	-	-
	F FLOW LB/H/ENG	1756	1711	1646	1577	-	-	-	-
	IAS KT	205	198	187	170	-	-	-	-
38000	TAS KT	290	285	274	254	-	-	-	-
	INDICATED MACH	0.479	0.472	0.456	0.425	-	-	-	-
	BUFFET MARGIN G	2.26	2.11	1.90	1.60	-	-	-	-
	SR NM/LB	0.164	0.166	0.166	0.161	-	-	-	-
	N1 %	89.3	90.3	90.0	91.1	91.3	-	-	-
	F FLOW LB/H/ENG	1721	1713	1643	1603	1543	-	-	-
	IAS KT	209	206	197	190	179	-	-	-
36000	TAS KT	295	296	288	283	271	-	-	-
	INDICATED MACH	0.487	0.492	0.481	0.474	0.456	-	-	-
	BUFFET MARGIN G	2.45	2.39	2.20	2.05	1.83	-	-	-
	SR NM/LB	0.171	0.173	0.174	0.177	0.176	-	-	-
	N1 %	87.4	88.4	89.7	90.7	90.5	91.5	91.7	-
	F FLOW LB/H/ENG	1605	1611	1619	1607	1547	1509	1454	-
	IAS KT	203	203	202	199	191	184	173	-
34000	TAS KT	288	291	295	296	289	284	272	-
	INDICATED MACH	0.476	0.484	0.493	0.496	0.486	0.479	0.462	-
	BUFFET MARGIN G	2.49	2.46	2.43	2.35	2.17	2.02	1.81	-
	SR NM/LB	0.179	0.181	0.182	0.184	0.185	0.188	0.187	-
	N1 %	85.9	86.6	87.5	88.7	90.2	91.1	90.9	91.9
	F FLOW LB/H/ENG	1497	1500	1505	1513	1521	1511	1459	1431
	IAS KT	199	198	197	197	196	194	186	180
32000	TAS KT	281	284	288	292	296	297	291	287
	INDICATED MACH	0.465	0.473	0.481	0.490	0.499	0.503	0.494	0.489
	BUFFET MARGIN G	2.54	2.50	2.47	2.44	2.40	2.33	2.16	2.03
	SR NM/LB	0.188	0.190	0.192	0.193	0.195	0.196	0.198	0.200
	N1 %	84.2	85.0	85.7	86.5	87.6	89.0	90.5	91.7
	F FLOW LB/H/ENG	1389	1393	1397	1400	1406	1414	1424	1434
	IAS KT	194	193	192	192	191	191	190	190
30000	TAS KT	274	278	281	285	289	293	297	301
	INDICATED MACH	0.454	0.462	0.470	0.478	0.486	0.495	0.505	0.515
	BUFFET MARGIN G	2.56	2.56	2.52	2.49	2.45	2.42	2.39	2.35
	SR NM/LB	0.197	0.199	0.201	0.203	0.205	0.207	0.209	0.210
	N1 %	82.4	83.2	84.1	84.8	85.5	86.5	87.6	89.2
	F FLOW LB/H/ENG	1287	1286	1290	1293	1297	1301	1308	1315
	IAS KT	189	188	187	187	186	185	185	184
28000	TAS KT	266	270	273	277	281	285	289	293
	INDICATED MACH	0.442	0.449	0.457	0.465	0.474	0.482	0.491	0.500
	BUFFET MARGIN G	2.56	2.56	2.56	2.54	2.51	2.47	2.44	2.41
	SR NM/LB	0.207	0.210	0.212	0.214	0.217	0.219	0.221	0.223

INCREASE / DECREASE N1% BY 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE FUEL FLOW 1 % PER 5°C ABOVE / BELOW ISA CONDITIONS.
INCREASE / DECREASE TAS BY 3 KT PER 5°C ABOVE / BELOW ISA CONDITIONS.

FOR ANTI-ICE ON:
INCREASE N1 BY 0.7 % AND FUEL FLOW BY 8%.
DECREASE SR BY 7%.

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DRIFTDOWN TABLE

In the event of an engine failure during cruise it will generally be necessary to reduce speed and descent to a lower altitude.

Immediately after engine failure set maximum continuous N1 and allow the airplane to decelerate from the cruise speed to the initial drift down speed shown in the driftdown table. When this speed is achieved start the descend profile.

The airplane should level off at the gross altitude and weight shown in the driftdown table.

NET LEVEL OFF ALTITUDE

Federal regulations require terrain clearance flight planning based on net performance which is the gross (or real) gradient performance degraded by 1.1%.

To estimate the net level off pressure altitude, enter with the gross weight, proceed to the ISA deviation, and find the value within bracket. This is the net level off pressure altitude. The net level off geometric altitude must clear all en-route obstacle by at least 1000 ft.

In case the obstacles heights are close to the values published in the following tables, a detailed driftdown analysis must be accomplished.

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DRIFTDOWN TABLE
EMB-145 - AE3007A1 AND AE3007A1P ENGINES - FAA CERTIFICATION
BLEEDS ON/ANTI ICE OFF

WEIGHT (LB)		INITIAL DRIFTDOWN SPEED (KIAS)	GROSS LEVEL OFF ALTITUDE - FT (NET LEVEL OFF ALTITUDE - FT)		
START DRIFTDOWN	LEVEL OFF		ISA +10 & BELOW	ISA +15	ISA +20
50000	48000	179	17900 (13800)	17700 (13700)	17400 (12900)
48000	46100	176	19100 (14400)	19000 (14300)	18800 (14000)
46000	44200	172	20770 (16010)	20640 (15930)	20220 (15690)
44000	42300	169	22030 (17490)	21880 (17390)	21470 (17180)
42000	40500	165	23430 (19400)	23050 (19250)	22710 (18760)
40000	38700	161	24860 (21055)	24520 (20910)	23950 (20410)
38000	36900	157	26440 (22460)	26170 (22260)	25470 (21950)
36000	34900	154	28150 (24110)	27520 (23730)	26920 (23250)
34000	33000	149	29820 (25850)	29220 (25560)	28260 (24890)
32000	31100	145	31870 (27550)	30784 (27000)	29680 (26410)

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DRIFTDOWN TABLE
EMB-145 - AE3007A1 AND AE3007A1P ENGINES - FAA CERTIFICATION
BLEEDS ON/ANTI ICE ON

WEIGHT (LB)		INITIAL DRIFT DOWN SPEED (KIAS)	GROSS LEVEL OFF ALTITUDE - FT (NET LEVEL OFF ALTITUDE - FT)				
START DRIFT DOWN	LEVEL OFF		ISA-10 & BELOW	ISA-5	ISA	ISA +5	ISA +10
50000	47400	179	14100 (10000)	13900 (9900)	13100 (9400)	11500 (6800)	9900 (6000)
48000	45700	176	15700 (11500)	15500 (11400)	14500 (10900)	12800 (8800)	11300 (7500)
46000	43600	173	17190 (13220)	17090 (13030)	15980 (12280)	14260 (10670)	12630 (8550)
44000	42000	169	18730 (14620)	18540 (14410)	17480 (13460)	15620 (11890)	13850 (10330)
42000	40100	165	20390 (16150)	20200 (15940)	19200 (14940)	17370 (13260)	15350 (11750)
40000	38200	161	21790 (17840)	21450 (17780)	20600 (16620)	18920 (14830)	16960 (13220)
38000	36300	158	23180 (19780)	22730 (19570)	21840 (18350)	20540 (16590)	18450 (14670)
36000	34400	154	24590 (21390)	24300 (21050)	23150 (20270)	21850 (18450)	20010 (16400)
34000	32600	149	26080 (22990)	25340 (22580)	24420 (21670)	23190 (20370)	21410 (18250)
32000	30700	145	27370 (24460)	26550 (23900)	25660 (23020)	24390 (21700)	22690 (19810)

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HOLDING

The holding tables show indicated airspeed, mach number, N1, fuel flow and fuel consumption for various weights and altitudes. Data are presented in ISA condition for all engines operating and one engine inoperative configuration. For both conditions, tables for anti-ice on (with and without ice accretion) and off are provided.

The associated conditions are:

- Flaps.....UP
- Gears.....UP
- Bleeds .....OPEN
- Airspeed .....1.3 V_S or 200 KIAS
- Anti-Ice .....ON or OFF

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HOLDING - ONE ENGINE INOPERATIVE

AE3007A1 AND AE3007A1P ENGINES

CRUISE CONFIGURATION
BLEED: OPEN
ANTI-ICE: OFF
MINIMUM FUEL CONSUMPTION SPEED
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)								
			0	5000	10000	15000	20000	25000	30000	35000	37000
	IAS	KT	179	174	171	169	-	-	-	-	-
	TAS	KT	178.6	187	197.8	211.7	-	-	-	-	-
49000	Mach		0.27	0.288	0.311	0.339	-	-	-	-	-
	N1	%	74.3	78.4	83.1	87.4	-	-	-	-	-
	FF	LB/H/ENG	1931	1925	1946	1995	-	-	-	-	-
	FC	LB/H	1931	1925	1946	1995	-	-	-	-	-
	IAS	KT	175	170	167	165	164	-	-	-	-
	TAS	KT	174.9	182.6	192.6	205.5	222.2	-	-	-	-
46000	Mach		0.265	0.282	0.303	0.329	0.363	-	-	-	-
	N1	%	72.6	76.4	81.1	85.6	90.9	-	-	-	-
	FF	LB/H/ENG	1809	1796	1807	1845	1910	-	-	-	-
	FC	LB/H	1809	1796	1807	1845	1910	-	-	-	-
	IAS	KT	173	168	164	161	161	-	-	-	-
	TAS	KT	172.3	179.6	189.1	201.3	217.1	-	-	-	-
44000	Mach		0.261	0.277	0.298	0.323	0.355	-	-	-	-
	N1	%	71.3	75.1	79.7	84.3	89	-	-	-	-
	FF	LB/H/ENG	1730	1711	1717	1747	1804	-	-	-	-
	FC	LB/H	1730	1711	1717	1747	1804	-	-	-	-
	IAS	KT	170	165	161	158	157	-	-	-	-
	TAS	KT	169.7	176.7	185.6	197.1	212.1	-	-	-	-
42000	Mach		0.258	0.273	0.292	0.316	0.347	-	-	-	-
	N1	%	70	73.8	78.2	82.8	87.3	-	-	-	-
	FF	LB/H/ENG	1653	1629	1629	1652	1700	-	-	-	-
	FC	LB/H	1653	1629	1629	1652	1700	-	-	-	-
	IAS	KT	168	162	158	155	153	-	-	-	-
	TAS	KT	167.2	173.7	182.1	193	207.1	-	-	-	-
40000	Mach		0.254	0.269	0.287	0.31	0.339	-	-	-	-
	N1	%	68.6	72.5	76.6	81.4	85.8	-	-	-	-
	FF	LB/H/ENG	1577	1548	1542	1559	1599	-	-	-	-
	FC	LB/H	1577	1548	1542	1559	1599	-	-	-	-
	IAS	KT	166	160	155	152	150	150	-	-	-
	TAS	KT	164.7	170.7	178.5	188.7	202	219.3	-	-	-
38000	Mach		0.25	0.264	0.282	0.304	0.331	0.367	-	-	-
	N1	%	67.3	71.1	75	79.8	84.4	90.1	-	-	-
	FF	LB/H/ENG	1503	1469	1457	1468	1501	1558	-	-	-
	FC	LB/H	1503	1469	1457	1468	1501	1558	-	-	-

NOTE: MACH setting and FF KG/H/ENG remain constant, regardless of the temperature change.

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HOLDING - ONE ENGINE INOPERATIVE

AE3007A1 AND AE3007A1P ENGINES

CRUISE CONFIGURATION
BLEED: OPEN
ANTI-ICE: OFF
MINIMUM FUEL CONSUMPTION SPEED
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)								
			0	5000	10000	15000	20000	25000	30000	35000	37000
	IAS	KT	163	157	152	148	146	145	-	-	-
	TAS	KT	162.2	167.7	175	184.6	197	213.3	-	-	-
36000	Mach		0.247	0.26	0.276	0.297	0.324	0.357	-	-	-
	N1	%	65.7	69.6	73.5	78.1	82.8	87.8	-	-	-
	FF	LB/H/ENG	1430	1391	1375	1379	1405	1453	-	-	-
	FC	LB/H	1430	1391	1375	1379	1405	1453	-	-	-
	IAS	KT	161	154	149	145	142	141	-	-	-
	TAS	KT	159.7	164.8	171.6	180.5	192.2	207.4	-	-	-
34000	Mach		0.243	0.256	0.271	0.291	0.316	0.348	-	-	-
	N1	%	64.2	68	71.9	76.3	81.1	85.6	-	-	-
	FF	LB/H/ENG	1359	1316	1294	1292	1311	1351	-	-	-
	FC	LB/H	1359	1316	1294	1292	1311	1351	-	-	-
	IAS	KT	158	152	146	142	139	137	138	-	-
	TAS	KT	157.1	161.9	168.2	176.5	187.3	201.5	220.1	-	-
32000	Mach		0.24	0.251	0.266	0.284	0.308	0.338	0.377	-	-
	N1	%	62.6	66.4	70.3	74.4	79.3	83.8	90.3	-	-
	FF	LB/H/ENG	1290	1242	1215	1208	1220	1252	1306	-	-
	FC	LB/H	1290	1242	1215	1208	1220	1252	1306	-	-
	IAS	KT	156	149	143	139	135	133	133	-	-
	TAS	KT	154.7	159	164.8	172.4	182.5	195.6	212.8	-	-
30000	Mach		0.236	0.247	0.261	0.278	0.3	0.328	0.365	-	-
	N1	%	60.9	64.6	68.6	72.5	77.3	82.1	87.6	-	-
	FF	LB/H/ENG	1223	1170	1138	1126	1131	1156	1200	-	-
	FC	LB/H	1223	1170	1138	1126	1131	1156	1200	-	-
	IAS	KT	154	146	140	135	132	129	128	129	-
	TAS	KT	152.3	156.2	161.4	168.4	177.6	189.6	205.6	226.7	-
28000	Mach		0.232	0.243	0.255	0.271	0.292	0.318	0.353	0.397	-
	N1	%	59.2	62.8	66.7	70.7	75.2	80	84.9	92.7	-
	FF	LB/H/ENG	1159	1101	1064	1046	1045	1063	1098	1152	-
	FC	LB/H	1159	1101	1064	1046	1045	1063	1098	1152	-
	IAS	KT	151	144	137	132	128	125	124	124	125
	TAS	KT	149.9	153.4	158.1	164.3	172.7	183.7	198.3	217.7	228.1
26000	Mach		0.229	0.238	0.25	0.265	0.284	0.309	0.34	0.382	0.402
	N1	%	56.2	60.9	64.7	68.7	72.9	77.9	82.5	89.1	93.5
	FF	LB/H/ENG	1048	1034	992	969	962	973	1000	1047	1072
	FC	LB/H	1048	1034	992	969	962	973	1000	1047	1072

NOTE: MACH setting and FF KG/H/ENG remain constant, regardless of the temperature change.

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HOLDING - ONE ENGINE INOPERATIVE

AE3007A1 AND AE3007A1P ENGINES

CRUISE CONFIGURATION
BLEED: OPEN
ANTI-ICE: ON (WITH ICE ACCRETION)
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)								
			0	5000	10000	15000	20000	25000	30000	35000	37000
	IAS	KT	200	200	200	200	-	-	-	-	-
	TAS	KT	200.3	215.3	231.9	250.4	-	-	-	-	-
49000	Mach		0.302	0.331	0.363	0.399	-	-	-	-	-
	N1	%	74.9	78.9	83.3	87.6	-	-	-	-	-
	FF	LB/H/ENG	2130	2110	2118	2159	-	-	-	-	-
	FC	LB/H	2130	2110	2118	2159	-	-	-	-	-
	IAS	KT	200	200	200	200	-	-	-	-	-
	TAS	KT	200	215	231.6	250	-	-	-	-	-
46000	Mach		0.302	0.331	0.363	0.399	-	-	-	-	-
	N1	%	73.6	77.3	81.7	86.2	-	-	-	-	-
	FF	LB/H/ENG	2028	2003	2003	2033	-	-	-	-	-
	FC	LB/H	2028	2003	2003	2033	-	-	-	-	-
	IAS	KT	200	200	200	200	-	-	-	-	-
	TAS	KT	199.8	214.8	231.4	249.8	-	-	-	-	-
44000	Mach		0.302	0.331	0.363	0.399	-	-	-	-	-
	N1	%	72.6	76.3	80.7	85.2	-	-	-	-	-
	FF	LB/H/ENG	1963	1935	1930	1954	-	-	-	-	-
	FC	LB/H	1963	1935	1930	1954	-	-	-	-	-
	IAS	KT	200	200	200	200	200	-	-	-	-
	TAS	KT	199.6	214.6	231.1	249.6	270	-	-	-	-
42000	Mach		0.302	0.331	0.363	0.399	0.44	-	-	-	-
	N1	%	71.7	75.3	79.7	84.1	88.3	-	-	-	-
	FF	LB/H/ENG	1902	1870	1861	1879	1931	-	-	-	-
	FC	LB/H	1902	1870	1861	1879	1931	-	-	-	-
	IAS	KT	200	200	200	200	200	-	-	-	-
	TAS	KT	199.4	214.4	230.9	249.3	269.8	-	-	-	-
40000	Mach		0.302	0.331	0.363	0.399	0.44	-	-	-	-
	N1	%	70.8	74.4	78.6	83.1	87.3	-	-	-	-
	FF	LB/H/ENG	1843	1809	1796	1808	1852	-	-	-	-
	FC	LB/H	1843	1809	1796	1808	1852	-	-	-	-
	IAS	KT	200	200	200	200	200	-	-	-	-
	TAS	KT	199.2	214.2	230.7	249.1	269.5	-	-	-	-
38000	Mach		0.302	0.331	0.363	0.399	0.44	-	-	-	-
	N1	%	69.9	73.5	77.6	82	86.3	-	-	-	-
	FF	LB/H/ENG	1788	1750	1733	1741	1778	-	-	-	-
	FC	LB/H	1788	1750	1733	1741	1778	-	-	-	-

NOTE: MACH setting and FF KG/H/ENG remain constant, regardless of the temperature change.

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HOLDING - ONE ENGINE INOPERATIVE

AE3007A1 AND AE3007A1P ENGINES

CRUISE CONFIGURATION
BLEED: OPEN
ANTI-ICE: ON (WITH ICE ACCRETION)
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)								
			0	5000	10000	15000	20000	25000	30000	35000	37000
	IAS	KT	200	200	200	200	200	-	-	-	-
	TAS	KT	199.1	214	230.5	248.9	269.3	-	-	-	-
36000	Mach		0.302	0.331	0.363	0.399	0.44	-	-	-	-
	N1	%	69	72.7	76.5	81	85.4	-	-	-	-
	FF	LB/H/ENG	1735	1695	1675	1677	1708	-	-	-	-
	FC	LB/H	1735	1695	1675	1677	1708	-	-	-	-
	IAS	KT	200	200	200	200	200	-	-	-	-
	TAS	KT	198.9	213.8	230.3	248.6	269.1	-	-	-	-
34000	Mach		0.302	0.331	0.363	0.399	0.44	-	-	-	-
	N1	%	68.1	71.7	75.5	80.1	84.4	-	-	-	-
	FF	LB/H/ENG	1685	1643	1619	1617	1642	-	-	-	-
	FC	LB/H	1685	1643	1619	1617	1642	-	-	-	-
	IAS	KT	200	200	200	200	200	-	-	-	-
	TAS	KT	198.7	213.6	230.1	248.4	268.8	-	-	-	-
32000	Mach		0.302	0.331	0.363	0.399	0.44	-	-	-	-
	N1	%	67.2	70.9	74.6	79.2	83.4	-	-	-	-
	FF	LB/H/ENG	1637	1593	1567	1561	1580	-	-	-	-
	FC	LB/H	1637	1593	1567	1561	1580	-	-	-	-
	IAS	KT	200	200	200	200	200	200	-	-	-
	TAS	KT	198.5	213.4	229.9	248.2	268.6	291.3	-	-	-
30000	Mach		0.302	0.331	0.363	0.399	0.44	0.487	-	-	-
	N1	%	66.3	70	73.7	78.2	82.4	86.7	-	-	-
	FF	LB/H/ENG	1593	1546	1517	1508	1521	1564	-	-	-
	FC	LB/H	1593	1546	1517	1508	1521	1564	-	-	-
	IAS	KT	200	200	200	200	200	200	-	-	-
	TAS	KT	198.3	213.2	229.7	248	268.3	291.1	-	-	-
28000	Mach		0.302	0.331	0.363	0.399	0.44	0.487	-	-	-
	N1	%	65.5	69.2	72.9	77.1	81.4	85.8	-	-	-
	FF	LB/H/ENG	1551	1503	1471	1458	1467	1503	-	-	-
	FC	LB/H	1551	1503	1471	1458	1467	1503	-	-	-
	IAS	KT	200	200	200	200	200	200	-	-	-
	TAS	KT	198.2	213.1	229.5	247.8	268.2	290.9	-	-	-
26000	Mach		0.302	0.331	0.363	0.399	0.44	0.487	-	-	-
	N1	%	62.7	68.4	72.1	76.1	80.5	84.8	-	-	-
	FF	LB/H/ENG	1427	1462	1428	1411	1416	1446	-	-	-
	FC	LB/H	1427	1462	1428	1411	1416	1446	-	-	-

NOTE: MACH setting and FF KG/H/ENG remain constant, regardless of the temperature change.

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FLIGHT WITH LANDING GEAR DOWN

This section presents climb, cruise, descent and holding data for flight with all engines operating and the landing gear locked down.

This set of data may be used in the following situations:

- Dispatch of the airplane with the landing gear down. In this case, the applicable AFM supplement must be observed for takeoff, driftdown and landing performance penalties.
- On board flight planning in case of landing gear not retracting after takeoff.

OPERATIONAL LIMITATIONS

AIRSPEED

Maximum Operating Limit Speed ..... 250 KIAS

NOTE: The nose landing gear doors must be installed.

TEMPERATURE

Minimum Operating Temperature..... -40°C (SAT)

KINDS OF OPERATION

The ferry flight is authorized only under the following conditions:

- No icing;

- Visual (VFR)
- Instrument (IFR).

OCCUPANTS

In ferry flight, no passengers are allowed on board.

FLAPS

For ferry flight:
Takeoff Flaps..... 9°

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EMERGENCY AND ABNORMAL PROCEDURES

The Emergency and Abnormal Procedures remain unchanged, except that all procedures will be performed with landing gear down.

NORMAL PROCEDURES

The Normal Procedures remain unchanged, except that all procedures will be performed with the landing gear down and during the cruise phase the fuel quantity should be monitored throughout the flight.

CLIMB - FLIGHT WITH LANDING GEAR DOWN

The climb planning tables show fuel consumption, distance, and time elapsed from the Sea Level to the top of climb. Data is shown for various weights, ISA deviations and cruise altitudes.
The tables are based on a fixed climb speed of 150 KIAS.

The associated conditions are:

- Thrust Mode ..... CLB
- Flaps..... UP
- Landing Gear..... DOWN
- Bleeds..... OPEN
- Anti-Ice ..... OFF
- Airspeed ..... 150 KIAS

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CLIMB PLANNING - FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 5000 AND 6000 FT

SPEED SCHEDULE: 150 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			5000 FT ISA + °C					6000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	273	284	295	311	372	329	342	356	376	451
	DISTANCE	NM	8	9	9	10	13	10	11	11	12	16
	TIME	MIN	3	3	4	4	5	4	4	4	5	6
46000	FUEL	LB	231	239	249	261	307	278	288	300	314	371
	DISTANCE	NM	7	7	8	8	11	9	9	10	10	13
	TIME	MIN	3	3	3	3	4	4	4	4	4	5
42000	FUEL	LB	195	203	211	220	254	235	244	253	265	307
	DISTANCE	NM	6	6	7	7	9	7	8	8	9	11
	TIME	MIN	2	2	3	3	3	3	3	3	3	4
38000	FUEL	LB	166	172	179	187	212	199	207	215	224	256
	DISTANCE	NM	5	5	6	6	7	6	7	7	7	9
	TIME	MIN	2	2	2	2	3	3	3	3	3	3
34000	FUEL	LB	140	146	151	158	177	168	175	182	189	213
	DISTANCE	NM	4	5	5	5	6	5	6	6	6	8
	TIME	MIN	2	2	2	2	2	2	2	2	2	3
30000	FUEL	LB	118	123	127	133	148	142	147	153	159	177
	DISTANCE	NM	4	4	4	4	5	4	5	5	5	6
	TIME	MIN	1	2	2	2	2	2	2	2	2	2
26000	FUEL	LB	98	102	106	110	122	118	122	127	132	146
	DISTANCE	NM	3	3	3	3	4	4	4	4	4	5
	TIME	MIN	1	1	1	1	2	1	2	2	2	2

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CLIMB PLANNING - FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 7000 AND 8000 FT

SPEED SCHEDULE: 150 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			7000 FT ISA + °C					8000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	387	402	418	441	532	445	462	481	508	616
	DISTANCE	NM	12	13	13	14	19	15	15	16	17	23
	TIME	MIN	5	5	5	5	7	6	6	6	6	8
46000	FUEL	LB	325	338	351	368	437	374	388	403	423	504
	DISTANCE	NM	11	11	11	12	16	12	13	13	14	19
	TIME	MIN	4	4	4	5	6	5	5	5	5	7
42000	FUEL	LB	275	285	296	310	360	315	327	340	355	414
	DISTANCE	NM	9	9	10	10	13	10	11	11	12	16
	TIME	MIN	4	4	4	4	5	4	4	4	4	6
38000	FUEL	LB	233	241	251	262	299	266	276	287	300	343
	DISTANCE	NM	7	8	8	9	11	9	9	9	10	13
	TIME	MIN	3	3	3	3	4	3	4	4	4	5
34000	FUEL	LB	197	204	212	221	249	225	233	242	253	286
	DISTANCE	NM	6	7	7	7	9	7	8	8	8	11
	TIME	MIN	3	3	3	3	3	3	3	3	3	4
30000	FUEL	LB	165	172	178	186	207	189	196	204	212	237
	DISTANCE	NM	5	5	6	6	8	6	6	7	7	9
	TIME	MIN	2	2	2	2	3	2	2	3	3	3
26000	FUEL	LB	137	143	148	154	171	157	163	169	176	195
	DISTANCE	NM	4	5	5	5	6	5	5	5	6	7
	TIME	MIN	2	2	2	2	2	2	2	2	2	3

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CLIMB PLANNING - FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 9000 AND 10000 FT

SPEED SCHEDULE: 150 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			9000 FT ISA + °C					10000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	504	524	545	576	702	565	587	611	646	791
	DISTANCE	NM	17	17	18	20	27	19	20	21	22	31
	TIME	MIN	7	7	7	7	10	7	8	8	8	11
46000	FUEL	LB	422	439	456	478	572	472	490	510	535	643
	DISTANCE	NM	14	15	15	16	22	16	17	18	19	25
	TIME	MIN	6	6	6	6	8	6	6	7	7	9
42000	FUEL	LB	355	369	384	401	469	396	412	428	448	525
	DISTANCE	NM	12	12	13	14	18	14	14	15	16	21
	TIME	MIN	5	5	5	5	7	5	5	5	6	7
38000	FUEL	LB	300	311	324	338	388	334	347	361	377	434
	DISTANCE	NM	10	10	11	11	15	11	12	12	13	17
	TIME	MIN	4	4	4	4	5	4	5	5	5	6
34000	FUEL	LB	253	263	273	285	322	281	292	304	317	359
	DISTANCE	NM	8	9	9	10	12	10	10	10	11	14
	TIME	MIN	3	3	3	4	4	4	4	4	4	5
30000	FUEL	LB	212	220	229	239	267	236	245	255	265	297
	DISTANCE	NM	7	7	8	8	10	8	8	9	9	12
	TIME	MIN	3	3	3	3	4	3	3	3	3	4
26000	FUEL	LB	176	183	190	198	220	196	203	211	220	244
	DISTANCE	NM	6	6	6	7	8	7	7	7	7	9
	TIME	MIN	2	2	2	2	3	3	3	3	3	3

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CLIMB PLANNING - FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 11000 AND 12000 FT

SPEED SCHEDULE: 150 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			11000 FT ISA + °C					12000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	628	652	679	718	885	692	719	748	792	983
	DISTANCE	NM	22	23	24	25	35	25	26	27	29	40
	TIME	MIN	8	9	9	9	13	9	10	10	10	14
46000	FUEL	LB	523	543	565	592	715	574	597	621	651	790
	DISTANCE	NM	18	19	20	21	29	21	21	22	24	32
	TIME	MIN	7	7	7	8	10	8	8	8	8	11
42000	FUEL	LB	438	455	473	495	582	480	499	518	543	641
	DISTANCE	NM	15	16	17	18	23	17	18	19	20	26
	TIME	MIN	6	6	6	6	8	7	7	7	7	9
38000	FUEL	LB	368	383	398	416	480	403	419	435	455	526
	DISTANCE	NM	13	13	14	15	19	14	15	16	16	21
	TIME	MIN	5	5	5	5	7	5	6	6	6	8
34000	FUEL	LB	310	322	335	349	397	338	352	366	382	435
	DISTANCE	NM	11	11	12	12	16	12	12	13	14	18
	TIME	MIN	4	4	4	4	6	5	5	5	5	6
30000	FUEL	LB	259	270	280	292	328	283	294	306	319	359
	DISTANCE	NM	9	9	10	10	13	10	10	11	11	14
	TIME	MIN	3	4	4	4	5	4	4	4	4	5
26000	FUEL	LB	215	223	232	242	269	235	244	253	264	294
	DISTANCE	NM	7	8	8	8	11	8	9	9	9	12
	TIME	MIN	3	3	3	3	4	3	3	3	3	4

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CLIMB PLANNING - FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 13000 AND 14000 FT

SPEED SCHEDULE: 150 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			13000 FT ISA + °C					14000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	758	788	820	869	1087	827	860	895	949	1198
	DISTANCE	NM	28	29	30	32	45	31	32	33	36	51
	TIME	MIN	10	11	11	11	16	11	12	12	13	18
46000	FUEL	LB	627	652	678	711	869	681	708	737	774	950
	DISTANCE	NM	23	24	25	26	36	25	27	28	29	41
	TIME	MIN	9	9	9	9	13	9	10	10	10	14
42000	FUEL	LB	523	543	565	592	701	566	589	612	642	764
	DISTANCE	NM	19	20	21	22	29	21	22	23	24	33
	TIME	MIN	7	7	7	8	10	8	8	8	9	11
38000	FUEL	LB	438	455	473	495	574	474	492	512	536	623
	DISTANCE	NM	16	17	17	18	24	18	18	19	20	27
	TIME	MIN	6	6	6	7	8	7	7	7	7	9
34000	FUEL	LB	367	382	397	415	473	397	412	429	448	512
	DISTANCE	NM	13	14	14	15	20	15	15	16	17	22
	TIME	MIN	5	5	5	5	7	6	6	6	6	8
30000	FUEL	LB	307	319	332	346	390	331	344	358	373	421
	DISTANCE	NM	11	11	12	13	16	12	13	13	14	18
	TIME	MIN	4	4	4	5	6	5	5	5	5	6
26000	FUEL	LB	254	264	274	286	319	274	285	296	308	344
	DISTANCE	NM	9	9	10	10	13	10	10	11	11	14
	TIME	MIN	3	4	4	4	5	4	4	4	4	5

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CLIMB PLANNING - FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 15000 AND 16000 FT

SPEED SCHEDULE: 150 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			15000 FT ISA + °C					16000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	899	935	973	1033	1317	975	1014	1054	1122	1447
	DISTANCE	NM	34	36	37	40	58	38	39	41	45	65
	TIME	MIN	13	13	13	14	20	14	14	15	15	22
46000	FUEL	LB	738	767	798	838	1036	795	827	860	905	1127
	DISTANCE	NM	28	29	31	33	46	31	32	34	36	51
	TIME	MIN	10	11	11	11	16	11	12	12	12	17
42000	FUEL	LB	611	635	661	693	828	657	683	710	745	896
	DISTANCE	NM	23	24	25	27	36	26	27	28	29	40
	TIME	MIN	9	9	9	9	12	9	10	10	10	14
38000	FUEL	LB	510	530	551	577	674	547	569	591	619	726
	DISTANCE	NM	19	20	21	22	29	21	22	23	24	32
	TIME	MIN	7	7	7	8	10	8	8	8	8	11
34000	FUEL	LB	426	443	461	482	552	456	475	493	516	593
	DISTANCE	NM	16	17	17	18	24	18	18	19	20	26
	TIME	MIN	6	6	6	6	8	6	7	7	7	9
30000	FUEL	LB	355	369	384	401	453	380	395	411	429	486
	DISTANCE	NM	13	14	14	15	20	15	15	16	17	21
	TIME	MIN	5	5	5	5	7	5	5	6	6	7
26000	FUEL	LB	293	305	317	331	370	313	326	339	353	396
	DISTANCE	NM	11	11	12	12	16	12	12	13	14	17
	TIME	MIN	4	4	4	4	5	4	5	5	5	6

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CLIMB PLANNING - FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 17000 AND 18000 FT

SPEED SCHEDULE: 150 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			17000 FT ISA + °C					18000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	1053	1095	1139	1214	1589	1133	1178	1226	1310	1744
	DISTANCE	NM	42	44	46	49	74	46	48	50	55	83
	TIME	MIN	15	16	16	17	25	17	17	17	19	27
46000	FUEL	LB	855	889	925	975	1225	916	953	991	1046	1329
	DISTANCE	NM	34	36	37	40	57	38	39	41	44	63
	TIME	MIN	12	13	13	14	19	13	14	14	15	21
42000	FUEL	LB	704	732	761	799	967	751	781	813	855	1040
	DISTANCE	NM	28	29	30	32	44	31	32	33	35	49
	TIME	MIN	10	10	11	11	15	11	11	11	12	16
38000	FUEL	LB	584	608	632	662	779	622	647	673	706	835
	DISTANCE	NM	23	24	25	27	36	25	26	27	29	39
	TIME	MIN	8	9	9	9	12	9	9	9	10	13
34000	FUEL	LB	487	506	526	551	635	517	538	559	586	678
	DISTANCE	NM	19	20	21	22	29	21	22	23	24	32
	TIME	MIN	7	7	7	8	10	8	8	8	8	10
30000	FUEL	LB	404	421	437	457	519	429	446	464	485	553
	DISTANCE	NM	16	16	17	18	23	17	18	19	20	26
	TIME	MIN	6	6	6	6	8	6	6	7	7	9
26000	FUEL	LB	333	347	360	376	422	353	368	382	399	449
	DISTANCE	NM	13	13	14	15	19	14	15	15	16	21
	TIME	MIN	5	5	5	5	6	5	5	5	6	7

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CLIMB PLANNING - FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 19000 AND 20000 FT

SPEED SCHEDULE: 150 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			19000 FT ISA + °C					20000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	1215	1263	1314	1408	1908	1297	1349	1403	1506	2073
	DISTANCE	NM	51	53	55	60	94	55	58	60	66	104
	TIME	MIN	18	18	19	20	30	19	20	20	22	34
46000	FUEL	LB	977	1016	1057	1118	1435	1038	1080	1124	1190	1543
	DISTANCE	NM	41	43	44	48	70	44	46	48	52	77
	TIME	MIN	14	15	15	16	23	16	16	16	17	25
42000	FUEL	LB	798	831	864	910	1116	846	880	915	966	1191
	DISTANCE	NM	33	35	36	39	54	36	37	39	42	59
	TIME	MIN	12	12	12	13	18	13	13	13	14	19
38000	FUEL	LB	660	686	714	750	891	697	725	755	794	947
	DISTANCE	NM	27	28	30	32	43	29	31	32	34	46
	TIME	MIN	10	10	10	11	14	10	11	11	11	15
34000	FUEL	LB	547	570	592	621	721	578	601	625	656	764
	DISTANCE	NM	22	23	24	26	34	24	25	26	28	37
	TIME	MIN	8	8	8	9	11	9	9	9	9	12
30000	FUEL	LB	454	472	491	514	587	478	498	517	542	621
	DISTANCE	NM	19	19	20	21	28	20	21	22	23	30
	TIME	MIN	7	7	7	7	9	7	7	7	8	10
26000	FUEL	LB	373	388	404	422	476	393	409	425	445	502
	DISTANCE	NM	15	16	16	17	22	16	17	18	19	24
	TIME	MIN	5	6	6	6	7	6	6	6	6	8

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CLIMB PLANNING - FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 21000 AND 22000 FT

SPEED SCHEDULE: 150 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			21000 FT ISA + °C					22000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
	FUEL	LB	1382	1438	1496	1609	-	1475	1535	1596	1722	-
50000	DISTANCE	NM	60	63	65	72	-	66	68	71	79	-
	TIME	MIN	21	21	22	24	-	23	23	24	25	-
	FUEL	LB	1101	1146	1192	1265	1656	1168	1215	1264	1345	1781
46000	DISTANCE	NM	48	50	52	56	85	52	54	56	61	94
	TIME	MIN	17	17	17	18	27	18	18	19	20	29
	FUEL	LB	894	930	968	1022	1269	944	983	1023	1082	1352
42000	DISTANCE	NM	39	40	42	45	64	42	43	45	49	70
	TIME	MIN	13	14	14	15	21	14	15	15	16	22
	FUEL	LB	735	765	796	838	1004	775	806	839	884	1065
38000	DISTANCE	NM	32	33	34	37	50	34	35	37	39	54
	TIME	MIN	11	11	12	12	16	12	12	12	13	17
	FUEL	LB	608	633	658	691	808	639	666	692	728	854
34000	DISTANCE	NM	26	27	28	30	40	28	29	30	32	43
	TIME	MIN	9	9	9	10	13	10	10	10	11	14
	FUEL	LB	503	523	544	571	655	528	549	571	600	690
30000	DISTANCE	NM	21	22	23	25	32	23	24	25	26	35
	TIME	MIN	8	8	8	8	10	8	8	8	9	11
	FUEL	LB	413	429	447	468	529	433	450	469	491	556
26000	DISTANCE	NM	17	18	19	20	26	19	19	20	21	28
	TIME	MIN	6	6	6	7	8	7	7	7	7	9

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CLIMB PLANNING - FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 23000 AND 24000 FT

SPEED SCHEDULE: 150 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			23000 FT ISA + °C					24000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
50000	FUEL	LB	1577	1641	1707	1848	-	1692	1760	1830	1994	-
	DISTANCE	NM	72	75	78	87	-	79	83	86	96	-
	TIME	MIN	24	25	26	28	-	27	27	28	30	-
46000	FUEL	LB	1240	1290	1342	1432	1921	1318	1372	1427	1527	2084
	DISTANCE	NM	56	59	61	67	104	62	64	67	73	116
	TIME	MIN	19	20	20	21	32	21	21	22	23	35
42000	FUEL	LB	997	1038	1080	1145	1442	1054	1097	1141	1212	1541
	DISTANCE	NM	45	47	49	53	76	49	51	53	57	84
	TIME	MIN	15	16	16	17	24	16	17	17	18	26
38000	FUEL	LB	815	849	883	932	1128	858	893	930	983	1195
	DISTANCE	NM	36	38	40	43	59	39	41	43	46	64
	TIME	MIN	12	13	13	14	19	13	14	14	15	20
34000	FUEL	LB	672	699	727	765	901	705	734	764	805	950
	DISTANCE	NM	30	31	32	35	47	32	33	35	37	50
	TIME	MIN	10	10	11	11	15	11	11	11	12	16
30000	FUEL	LB	553	576	599	629	726	580	604	628	660	763
	DISTANCE	NM	24	25	26	28	37	26	27	28	30	40
	TIME	MIN	8	9	9	9	12	9	9	9	10	13
26000	FUEL	LB	453	472	491	514	584	474	494	513	539	613
	DISTANCE	NM	20	21	21	23	30	21	22	23	25	32
	TIME	MIN	7	7	7	8	10	7	7	8	8	10

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CLIMB PLANNING - FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 25000 FT

SPEED SCHEDULE: 150 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			25000 FT ISA + °C				
			-19	-10	0	10	20
50000	FUEL	LB	1835	1900	1974	-	-
	DISTANCE	NM	89	92	96	-	-
	TIME	MIN	29	30	30	-	-
46000	FUEL	LB	1405	1463	1521	1633	-
	DISTANCE	NM	68	70	73	81	-
	TIME	MIN	22	23	23	25	-
42000	FUEL	LB	1115	1161	1207	1285	1650
	DISTANCE	NM	53	55	57	62	93
	TIME	MIN	18	18	18	20	28
38000	FUEL	LB	903	941	979	1036	1268
	DISTANCE	NM	42	44	46	50	70
	TIME	MIN	14	14	15	16	21
34000	FUEL	LB	740	770	801	845	1002
	DISTANCE	NM	34	36	37	40	54
	TIME	MIN	12	12	12	13	17
30000	FUEL	LB	607	632	658	692	802
	DISTANCE	NM	28	29	30	33	43
	TIME	MIN	9	10	10	10	13
26000	FUEL	LB	495	516	537	563	643
	DISTANCE	NM	23	24	25	26	34
	TIME	MIN	8	8	8	8	11

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CRUISE - FLIGHT WITH LANDING GEAR DOWN

The Long Range Cruise and Maximum Speed Cruise tables show N1, fuel flow, indicated airspeed, true airspeed, indicated Mach number, buffet margin and specific range. Data is presented for ISA conditions and various weights, with corrections for ISA deviations.

In the Long Range Cruise schedule, all engines operating, the airplane is flown at a speed corresponding to a specific range equal to 99% of the maximum specific range. The LRC schedule is used when range is the main factor considered.

In the Maximum Speed Cruise schedule, the airplane is flown in a speed resulting from maximum cruise power setting or Vmo/Mmo, whichever is lower. It is used when minimum flight time is desired.

The associated conditions are:

- Flaps..... UP
- Landing Gear..... DOWN
- Bleeds..... OPEN
- Anti-Ice ..... OFF

The associated corrections for ISA deviation are:

- Increase/decrease N1% by 1% per 5°C above/below ISA conditions.
- Increase/decrease fuel flow 1% per 5°C above/below ISA conditions.
- Increase/decrease TAS by 2 kt per 5°C above/below ISA conditions.

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LONG RANGE CRUISE - ALL ENGINES OPERATING
FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: 5000 FT TO 11000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)						
			5000	6000	7000	8000	9000	10000	11000
	N1	%	73.3	74.0	74.6	75.3	75.9	76.8	77.6
	F FLOW	LB/H/ENG	1631	1620	1610	1600	1589	1581	1576
	IAS	KT	199	198	198	197	196	195	195
46000	TAS	KT	214	217	219	222	224	227	230
	INDICATED MACH		0.329	0.334	0.339	0.344	0.349	0.355	0.361
	BUFFET MARGIN	G	1.88	1.86	1.85	1.83	1.81	1.80	1.79
	SR	NM/LB	0.066	0.067	0.068	0.069	0.071	0.072	0.073
	N1	%	71.4	72.0	72.5	73.0	73.6	74.4	75.2
	F FLOW	LB/H/ENG	1505	1495	1483	1469	1459	1452	1443
	IAS	KT	193	192	191	190	190	189	189
42000	TAS	KT	207	210	212	214	216	219	222
	INDICATED MACH		0.319	0.324	0.328	0.333	0.338	0.343	0.349
	BUFFET MARGIN	G	1.92	1.91	1.89	1.87	1.85	1.84	1.82
	SR	NM/LB	0.069	0.070	0.071	0.073	0.074	0.075	0.077
	N1	%	69.4	69.9	70.4	70.9	71.4	72.1	72.7
	F FLOW	LB/H/ENG	1386	1370	1356	1344	1335	1325	1313
	IAS	KT	186	185	184	184	183	182	181
38000	TAS	KT	200	202	204	206	208	211	213
	INDICATED MACH		0.308	0.312	0.316	0.321	0.326	0.331	0.336
	BUFFET MARGIN	G	1.98	1.95	1.93	1.91	1.90	1.88	1.86
	SR	NM/LB	0.072	0.074	0.075	0.077	0.078	0.080	0.081
	N1	%	66.8	67.4	68.0	68.7	69.3	69.8	70.3
	F FLOW	LB/H/ENG	1264	1249	1236	1224	1214	1200	1189
	IAS	KT	179	178	177	177	176	175	174
34000	TAS	KT	192	193	195	198	200	202	204
	INDICATED MACH		0.296	0.300	0.304	0.309	0.314	0.318	0.322
	BUFFET MARGIN	G	2.04	2.01	1.99	1.98	1.96	1.93	1.91
	SR	NM/LB	0.076	0.077	0.079	0.081	0.082	0.084	0.086
	N1	%	64.0	64.6	65.2	65.9	66.5	67.1	67.8
	F FLOW	LB/H/ENG	1146	1133	1120	1107	1094	1080	1069
	IAS	KT	171	171	170	169	168	167	166
30000	TAS	KT	183	185	187	189	191	193	195
	INDICATED MACH		0.283	0.287	0.291	0.296	0.300	0.303	0.308
	BUFFET MARGIN	G	2.11	2.09	2.07	2.05	2.02	2.00	1.98
	SR	NM/LB	0.080	0.082	0.083	0.085	0.087	0.089	0.091
	N1	%	60.8	61.5	62.1	62.6	63.2	63.9	64.6
	F FLOW	LB/H/ENG	1034	1022	1007	991	977	965	955
	IAS	KT	163	163	162	160	160	159	158
26000	TAS	KT	174	176	178	179	181	183	185
	INDICATED MACH		0.270	0.274	0.278	0.281	0.284	0.288	0.293
	BUFFET MARGIN	G	2.21	2.19	2.16	2.13	2.10	2.08	2.06
	SR	NM/LB	0.084	0.086	0.088	0.090	0.093	0.095	0.097

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LONG RANGE CRUISE - ALL ENGINES OPERATING
FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: 12000 FT TO 18000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)						
		12000	13000	14000	15000	16000	17000	18000
46000	N1 %	78.4	79.2	80.1	80.8	81.5	82.2	82.9
	F FLOW LB/H/ENG	1566	1560	1557	1550	1549	1547	1544
	IAS KT	194	193	193	192	192	191	190
	TAS KT	232	235	238	241	244	247	250
	INDICATED MACH	0.366	0.371	0.378	0.384	0.390	0.397	0.403
	BUFFET MARGIN G	1.77	1.76	1.75	1.73	1.72	1.71	1.69
	SR NM/LB	0.074	0.075	0.076	0.078	0.079	0.080	0.081
42000	N1 %	75.9	76.7	77.6	78.3	79.2	80.0	80.7
	F FLOW LB/H/ENG	1432	1427	1422	1413	1409	1407	1403
	IAS KT	188	187	187	186	185	185	184
	TAS KT	224	227	230	232	235	238	241
	INDICATED MACH	0.354	0.359	0.366	0.371	0.377	0.384	0.390
	BUFFET MARGIN G	1.80	1.79	1.78	1.76	1.75	1.74	1.72
	SR NM/LB	0.078	0.079	0.081	0.082	0.083	0.085	0.086
38000	N1 %	73.3	74.1	74.8	75.6	76.4	77.3	78.1
	F FLOW LB/H/ENG	1303	1298	1288	1280	1274	1271	1265
	IAS KT	181	180	179	179	178	178	177
	TAS KT	215	218	220	223	226	229	232
	INDICATED MACH	0.341	0.347	0.352	0.357	0.363	0.369	0.375
	BUFFET MARGIN G	1.84	1.83	1.81	1.79	1.78	1.77	1.76
	SR NM/LB	0.083	0.084	0.086	0.087	0.089	0.090	0.092
34000	N1 %	70.8	71.5	72.0	72.8	73.5	74.3	75.1
	F FLOW LB/H/ENG	1180	1172	1161	1153	1145	1139	1132
	IAS KT	174	173	172	171	171	170	169
	TAS KT	206	209	211	214	216	219	221
	INDICATED MACH	0.327	0.333	0.337	0.343	0.348	0.354	0.359
	BUFFET MARGIN G	1.90	1.88	1.86	1.84	1.82	1.81	1.79
	SR NM/LB	0.087	0.089	0.091	0.093	0.094	0.096	0.098
30000	N1 %	68.4	68.9	69.4	70.0	70.5	71.2	71.9
	F FLOW LB/H/ENG	1061	1049	1038	1031	1021	1013	1005
	IAS KT	166	165	164	164	163	162	161
	TAS KT	197	199	201	204	206	208	211
	INDICATED MACH	0.313	0.318	0.322	0.327	0.332	0.337	0.343
	BUFFET MARGIN G	1.97	1.94	1.92	1.90	1.88	1.86	1.84
	SR NM/LB	0.093	0.095	0.097	0.099	0.101	0.103	0.105
26000	N1 %	65.3	65.9	66.5	67.2	67.7	68.2	68.7
	F FLOW LB/H/ENG	943	931	920	913	901	892	884
	IAS KT	157	156	156	155	154	153	153
	TAS KT	187	189	191	193	195	197	200
	INDICATED MACH	0.297	0.301	0.305	0.311	0.315	0.320	0.325
	BUFFET MARGIN G	2.04	2.01	1.99	1.98	1.95	1.93	1.91
	SR NM/LB	0.099	0.101	0.104	0.106	0.108	0.111	0.113

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LONG RANGE CRUISE - ALL ENGINES OPERATING
FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: 19000 FT TO 25000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)						
		19000	20000	21000	22000	23000	24000	25000
46000	N1 %	83.7	84.6	85.5	86.1	86.9	87.7	89.0
	F FLOW LB/H/ENG	1543	1544	1549	1549	1555	1555	1563
	IAS KT	190	189	189	188	188	187	187
	TAS KT	253	257	260	264	268	271	276
	INDICATED MACH	0.410	0.417	0.425	0.432	0.441	0.448	0.458
	BUFFET MARGIN G	1.67	1.66	1.65	1.63	1.62	1.60	1.59
	SR NM/LB	0.082	0.083	0.084	0.085	0.086	0.087	0.088
42000	N1 %	81.4	82.1	83.0	83.8	84.6	85.3	86.1
	F FLOW LB/H/ENG	1398	1397	1400	1398	1401	1403	1405
	IAS KT	183	183	182	182	181	181	180
	TAS KT	244	247	251	254	258	261	265
	INDICATED MACH	0.396	0.403	0.411	0.417	0.425	0.433	0.440
	BUFFET MARGIN G	1.70	1.69	1.68	1.66	1.65	1.63	1.62
	SR NM/LB	0.087	0.088	0.090	0.091	0.092	0.093	0.094
38000	N1 %	78.9	79.7	80.4	81.1	81.9	82.8	83.6
	F FLOW LB/H/ENG	1260	1257	1257	1254	1253	1253	1254
	IAS KT	176	176	175	175	174	173	173
	TAS KT	234	237	241	244	247	250	254
	INDICATED MACH	0.381	0.388	0.395	0.402	0.408	0.416	0.423
	BUFFET MARGIN G	1.74	1.72	1.72	1.70	1.68	1.67	1.65
	SR NM/LB	0.093	0.094	0.096	0.097	0.099	0.100	0.101
34000	N1 %	75.9	76.8	77.6	78.4	79.2	79.9	80.6
	F FLOW LB/H/ENG	1126	1122	1119	1115	1112	1112	1109
	IAS KT	169	168	168	167	166	166	165
	TAS KT	224	227	230	233	236	240	243
	INDICATED MACH	0.365	0.371	0.378	0.384	0.391	0.398	0.405
	BUFFET MARGIN G	1.78	1.76	1.75	1.74	1.72	1.71	1.69
	SR NM/LB	0.099	0.101	0.103	0.104	0.106	0.108	0.109
30000	N1 %	72.6	73.4	74.3	75.1	76.0	76.8	77.6
	F FLOW LB/H/ENG	999	994	988	983	978	975	971
	IAS KT	161	160	159	159	158	158	157
	TAS KT	213	216	219	222	224	228	230
	INDICATED MACH	0.348	0.354	0.36	0.366	0.372	0.379	0.385
	BUFFET MARGIN G	1.82	1.81	1.79	1.78	1.76	1.75	1.73
	SR NM/LB	0.107	0.109	0.111	0.113	0.115	0.117	0.119
26000	N1 %	69.4	70.0	70.7	71.4	72.2	73.0	73.9
	F FLOW LB/H/ENG	878	870	863	857	851	846	841
	IAS KT	152	152	151	150	150	149	148
	TAS KT	202	205	207	210	212	215	218
	INDICATED MACH	0.330	0.335	0.341	0.346	0.352	0.358	0.364
	BUFFET MARGIN G	1.89	1.87	1.85	1.83	1.81	1.80	1.78
	SR NM/LB	0.115	0.118	0.120	0.122	0.125	0.127	0.129

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING
FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: 5000 FT TO 11000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)						
			5000	6000	7000	8000	9000	10000	11000
50000	N1	%	79.5	80.0	80.5	81.0	81.4	81.8	82.1
	F FLOW	LB/H/ENG	2029	1999	1972	1945	1916	1888	1858
	IAS	KT	228	225	223	221	219	217	214
	TAS	KT	245	246	247	249	250	251	252
	INDICATED	MACH	0.377	0.379	0.383	0.387	0.389	0.393	0.395
	BUFFET MARGIN	G	2.26	2.21	2.17	2.13	2.07	2.04	1.98
	SR	NM/LB	0.060	0.061	0.063	0.064	0.065	0.067	0.068
46000	N1	%	79.2	79.6	80.2	80.7	81.2	81.6	82
	F FLOW	LB/H/ENG	2022	1991	1966	1940	1915	1883	1853
	IAS	KT	231	228	227	225	223	220	218
	TAS	KT	249	249	252	253	255	255	257
	INDICATED	MACH	0.382	0.384	0.390	0.393	0.397	0.399	0.403
	BUFFET MARGIN	G	2.54	2.47	2.44	2.40	2.35	2.28	2.24
	SR	NM/LB	0.062	0.063	0.064	0.065	0.067	0.068	0.069
42000	N1	%	79.1	79.6	80.1	80.6	81.2	81.6	82.0
	F FLOW	LB/H/ENG	2024	1993	1968	1942	1917	1885	1856
	IAS	KT	235	233	231	229	227	225	223
	TAS	KT	253	254	256	257	259	260	262
	INDICATED	MACH	0.389	0.393	0.396	0.400	0.404	0.408	0.412
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.55
	SR	NM/LB	0.062	0.064	0.065	0.066	0.068	0.069	0.071
38000	N1	%	79.1	79.6	80.1	80.6	81.1	81.6	82.0
	F FLOW	LB/H/ENG	2025	1994	1970	1944	1919	1887	1859
	IAS	KT	238	236	235	233	231	229	227
	TAS	KT	255	257	260	261	263	264	266
	INDICATED	MACH	0.394	0.397	0.403	0.407	0.411	0.415	0.419
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.063	0.064	0.066	0.067	0.068	0.070	0.072
34000	N1	%	79.1	79.6	80.1	80.6	81.1	81.5	82.0
	F FLOW	LB/H/ENG	2026	1996	1971	1946	1921	1889	1861
	IAS	KT	242	240	238	237	235	233	231
	TAS	KT	259	260	262	265	267	268	270
	INDICATED	MACH	0.400	0.404	0.408	0.414	0.418	0.422	0.426
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.064	0.065	0.066	0.068	0.069	0.071	0.073

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: 5000 FT TO 11000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)						
			5000	6000	7000	8000	9000	10000	11000
30000	N1	%	79.1	79.5	80.1	80.6	81.1	81.5	81.9
	F FLOW	LB/H/ENG	2027	1997	1973	1947	1923	1892	1864
	IAS	KT	245	243	242	240	239	237	235
	TAS	KT	261	263	266	267	270	272	274
	INDICATED	MACH	0.405	0.409	0.415	0.419	0.425	0.429	0.433
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.064	0.066	0.067	0.069	0.070	0.072	0.073
26000	N1	%	79.1	79.5	80.0	80.6	81.1	81.5	81.9
	F FLOW	LB/H/ENG	2028	1998	1974	1948	1924	1893	1866
	IAS	KT	248	246	245	243	242	240	238
	TAS	KT	264	266	268	270	273	275	277
	INDICATED	MACH	0.410	0.414	0.420	0.424	0.430	0.434	0.439
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.065	0.066	0.068	0.069	0.071	0.073	0.074

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: 12000 FT TO 18000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)						
		12000	13000	14000	15000	16000	17000	18000
50000	N1 %	82.5	82.9	83.2	83.9	84.5	85.3	86.0
	F FLOW LB/H/ENG	1829	1796	1763	1754	1746	1745	1747
	IAS KT	211	208	206	204	203	202	201
	TAS KT	252	253	253	255	258	261	264
	INDICATED MACH	0.398	0.400	0.402	0.406	0.413	0.419	0.426
	BUFFET MARGIN G	1.93	1.87	1.82	1.79	1.77	1.75	1.73
	SR NM/LB	0.069	0.070	0.072	0.073	0.074	0.075	0.076
46000	N1 %	82.4	82.7	83.0	83.3	84.2	85.2	85.9
	F FLOW LB/H/ENG	1825	1792	1758	1728	1745	1755	1746
	IAS KT	216	213	210	208	209	209	208
	TAS KT	258	259	259	260	265	269	272
	INDICATED MACH	0.407	0.409	0.411	0.415	0.425	0.433	0.439
	BUFFET MARGIN G	2.19	2.13	2.06	2.02	2.03	2.02	1.99
	SR NM/LB	0.071	0.072	0.074	0.075	0.076	0.077	0.078
42000	N1 %	82.4	82.7	83	83.3	84.2	85.2	85.9
	F FLOW LB/H/ENG	1828	1795	1761	1731	1748	1759	1751
	IAS KT	221	218	216	213	214	215	214
	TAS KT	264	264	266	266	271	277	279
	INDICATED MACH	0.416	0.418	0.422	0.424	0.434	0.445	0.451
	BUFFET MARGIN G	2.50	2.42	2.37	2.30	2.31	2.32	2.28
	SR NM/LB	0.072	0.074	0.075	0.077	0.078	0.079	0.080
38000	N1 %	82.4	82.7	83.0	83.3	84.2	85.2	85.9
	F FLOW LB/H/ENG	1830	1798	1764	1735	1752	1763	1755
	IAS KT	225	223	220	218	219	220	219
	TAS KT	268	269	270	271	277	282	285
	INDICATED MACH	0.423	0.427	0.430	0.434	0.444	0.455	0.461
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.073	0.075	0.076	0.078	0.079	0.080	0.081
34000	N1 %	82.4	82.7	83.0	83.3	84.2	85.1	85.9
	F FLOW LB/H/ENG	1833	1801	1767	1737	1756	1766	1758
	IAS KT	229	227	225	222	224	223	222
	TAS KT	272	273	275	275	282	286	290
	INDICATED MACH	0.430	0.435	0.439	0.442	0.454	0.463	0.469
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.074	0.076	0.078	0.079	0.080	0.081	0.082

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: 12000 FT TO 18000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)						
			12000	13000	14000	15000	16000	17000	18000
30000	N1	%	82.4	82.7	83.0	83.3	84.2	85.1	85.8
	F FLOW	LB/H/ENG	1836	1803	1769	1739	1758	1770	1761
	IAS	KT	233	231	228	226	226	227	226
	TAS	KT	276	277	278	280	285	291	294
	INDICATED	MACH	0.438	0.442	0.445	0.449	0.460	0.471	0.478
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.075	0.077	0.079	0.080	0.081	0.082	0.083
26000	N1	%	82.4	82.7	83.0	83.3	84.2	85.1	85.8
	F FLOW	LB/H/ENG	1838	1805	1771	1742	1761	1773	1765
	IAS	KT	236	234	232	230	231	231	230
	TAS	KT	278	280	282	284	289	295	298
	INDICATED	MACH	0.443	0.448	0.452	0.457	0.468	0.479	0.486
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.076	0.078	0.080	0.081	0.082	0.083	0.085

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING
FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

ALTITUDE: 19000 FT TO 25000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)						
		19000	20000	21000	22000	23000	24000	25000
46000	N1 %	86.4	86.9	87.3	87.7	88.1	88.7	89.4
	F FLOW LB/H/ENG	1729	1719	1697	1669	1636	1615	1584
	IAS KT	205	204	202	199	195	192	189
	TAS KT	274	277	278	278	277	278	278
	INDICATED MACH	0.443	0.45	0.454	0.456	0.456	0.46	0.462
	BUFFET MARGIN G	1.94	1.91	1.86	1.80	1.72	1.68	1.62
	SR NM/LB	0.079	0.080	0.082	0.083	0.085	0.086	0.088
42000	N1 %	86.4	86.9	87.3	87.7	88.0	88.7	89.3
	F FLOW LB/H/ENG	1733	1724	1701	1674	1642	1622	1592
	IAS KT	211	210	208	205	202	200	196
	TAS KT	281	284	286	286	286	288	288
	INDICATED MACH	0.456	0.462	0.467	0.469	0.472	0.476	0.479
	BUFFET MARGIN G	2.23	2.19	2.14	2.07	2.00	1.95	1.88
	SR NM/LB	0.081	0.082	0.084	0.085	0.087	0.089	0.090
38000	N1 %	86.4	86.9	87.3	87.6	88.0	88.6	89.2
	F FLOW LB/H/ENG	1737	1727	1705	1678	1647	1628	1599
	IAS KT	216	215	213	211	208	206	203
	TAS KT	287	290	292	294	294	296	297
	INDICATED MACH	0.466	0.473	0.478	0.483	0.485	0.490	0.495
	BUFFET MARGIN G	2.56	2.51	2.45	2.39	2.31	2.25	2.19
	SR NM/LB	0.083	0.084	0.086	0.087	0.089	0.091	0.093
34000	N1 %	86.4	86.9	87.2	87.6	87.9	88.5	89.1
	F FLOW LB/H/ENG	1741	1731	1708	1682	1651	1633	1605
	IAS KT	221	220	218	216	213	211	208
	TAS KT	293	296	298	300	300	303	304
	INDICATED MACH	0.476	0.484	0.489	0.494	0.496	0.504	0.507
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.54
	SR NM/LB	0.084	0.085	0.087	0.089	0.091	0.093	0.095
30000	N1 %	86.4	86.9	87.2	87.6	87.9	88.5	89.0
	F FLOW LB/H/ENG	1744	1734	1711	1685	1655	1637	1610
	IAS KT	225	224	222	220	218	215	213
	TAS KT	297	300	302	304	306	308	310
	INDICATED MACH	0.485	0.492	0.497	0.502	0.508	0.513	0.518
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.085	0.087	0.088	0.090	0.093	0.094	0.096
26000	N1 %	86.3	86.9	87.2	87.5	87.8	88.4	89.0
	F FLOW LB/H/ENG	1746	1737	1714	1688	1658	1641	1614
	IAS KT	228	228	226	224	222	219	217
	TAS KT	300	305	307	309	311	313	315
	INDICATED MACH	0.491	0.501	0.506	0.511	0.517	0.522	0.528
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.086	0.088	0.090	0.092	0.094	0.095	0.098

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DESCENT - FLIGHT WITH LANDING GEAR DOWN

The descent table shows fuel consumption, distance and time from the top of descent to sea level for various cruise altitudes. The data is calculated based on flight idle thrust and a fixed airspeed of 240 KIAS.

The associated conditions are:

- Flaps.....UP
- Landing Gear.....DOWN
- Bleeds.....OPEN
- Anti-Ice .....OFF
- Airspeed .....240 KIAS

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DESCENT - ALL ENGINES OPERATING
FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

BLEED: OPEN
AIRSPEED: 240 KIAS
ISA CONDITIONS

WEIGHT (LB)			TOP OF DESCENT (FT)				
			5000	10000	15000	20000	25000
	FUEL	LB	21	42	60	76	90
46000	DISTANCE	NM	6	11	17	23	30
	TIME	MIN	1	3	4	5	6
	FUEL	LB	20	39	56	72	85
42000	DISTANCE	NM	5	11	16	22	28
	TIME	MIN	1	3	4	5	6
	FUEL	LB	19	37	53	67	79
38000	DISTANCE	NM	5	10	15	21	26
	TIME	MIN	1	2	3	4	5
	FUEL	LB	18	34	48	62	73
34000	DISTANCE	NM	4	9	14	19	24
	TIME	MIN	1	2	3	4	5
	FUEL	LB	16	31	44	56	66
30000	DISTANCE	NM	4	8	13	17	22
	TIME	MIN	1	2	3	4	5
	FUEL	LB	14	27	39	50	59
26000	DISTANCE	NM	4	7	11	15	19
	TIME	MIN	1	2	3	3	4

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HOLDING - FLIGHT WITH LANDING GEAR DOWN

The holding tables show indicated airspeed, Mach number, N1, fuel flow and fuel consumption for various weights and altitudes. Data is presented for ISA condition and all engines operating.

The associated conditions are:

- Flaps.....UP
- Landing Gear.....DOWN
- Bleeds.....OPEN
- Airspeed .....1.3 V_S
- Anti-Ice .....OFF

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HOLDING - ALL ENGINES OPERATING
FLIGHT WITH LANDING GEAR DOWN

AE3007A1 and A1P ENGINES

BLEED: OPEN
ANTI ICE: OFF
MINIMUM FUEL CONSUMPTION SPEED
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)						
			0	1500	5000	10000	15000	20000	25000
	IAS	KT	175	174	170	167	165	164	166
	TAS	KT	175.1	177.2	182.8	192.8	205.8	222.4	244.0
46000	MACH		0.265	0.270	0.282	0.303	0.329	0.363	0.406
	N1	%	66.4	67.3	69.6	72.6	76.8	81.3	85.8
	FF	LB/H/ENG	1435	1412	1367	1323	1304	1312	1348
	FC	LB/H	2870	2824	2734	2646	2608	2623	2695
	IAS	KT	170	169	165	161	158	157	158
	TAS	KT	170.0	171.8	176.9	185.8	197.4	212.4	231.9
42000	MACH		0.258	0.262	0.273	0.292	0.316	0.347	0.387
	N1	%	64.2	65.1	67.3	70.4	74.1	78.7	83.4
	FF	LB/H/ENG	1336	1312	1263	1212	1184	1180	1203
	FC	LB/H	2673	2624	2526	2424	2368	2359	2406
	IAS	KT	166	164	160	155	152	150	150
	TAS	KT	164.9	166.6	171.0	178.9	189.0	202.3	219.6
38000	MACH		0.250	0.254	0.264	0.282	0.304	0.331	0.367
	N1	%	61.9	62.8	64.9	68.3	71.4	75.8	80.3
	FF	LB/H/ENG	1242	1216	1163	1106	1070	1055	1063
	FC	LB/H	2483	2432	2326	2212	2139	2109	2127
	IAS	KT	161	159	154	149	145	142	141
	TAS	KT	159.9	161.2	165.0	171.8	180.7	192.4	207.7
34000	MACH		0.243	0.247	0.256	0.271	0.291	0.316	0.348
	N1	%	59.5	60.3	62.3	65.6	68.8	72.5	77.3
	FF	LB/H/ENG	1151	1123	1067	1004	961	937	934
	FC	LB/H	2301	2246	2134	2009	1923	1875	1867
	IAS	KT	156	154	149	143	139	135	133
	TAS	KT	154.9	156.1	159.3	165.0	172.7	182.7	195.9
30000	MACH		0.236	0.239	0.247	0.261	0.278	0.300	0.328
	N1	%	57.1	57.7	59.5	62.6	66.1	69.3	73.7
	FF	LB/H/ENG	1064	1036	977	909	860	828	813
	FC	LB/H	2128	2071	1953	1818	1719	1655	1627
	IAS	KT	151	149	144	137	132	128	125
	TAS	KT	150.1	151.0	153.6	158.3	164.6	172.9	184.0
26000	MACH		0.229	0.231	0.238	0.250	0.265	0.284	0.309
	N1	%	54.6	55.1	56.7	59.5	62.8	66.3	69.7
	FF	LB/H/ENG	983	953	891	818	763	724	701
	FC	LB/H	1966	1906	1782	1637	1526	1449	1402

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FLIGHT WITH FLAPS LOCKED AT 9°

This section presents climb, cruise, descent and holding data for flight with all engines operating and the flaps locked at 9°.

This set of data may be used in the following situations:

- Dispatch of the airplane with the flaps locked at 9°. In this case, the applicable AFM supplement must be observed for takeoff, driftdown and landing performance penalties.
- On board flight planning in case of flaps locked at 9° after takeoff.

CLIMB - FLIGHT WITH FLAPS LOCKED AT 9°

The climb planning tables show fuel consumption, distance, and time elapsed from the Sea Level to the top of climb. Data is shown for various weights, ISA deviations and cruise altitudes.
The tables are based on a fixed climb speed of 190 KIAS.

The associated conditions are:

- Thrust Mode ..... CLB
- Flaps..... 9°
- Landing Gear..... UP
- Bleeds..... OPEN
- Anti-Ice ..... OFF
- Airspeed ..... 190 KIAS

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CLIMB PLANNING - FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 5000 AND 6000 FT

SPEED SCHEDULE: 190 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			5000 FT ISA + °C					6000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
46000	FUEL	LB	161	167	174	181	204	194	201	209	218	246
	DISTANCE	NM	6	7	7	7	9	8	8	8	9	11
	TIME	MIN	2	2	2	2	3	2	2	3	3	3
42000	FUEL	LB	141	146	152	158	177	169	175	182	190	212
	DISTANCE	NM	6	6	6	6	8	7	7	7	8	10
	TIME	MIN	2	2	2	2	2	2	2	2	2	3
38000	FUEL	LB	123	127	132	138	153	147	153	159	165	183
	DISTANCE	NM	5	5	5	5	7	6	6	6	7	8
	TIME	MIN	2	2	2	2	2	2	2	2	2	2
34000	FUEL	LB	106	110	115	119	131	127	132	137	143	158
	DISTANCE	NM	4	4	4	5	6	5	5	5	6	7
	TIME	MIN	1	1	1	1	2	2	2	2	2	2
30000	FUEL	LB	91	95	98	102	112	109	113	118	123	134
	DISTANCE	NM	4	4	4	4	5	4	4	5	5	6
	TIME	MIN	1	1	1	1	1	1	1	1	1	2
26000	FUEL	LB	77	80	83	87	94	93	96	100	104	113
	DISTANCE	NM	3	3	3	3	4	4	4	4	4	5
	TIME	MIN	1	1	1	1	1	1	1	1	1	2

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CLIMB PLANNING - FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 7000 AND 8000 FT

SPEED SCHEDULE: 190 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			7000 FT ISA + °C					8000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
46000	FUEL	LB	226	235	244	255	288	259	269	279	292	331
	DISTANCE	NM	9	10	10	11	13	11	11	12	12	16
	TIME	MIN	3	3	3	3	4	3	3	3	4	5
42000	FUEL	LB	197	205	213	222	248	225	234	243	254	285
	DISTANCE	NM	8	8	9	9	12	9	10	10	11	13
	TIME	MIN	3	3	3	3	3	3	3	3	3	4
38000	FUEL	LB	171	178	185	193	214	196	204	211	220	245
	DISTANCE	NM	7	7	8	8	10	8	8	9	9	12
	TIME	MIN	2	2	2	2	3	3	3	3	3	3
34000	FUEL	LB	148	154	160	167	184	169	176	183	190	210
	DISTANCE	NM	6	6	6	7	8	7	7	8	8	10
	TIME	MIN	2	2	2	2	2	2	2	2	2	3
30000	FUEL	LB	127	132	137	143	157	145	151	157	163	179
	DISTANCE	NM	5	5	6	6	7	6	6	6	7	8
	TIME	MIN	2	2	2	2	2	2	2	2	2	2
26000	FUEL	LB	108	112	116	121	132	123	128	133	138	151
	DISTANCE	NM	4	4	5	5	6	5	5	5	6	7
	TIME	MIN	1	1	1	1	2	2	2	2	2	2

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CLIMB PLANNING - FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 9000 AND 10000 FT

SPEED SCHEDULE: 190 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			9000 FT ISA + °C					10000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
46000	FUEL	LB	292	303	315	329	374	325	337	351	366	417
	DISTANCE	NM	12	13	13	14	18	14	15	15	16	21
	TIME	MIN	4	4	4	4	5	4	4	4	5	6
42000	FUEL	LB	254	264	274	286	321	282	293	305	318	358
	DISTANCE	NM	11	11	12	12	15	12	13	13	14	18
	TIME	MIN	3	3	3	4	4	4	4	4	4	5
38000	FUEL	LB	220	229	238	248	276	245	255	265	276	308
	DISTANCE	NM	9	10	10	11	13	11	11	11	12	15
	TIME	MIN	3	3	3	3	4	3	3	3	3	4
34000	FUEL	LB	190	198	206	214	237	212	220	228	238	264
	DISTANCE	NM	8	8	9	9	11	9	9	10	10	13
	TIME	MIN	2	3	3	3	3	3	3	3	3	4
30000	FUEL	LB	163	170	176	183	202	181	188	196	204	224
	DISTANCE	NM	7	7	7	8	10	8	8	8	9	11
	TIME	MIN	2	2	2	2	3	2	2	2	3	3
26000	FUEL	LB	138	143	149	155	170	153	159	165	172	189
	DISTANCE	NM	6	6	6	7	8	6	7	7	7	9
	TIME	MIN	2	2	2	2	2	2	2	2	2	3

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CLIMB PLANNING - FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 11000 AND 12000 FT

SPEED SCHEDULE: 190 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			11000 FT ISA + °C					12000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
46000	FUEL	LB	358	372	387	404	462	392	407	423	442	507
	DISTANCE	NM	16	16	17	18	23	18	18	19	20	26
	TIME	MIN	5	5	5	5	7	5	5	6	6	7
42000	FUEL	LB	311	323	336	351	396	340	353	367	383	434
	DISTANCE	NM	14	14	15	16	20	15	16	16	17	22
	TIME	MIN	4	4	4	4	6	5	5	5	5	6
38000	FUEL	LB	270	280	291	304	340	294	306	318	332	372
	DISTANCE	NM	12	12	13	13	17	13	14	14	15	19
	TIME	MIN	4	4	4	4	5	4	4	4	4	5
34000	FUEL	LB	233	242	251	262	291	254	264	274	286	318
	DISTANCE	NM	10	11	11	12	15	11	12	12	13	16
	TIME	MIN	3	3	3	3	4	3	3	4	4	5
30000	FUEL	LB	199	207	215	224	247	217	226	235	244	270
	DISTANCE	NM	9	9	9	10	12	10	10	10	11	14
	TIME	MIN	3	3	3	3	3	3	3	3	3	4
26000	FUEL	LB	168	175	182	189	208	183	191	198	206	227
	DISTANCE	NM	7	8	8	8	10	8	8	9	9	11
	TIME	MIN	2	2	2	2	3	2	3	3	3	3

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CLIMB PLANNING - FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 13000 AND 14000 FT

SPEED SCHEDULE: 190 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			13000 FT ISA + °C					14000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
46000	FUEL	LB	426	443	460	481	553	460	479	498	520	600
	DISTANCE	NM	20	20	21	22	29	22	22	23	25	32
	TIME	MIN	6	6	6	6	8	6	6	7	7	9
42000	FUEL	LB	369	384	399	416	472	398	414	431	450	512
	DISTANCE	NM	17	18	18	19	25	19	19	20	21	27
	TIME	MIN	5	5	5	5	7	6	6	6	6	7
38000	FUEL	LB	319	332	345	360	404	344	358	372	389	437
	DISTANCE	NM	15	15	16	17	21	16	17	17	18	23
	TIME	MIN	4	4	5	5	6	5	5	5	5	6
34000	FUEL	LB	275	286	297	310	345	297	308	321	334	373
	DISTANCE	NM	12	13	14	14	18	14	14	15	16	20
	TIME	MIN	4	4	4	4	5	4	4	4	4	5
30000	FUEL	LB	235	245	254	265	293	253	263	274	285	316
	DISTANCE	NM	11	11	12	12	15	12	12	13	13	17
	TIME	MIN	3	3	3	3	4	3	4	4	4	5
26000	FUEL	LB	199	206	215	224	246	214	222	231	241	265
	DISTANCE	NM	9	9	10	10	13	10	10	11	11	14
	TIME	MIN	3	3	3	3	4	3	3	3	3	4

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CLIMB PLANNING - FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 15000 AND 16000 FT

SPEED SCHEDULE: 190 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			15000 FT ISA + °C					16000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
46000	FUEL	LB	495	515	536	560	648	531	552	574	601	697
	DISTANCE	NM	24	25	26	27	36	26	27	28	30	39
	TIME	MIN	7	7	7	8	10	8	8	8	8	10
42000	FUEL	LB	428	445	463	484	552	458	477	496	518	592
	DISTANCE	NM	20	21	22	23	30	22	23	24	26	33
	TIME	MIN	6	6	6	6	8	6	7	7	7	9
38000	FUEL	LB	370	385	400	417	471	395	411	428	447	504
	DISTANCE	NM	18	18	19	20	26	19	20	21	22	28
	TIME	MIN	5	5	5	6	7	6	6	6	6	8
34000	FUEL	LB	318	331	344	359	401	340	353	367	383	429
	DISTANCE	NM	15	16	16	17	22	16	17	18	19	24
	TIME	MIN	4	5	5	5	6	5	5	5	5	6
30000	FUEL	LB	272	282	294	306	340	290	302	313	327	363
	DISTANCE	NM	13	13	14	15	18	14	15	15	16	20
	TIME	MIN	4	4	4	4	5	4	4	4	4	5
26000	FUEL	LB	229	238	248	258	285	244	254	264	275	304
	DISTANCE	NM	11	11	12	12	15	12	12	13	13	17
	TIME	MIN	3	3	3	3	4	3	4	4	4	5

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CLIMB PLANNING - FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 17000 AND 18000 FT

SPEED SCHEDULE: 190 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			17000 FT ISA + °C					18000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
46000	FUEL	LB	567	590	614	643	748	604	628	653	685	800
	DISTANCE	NM	28	30	31	33	43	31	32	33	36	47
	TIME	MIN	8	8	8	9	11	9	9	9	10	12
42000	FUEL	LB	489	509	529	553	634	519	540	562	588	676
	DISTANCE	NM	24	25	26	28	36	26	27	29	30	40
	TIME	MIN	7	7	7	8	10	8	8	8	8	10
38000	FUEL	LB	421	438	456	476	539	447	465	484	506	574
	DISTANCE	NM	21	22	23	24	31	23	24	25	26	33
	TIME	MIN	6	6	6	7	8	6	7	7	7	9
34000	FUEL	LB	362	376	391	408	458	383	399	415	433	487
	DISTANCE	NM	18	19	19	20	26	19	20	21	22	28
	TIME	MIN	5	5	5	6	7	6	6	6	6	7
30000	FUEL	LB	308	321	333	348	387	327	340	353	369	411
	DISTANCE	NM	15	16	16	17	22	16	17	18	19	24
	TIME	MIN	4	4	5	5	6	5	5	5	5	6
26000	FUEL	LB	260	270	281	293	324	275	286	297	310	344
	DISTANCE	NM	13	13	14	15	18	14	14	15	16	20
	TIME	MIN	4	4	4	4	5	4	4	4	4	5

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CLIMB PLANNING - FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: SEA LEVEL TO 19000 AND 20000 FT

SPEED SCHEDULE: 190 KIAS
ALL ENGINES OPERATING
BLEED: OPEN

WEIGHT (LB)			19000 FT ISA + °C					20000 FT ISA + °C				
			-20	-10	0	10	20	-20	-10	0	10	20
	FUEL	LB	640	666	693	727	852	676	704	732	769	905
46000	DISTANCE	NM	33	35	36	39	51	36	37	39	42	56
	TIME	MIN	9	10	10	10	13	10	10	10	11	14
	FUEL	LB	550	572	595	624	718	580	604	628	659	761
42000	DISTANCE	NM	28	30	31	33	43	31	32	33	35	46
	TIME	MIN	8	8	8	9	11	9	9	9	9	12
	FUEL	LB	473	492	512	536	609	498	519	539	565	644
38000	DISTANCE	NM	24	25	26	28	36	26	27	28	30	39
	TIME	MIN	7	7	7	8	9	7	7	8	8	10
	FUEL	LB	405	422	438	459	516	427	444	462	483	545
34000	DISTANCE	NM	21	22	23	24	31	22	23	24	26	33
	TIME	MIN	6	6	6	6	8	6	6	7	7	9
	FUEL	LB	345	359	373	390	435	363	378	393	411	459
30000	DISTANCE	NM	18	18	19	20	26	19	20	20	22	28
	TIME	MIN	5	5	5	5	7	5	5	6	6	7
	FUEL	LB	290	302	314	328	363	305	318	330	345	383
26000	DISTANCE	NM	15	15	16	17	21	16	16	17	18	23
	TIME	MIN	4	4	4	5	6	4	5	5	5	6

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CRUISE - FLIGHT WITH FLAPS LOCKED AT 9°

The Long Range Cruise and Maximum Speed Cruise tables show N1, fuel flow, indicated airspeed, true airspeed, indicated Mach number, buffet margin and specific range. Data is presented for ISA conditions and various weights, with corrections for ISA deviations.

In the Long Range Cruise schedule, all engines operating, the airplane is flown at a speed corresponding to a specific range equal to 99% of the maximum specific range. The LRC schedule is used when range is the main factor considered.

In the Maximum Speed Cruise schedule, the airplane is flown in a speed resulting from maximum cruise power setting or Vmo/Mmo, whichever is lower. It is used when minimum flight time is desired.

The associated conditions are:

- Flaps ..... 9°
- Landing Gear ..... UP
- Bleeds ..... OPEN
- Anti-Ice..... OFF

The associated corrections for ISA deviation are:

- Increase/decrease N1% by 1% per 5°C above/below ISA conditions.
- Increase/decrease fuel flow 1% per 5°C above/below ISA conditions.
- Increase/decrease TAS by 2 kt per 5°C above/below ISA conditions.

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LONG RANGE CRUISE - ALL ENGINES OPERATING
FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: 5000 FT TO 12000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)							
		5000	6000	7000	8000	9000	10000	11000	12000
	N1 %	67.8	68.4	69.0	69.6	70.1	70.7	71.2	71.7
	F FLOW LB/H/ENG	1323	1311	1299	1287	1276	1267	1258	1250
	IAS KT	233	233	232	231	230	229	228	228
46000	TAS KT	251	254	257	259	262	265	269	272
	INDICATED MACH	0.386	0.391	0.397	0.403	0.409	0.415	0.422	0.428
	BUFFET MARGIN G	2.56	2.56	2.53	2.51	2.49	2.46	2.44	2.42
	SR NM/LB	0.095	0.097	0.099	0.101	0.103	0.105	0.107	0.109
	N1 %	65.7	66.3	66.9	67.6	68.2	68.9	69.4	69.9
	F FLOW LB/H/ENG	1229	1215	1203	1191	1181	1170	1159	1150
	IAS KT	226	225	224	223	222	222	221	220
42000	TAS KT	243	245	248	251	254	256	259	262
	INDICATED MACH	0.373	0.379	0.384	0.390	0.396	0.402	0.408	0.414
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.55	2.52	2.50	2.47
	SR NM/LB	0.099	0.101	0.103	0.105	0.107	0.110	0.112	0.114
	N1 %	63.4	64.0	64.6	65.3	65.9	66.6	67.2	67.9
	F FLOW LB/H/ENG	1137	1124	1110	1097	1085	1074	1062	1052
	IAS KT	218	217	216	215	214	214	213	212
38000	TAS KT	234	236	239	241	244	247	249	252
	INDICATED MACH	0.360	0.366	0.371	0.376	0.382	0.387	0.393	0.399
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.55	2.53
	SR NM/LB	0.103	0.105	0.108	0.110	0.112	0.115	0.117	0.120
	N1 %	60.9	61.5	62.1	62.7	63.3	64.1	64.7	65.4
	F FLOW LB/H/ENG	1046	1032	1018	1005	992	981	970	960
	IAS KT	210	209	208	207	206	205	204	203
34000	TAS KT	225	227	229	231	234	236	239	242
	INDICATED MACH	0.347	0.352	0.356	0.361	0.366	0.372	0.377	0.383
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.107	0.110	0.113	0.115	0.118	0.121	0.123	0.126
	N1 %	58.1	58.7	59.3	59.9	60.6	61.3	61.9	62.6
	F FLOW LB/H/ENG	958	943	930	917	904	892	880	868
	IAS KT	201	200	199	198	197	196	195	194
30000	TAS KT	215	217	219	221	224	226	228	231
	INDICATED MACH	0.332	0.337	0.341	0.346	0.351	0.356	0.361	0.366
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.112	0.115	0.118	0.121	0.124	0.127	0.130	0.133
	N1 %	55.3	55.8	56.3	56.9	57.4	58.1	58.8	59.4
	F FLOW LB/H/ENG	873	858	843	829	815	803	791	780
	IAS KT	192	191	189	188	187	186	185	185
26000	TAS KT	205	206	208	210	212	214	217	219
	INDICATED MACH	0.317	0.321	0.325	0.329	0.334	0.338	0.343	0.348
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.117	0.120	0.124	0.127	0.130	0.133	0.137	0.140

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LONG RANGE CRUISE - ALL ENGINES OPERATING
FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: 13000 FT TO 20000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)							
		13000	14000	15000	16000	17000	18000	19000	20000
	N1 %	72.3	73.0	73.7	74.4	75.2	76.0	76.8	77.7
	F FLOW LB/H/ENG	1242	1235	1228	1221	1216	1212	1208	1206
	IAS KT	227	226	225	225	224	223	222	222
46000	TAS KT	275	278	282	285	289	292	296	300
	INDICATED MACH	0.435	0.442	0.449	0.456	0.463	0.471	0.479	0.487
	BUFFET MARGIN G	2.39	2.37	2.34	2.31	2.28	2.25	2.23	2.20
	SR NM/LB	0.111	0.113	0.115	0.117	0.119	0.121	0.122	0.124
	N1 %	70.4	70.9	71.5	72.2	72.9	73.6	74.4	75.3
	F FLOW LB/H/ENG	1140	1132	1124	1118	1112	1107	1103	1099
	IAS KT	219	218	217	217	216	215	215	214
42000	TAS KT	265	268	271	275	278	282	285	289
	INDICATED MACH	0.420	0.426	0.433	0.440	0.447	0.455	0.463	0.471
	BUFFET MARGIN G	2.45	2.42	2.39	2.37	2.34	2.32	2.29	2.26
	SR NM/LB	0.116	0.118	0.121	0.123	0.125	0.127	0.129	0.132
	N1 %	68.5	69.0	69.5	70.0	70.7	71.3	72.0	72.7
	F FLOW LB/H/ENG	1043	1034	1026	1019	1013	1007	1001	995
	IAS KT	211	210	210	209	208	208	207	206
38000	TAS KT	255	258	261	264	268	271	275	278
	INDICATED MACH	0.405	0.411	0.418	0.425	0.432	0.439	0.446	0.453
	BUFFET MARGIN G	2.51	2.48	2.46	2.44	2.41	2.39	2.36	2.33
	SR NM/LB	0.122	0.125	0.127	0.130	0.132	0.135	0.137	0.140
	N1 %	66.1	66.7	67.4	67.9	68.4	68.9	69.5	70.1
	F FLOW LB/H/ENG	951	941	931	922	913	906	899	893
	IAS KT	203	202	201	200	199	198	198	197
34000	TAS KT	245	248	250	253	256	259	262	266
	INDICATED MACH	0.389	0.395	0.401	0.407	0.413	0.420	0.427	0.434
	BUFFET MARGIN G	2.56	2.56	2.53	2.50	2.47	2.45	2.42	2.40
	SR NM/LB	0.129	0.132	0.134	0.137	0.140	0.143	0.146	0.149
	N1 %	63.2	63.9	64.5	65.2	65.9	66.6	67.2	67.7
	F FLOW LB/H/ENG	857	846	837	828	820	812	805	798
	IAS KT	193	192	192	191	190	190	189	188
30000	TAS KT	233	236	238	241	244	247	250	253
	INDICATED MACH	0.371	0.377	0.383	0.389	0.395	0.401	0.408	0.415
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.53	2.51	2.48
	SR NM/LB	0.136	0.139	0.142	0.146	0.149	0.152	0.155	0.159
	N1 %	60.1	60.8	61.4	62.1	62.7	63.4	64.0	64.7
	F FLOW LB/H/ENG	770	760	748	738	729	720	711	704
	IAS KT	184	183	182	181	180	179	178	178
26000	TAS KT	222	224	226	229	231	234	236	239
	INDICATED MACH	0.354	0.359	0.364	0.369	0.374	0.380	0.386	0.392
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.144	0.147	0.151	0.155	0.159	0.162	0.166	0.170

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING
FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: 5000 FT TO 12000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)							
		5000	6000	7000	8000	9000	10000	11000	12000
46000	N1 %	70.3	70.8	71.3	71.9	72.5	73.3	74.0	74.8
	F FLOW LB/H/ENG	1450	1445	1439	1435	1431	1427	1425	1423
	IAS KT	250	250	250	250	250	250	250	250
	TAS KT	269	273	277	281	285	289	294	298
	INDICATED MACH	0.413	0.420	0.428	0.436	0.444	0.452	0.461	0.469
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.093	0.094	0.096	0.098	0.100	0.101	0.103	0.105
42000	N1 %	69.5	70.2	70.7	71.3	71.9	72.6	73.2	74.0
	F FLOW LB/H/ENG	1412	1406	1400	1395	1390	1386	1383	1380
	IAS KT	250	250	250	250	250	250	250	250
	TAS KT	268	272	276	280	285	289	293	297
	INDICATED MACH	0.413	0.420	0.428	0.436	0.444	0.452	0.461	0.469
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.095	0.097	0.099	0.100	0.102	0.104	0.106	0.108
38000	N1 %	68.8	69.5	70.2	70.7	71.2	71.9	72.5	73.2
	F FLOW LB/H/ENG	1377	1370	1364	1358	1353	1349	1345	1341
	IAS KT	250	250	250	250	250	250	250	250
	TAS KT	268	272	276	280	284	288	292	297
	INDICATED MACH	0.413	0.420	0.428	0.436	0.444	0.452	0.461	0.469
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.097	0.099	0.101	0.103	0.105	0.107	0.109	0.111
34000	N1 %	68.1	68.8	69.5	70.1	70.7	71.3	71.9	72.5
	F FLOW LB/H/ENG	1344	1337	1330	1324	1318	1313	1309	1305
	IAS KT	250	250	250	250	250	250	250	250
	TAS KT	267	271	275	279	283	287	292	296
	INDICATED MACH	0.413	0.420	0.428	0.436	0.444	0.452	0.461	0.469
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.099	0.101	0.103	0.105	0.107	0.109	0.111	0.113
30000	N1 %	67.5	68.2	68.9	69.6	70.1	70.7	71.3	71.9
	F FLOW LB/H/ENG	1315	1307	1300	1293	1287	1282	1277	1272
	IAS KT	250	250	250	250	250	250	250	250
	TAS KT	267	270	274	278	283	287	291	295
	INDICATED MACH	0.413	0.420	0.428	0.436	0.444	0.452	0.461	0.469
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.101	0.103	0.106	0.108	0.110	0.112	0.114	0.116
26000	N1 %	66.9	67.6	68.3	69.0	69.7	70.3	70.8	71.4
	F FLOW LB/H/ENG	1289	1281	1274	1267	1260	1254	1249	1244
	IAS KT	250	250	250	250	250	250	250	250
	TAS KT	266	270	274	278	282	286	290	295
	INDICATED MACH	0.413	0.420	0.428	0.436	0.444	0.452	0.461	0.469
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.103	0.105	0.107	0.110	0.112	0.114	0.116	0.118

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING
FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

ALTITUDE: 13000 FT TO 20000 FT

BLEED: OPEN
ISA CONDITION

WEIGHT (LB)		ALTITUDE (FT)							
		13000	14000	15000	16000	17000	18000	19000	20000
	N1 %	75.6	76.4	77.3	78.2	79.1	80.0	80.9	81.7
	F FLOW LB/H/ENG	1421	1421	1421	1421	1423	1425	1428	1432
	IAS KT	250	250	250	250	250	250	250	250
46000	TAS KT	302	307	312	316	321	326	331	337
	INDICATED MACH	0.478	0.487	0.497	0.506	0.516	0.526	0.536	0.547
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.106	0.108	0.110	0.111	0.113	0.114	0.116	0.118
	N1 %	74.7	75.5	76.4	77.2	78.1	79.1	80.0	80.9
	F FLOW LB/H/ENG	1378	1377	1376	1376	1377	1378	1380	1383
	IAS KT	250	250	250	250	250	250	250	250
42000	TAS KT	302	307	311	316	321	326	331	336
	INDICATED MACH	0.478	0.487	0.497	0.506	0.516	0.526	0.536	0.547
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.110	0.111	0.113	0.115	0.116	0.118	0.120	0.121
	N1 %	73.9	74.7	75.5	76.4	77.2	78.2	79.1	80.0
	F FLOW LB/H/ENG	1339	1336	1335	1334	1334	1334	1335	1337
	IAS KT	250	250	250	250	250	250	250	250
38000	TAS KT	301	306	311	315	320	325	330	335
	INDICATED MACH	0.478	0.487	0.497	0.506	0.516	0.526	0.536	0.547
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.113	0.114	0.116	0.118	0.120	0.122	0.124	0.125
	N1 %	73.2	74.0	74.7	75.5	76.4	77.3	78.2	79.1
	F FLOW LB/H/ENG	1302	1299	1297	1295	1294	1294	1294	1295
	IAS KT	250	250	250	250	250	250	250	250
34000	TAS KT	301	305	310	315	319	324	329	335
	INDICATED MACH	0.478	0.487	0.497	0.506	0.516	0.526	0.536	0.547
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.115	0.117	0.119	0.121	0.123	0.125	0.127	0.129
	N1 %	72.6	73.3	74.0	74.8	75.6	76.5	77.3	78.3
	F FLOW LB/H/ENG	1268	1265	1262	1260	1258	1257	1257	1257
	IAS KT	250	250	250	250	250	250	250	250
30000	TAS KT	300	304	309	314	319	324	329	334
	INDICATED MACH	0.478	0.487	0.497	0.506	0.516	0.526	0.536	0.547
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.118	0.120	0.122	0.125	0.127	0.129	0.131	0.133
	N1 %	72.0	72.7	73.4	74.1	74.9	75.7	76.6	77.5
	F FLOW LB/H/ENG	1239	1235	1232	1229	1227	1225	1224	1223
	IAS KT	250	250	250	250	250	250	250	250
26000	TAS KT	299	304	308	313	318	323	328	333
	INDICATED MACH	0.478	0.487	0.497	0.506	0.516	0.526	0.536	0.547
	BUFFET MARGIN G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR NM/LB	0.121	0.123	0.125	0.127	0.130	0.132	0.134	0.136

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DESCENT - FLIGHT WITH FLAPS LOCKED AT 9°

The descent table shows fuel consumption, distance and time from the top of descent to sea level for various cruise altitudes. The data is calculated based on flight idle thrust and a fixed airspeed of 240 KIAS.

The associated conditions are:

- Flaps ..... 9°
- Landing Gear ..... UP
- Bleeds ..... OPEN
- Anti-Ice ..... OFF
- Airspeed ..... 240 KIAS

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DESCENT - ALL ENGINES OPERATING

FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

BLEED: OPEN
AIRSPEED: 240 KIAS
ISA CONDITIONS

WEIGHT (LB)			TOP OF DESCENT (FT)			
			5000	10000	15000	20000
46000	FUEL	LB	39	75	107	136
	DISTANCE	NM	10	20	31	42
	TIME	MIN	2	5	7	9
42000	FUEL	LB	38	72	102	130
	DISTANCE	NM	9	19	29	40
	TIME	MIN	2	4	7	9
38000	FUEL	LB	36	68	96	123
	DISTANCE	NM	9	18	28	38
	TIME	MIN	2	4	6	8
34000	FUEL	LB	33	63	90	114
	DISTANCE	NM	8	17	26	35
	TIME	MIN	2	4	6	8
30000	FUEL	LB	30	58	82	105
	DISTANCE	NM	7	15	23	32
	TIME	MIN	2	4	5	7
26000	FUEL	LB	27	52	74	94
	DISTANCE	NM	7	14	21	29
	TIME	MIN	2	3	5	6

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HOLDING - FLIGHT WITH FLAPS LOCKED AT 9°

The holding tables show indicated airspeed, Mach number, N1, fuel flow and fuel consumption for various weights and altitudes. Data is presented for ISA condition and all engines operating.

The associated conditions are:

- Flaps ..... 9°
- Landing Gear ..... UP
- Bleeds ..... OPEN
- Airspeed ..... 1.3 V_S
- Anti-Ice ..... OFF

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HOLDING - ALL ENGINES OPERATING

FLIGHT WITH FLAPS LOCKED AT 9°

AE3007A1 and A1P ENGINES

BLEED: OPEN
ANTI ICE: OFF
MINIMUM FUEL CONSUMPTION SPEED
STANDARD ATMOSPHERE

WEIGHT (LB)			ALTITUDE (FT)					
			0	1500	5000	10000	15000	20000
	IAS	KT	175	174	170	167	165	164
	TAS	KT	175.1	177.2	182.8	192.8	205.8	222.4
46000	MACH		0.265	0.270	0.282	0.303	0.329	0.363
	N1	%	57.7	58.8	61.4	65.5	69.2	73.4
	FF	LB/H/ENG	1089	1072	1039	1004	984	978
	FC	LB/H	2177	2144	2077	2009	1969	1957
	IAS	KT	170	169	165	161	158	157
	TAS	KT	170.0	171.8	176.9	185.8	197.4	212.4
42000	MACH		0.258	0.262	0.273	0.292	0.316	0.347
	N1	%	55.5	56.4	58.9	63.0	67.2	70.9
	FF	LB/H/ENG	1014	996	960	922	898	886
	FC	LB/H	2027	1992	1920	1844	1796	1773
	IAS	KT	166	164	160	155	152	150
	TAS	KT	164.9	166.6	171.0	178.9	189.0	202.3
38000	MACH		0.250	0.254	0.264	0.282	0.304	0.331
	N1	%	53.1	54.0	56.4	60.3	64.5	68.3
	FF	LB/H/ENG	941	922	884	842	814	798
	FC	LB/H	1882	1845	1768	1685	1628	1596
	IAS	KT	161	159	154	149	145	142
	TAS	KT	159.9	161.2	165.0	171.8	180.7	192.4
34000	MACH		0.243	0.247	0.256	0.271	0.291	0.316
	N1	%	50.7	51.5	53.7	57.4	61.5	65.8
	FF	LB/H/ENG	872	852	811	765	733	713
	FC	LB/H	1743	1703	1621	1531	1466	1425
	IAS	KT	156	154	149	143	139	135
	TAS	KT	154.9	156.1	159.3	165.0	172.7	182.7
30000	MACH		0.236	0.239	0.247	0.261	0.278	0.300
	N1	%	48.2	48.9	50.9	54.3	58.2	62.6
	FF	LB/H/ENG	805	784	741	692	655	631
	FC	LB/H	1611	1568	1482	1383	1311	1262
	IAS	KT	151	149	144	137	132	128
	TAS	KT	150.1	151.0	153.6	158.3	164.6	172.9
26000	MACH		0.229	0.231	0.238	0.250	0.265	0.284
	N1	%	45.6	46.2	47.9	51.0	54.6	58.8
	FF	LB/H/ENG	743	721	675	621	581	553
	FC	LB/H	1486	1442	1349	1243	1163	1106

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FLIGHT WITH ENGINE ANTI ICE VALVE LOCKED OPEN

This section presents altitude capability and cruise data for flight with all engines operating and the Engine Anti Ice Valve Locked Open according to DDPM procedure (30-21-01).

This set of data may be used in the following situations:

- Dispatch of the airplane with the Engine Anti Ice Valve Locked Open. In this case, the applicable AFM supplement must be observed for takeoff, driftdown and landing performance penalties.

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CRUISE - ALTITUDE CAPABILITY TABLE

The table below permits quick determination of the altitude capability, based on the initial cruise weight. The table data are presented for various ISA conditions, all engines operating and Maximum Speed Cruise schedule. This table must be used only when the airplane is dispatched with the Engine Anti Ice Valve Locked Open in agreement with MEL and DDPM.

The established associated conditions are:

- Flaps ..... UP
- Gears ..... UP
- Bleeds ..... OPEN
- Anti Ice……..ON (Engine or all)

CRUISE ALTITUDE CAPABILITY
ENGINE ANTI ICE VALVE LOCKED OPEN
ALL ENGINES OPERATING

AE3007A1 AND A1P ENGINES, MAX SPEED CRUISE, CRUISE THRUST LIMITED

	ISA + °C									
Weight (lb)	**-10**	**-5**	**0**	**5**	**10**	**15**	**20**	**25**	**30**	**35**
50000	330	350	350	320	300	280	260	220	220	200
48000	330	360	360	330	310	290	270	240	230	220
46000	330	370	360	360	330	300	280	260	240	240
44000	330	370	370	370	350	320	290	270	250	250
42000	330	370	370	370	360	350	300	280	270	260
40000	330	370	370	370	370	360	330	290	280	270
38000	330	370	370	370	370	370	360	310	290	270
36000	330	370	370	370	370	370	360	340	300	290
34000	330	370	370	370	370	370	370	360	330	300
32000	330	370	370	370	370	370	370	370	360	320
30000	330	370	370	370	370	370	370	370	370	350
28000	330	370	370	370	370	370	370	370	370	360

NOTE: The weight values refer to the initial cruise weight.

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CRUISE TABLES

The long range cruise and maximum speed cruise tables show N1, fuel flow, indicated airspeed, true airspeed, indicated Mach number, buffet margin and specific range. Data are presented for various weights in ISA conditions and corrections for ISA deviation.

In the long range cruise schedule, all engines operating or one engine inoperative, the airplane is flown at a speed corresponding to a specific range equal to 99% of maximum specific range. It is used when range is the principal factor.

In the maximum speed schedule, the airplane is flown in a speed resulting from maximum cruise power setting. It is used when minimum flight time is desired.

Thrust selection in cruise condition is adjusted to CRZ mode. The climb to cruise transition should be made as follows:

- After reaching the cruise level, allow the airplane to accelerate past 0.60M, before selecting cruise mode.
- When in cruise mode, adjust thrust to keep N1 or cruise speed constant (whichever occurs first).

The associated conditions are:

- Flaps.....UP
- Gear.....UP
- Bleeds.....OPEN
- Anti-Ice .....ON (Engine or all)

NOTE: The corrections (N1, Fuel Flow and TAS) given in the Long Range Cruise and Maximum Speed Cruise tables are applicable only to ISA -15°C to ISA +15°C range.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
50000	N1	%	66.7	71.6	72.1	72.7	73.2	73.9	74.5	75.2	75.9	76.6
	F FLOW	LB/H/ENG	1425	1447	1434	1420	1406	1396	1384	1376	1366	1358
	IAS	KT	250	260	258	257	255	254	253	252	250	249
	TAS	KT	269	300	303	306	309	312	315	319	322	325
	INDICATED	MACH	0.414	0.470	0.476	0.482	0.488	0.496	0.502	0.510	0.517	0.524
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.52	2.47
	SR	NM/LB	0.095	0.104	0.106	0.108	0.110	0.112	0.114	0.116	0.118	0.120
48000	N1	%	66.1	70.7	71.2	71.8	72.3	73.0	73.6	74.2	74.9	75.6
	F FLOW	LB/H/ENG	1398	1396	1383	1370	1356	1347	1334	1325	1315	1306
	IAS	KT	250	256	255	254	252	251	249	248	247	246
	TAS	KT	269	296	299	302	304	308	311	314	317	320
	INDICATED	MACH	0.413	0.463	0.469	0.476	0.482	0.489	0.495	0.503	0.510	0.517
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.52
	SR	NM/LB	0.096	0.106	0.108	0.110	0.112	0.114	0.117	0.118	0.121	0.123
46000	N1	%	65.6	69.8	70.3	70.9	71.4	72.1	72.6	73.3	73.9	74.6
	F FLOW	LB/H/ENG	1375	1348	1334	1320	1307	1298	1284	1275	1264	1255
	IAS	KT	250	252	251	250	248	247	246	245	243	242
	TAS	KT	268	291	294	297	300	303	306	310	313	316
	INDICATED	MACH	0.413	0.456	0.462	0.469	0.475	0.482	0.488	0.496	0.503	0.510
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.098	0.108	0.110	0.113	0.115	0.117	0.119	0.121	0.124	0.126
44000	N1	%	65.0	68.9	69.5	70.0	70.5	71.1	71.6	72.3	72.9	73.5
	F FLOW	LB/H/ENG	1352	1302	1288	1275	1259	1249	1235	1226	1214	1205
	IAS	KT	250	249	248	246	245	244	242	241	240	238
	TAS	KT	268	287	290	293	295	299	301	305	308	311
	INDICATED	MACH	0.413	0.450	0.456	0.463	0.468	0.475	0.481	0.489	0.495	0.502
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.099	0.110	0.113	0.115	0.117	0.120	0.122	0.124	0.127	0.129
42000	N1	%	64.5	68.0	68.5	69.0	69.6	70.1	70.7	71.3	71.8	72.5
	F FLOW	LB/H/ENG	1331	1254	1239	1226	1213	1200	1187	1177	1165	1155
	IAS	KT	250	245	243	242	241	240	238	237	236	235
	TAS	KT	268	282	285	288	291	294	297	300	303	306
	INDICATED	MACH	0.413	0.443	0.449	0.455	0.462	0.468	0.474	0.481	0.488	0.495
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.101	0.113	0.115	0.117	0.120	0.122	0.125	0.127	0.130	0.132

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
40000	N1	%	64.1	66.9	67.5	68.1	68.6	69.1	69.7	70.2	70.8	71.4
	F FLOW	LB/H/ENG	1294	1207	1192	1178	1164	1152	1139	1128	1117	1107
	IAS	KT	247	241	239	238	237	236	235	233	232	231
	TAS	KT	265	278	280	283	286	289	292	295	298	301
	INDICATED	MACH	0.409	0.436	0.442	0.448	0.454	0.460	0.467	0.473	0.480	0.487
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.102	0.115	0.117	0.120	0.123	0.125	0.128	0.131	0.133	0.136
38000	N1	%	62.9	65.9	66.5	67.1	67.6	68.1	68.6	69.2	69.7	70.3
	F FLOW	LB/H/ENG	1248	1163	1148	1134	1117	1104	1092	1080	1069	1058
	IAS	KT	243	237	236	235	233	232	231	229	228	227
	TAS	KT	260	273	276	279	281	284	286	289	292	295
	INDICATED	MACH	0.402	0.429	0.435	0.441	0.446	0.453	0.459	0.466	0.472	0.479
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.104	0.117	0.120	0.123	0.126	0.128	0.131	0.134	0.137	0.140
36000	N1	%	61.7	64.7	65.3	65.9	66.5	67.1	67.6	68.1	68.6	69.2
	F FLOW	LB/H/ENG	1203	1116	1101	1087	1073	1060	1045	1033	1021	1011
	IAS	KT	239	233	232	230	229	228	226	225	224	223
	TAS	KT	256	268	270	273	276	279	281	284	287	290
	INDICATED	MACH	0.395	0.421	0.427	0.433	0.439	0.445	0.451	0.457	0.464	0.470
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.106	0.120	0.123	0.126	0.129	0.132	0.135	0.138	0.141	0.143
34000	N1	%	60.6	63.5	64.1	64.7	65.3	65.8	66.4	67.0	67.5	68.0
	F FLOW	LB/H/ENG	1160	1070	1055	1040	1026	1013	1000	988	976	964
	IAS	KT	235	228	227	226	225	224	222	221	220	219
	TAS	KT	251	263	265	268	270	273	276	279	282	284
	INDICATED	MACH	0.389	0.414	0.419	0.425	0.431	0.437	0.443	0.449	0.456	0.462
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.108	0.123	0.126	0.129	0.132	0.135	0.138	0.141	0.144	0.147
32000	N1	%	59.3	62.3	62.8	63.4	64.0	64.6	65.2	65.7	66.3	66.9
	F FLOW	LB/H/ENG	1115	1028	1010	995	980	967	954	941	929	918
	IAS	KT	231	224	223	221	220	219	218	217	215	214
	TAS	KT	246	258	260	262	265	267	270	273	276	278
	INDICATED	MACH	0.382	0.407	0.411	0.416	0.422	0.428	0.434	0.440	0.446	0.453
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.111	0.125	0.129	0.132	0.135	0.138	0.142	0.145	0.148	0.152

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
30000	N1	%	58.1	60.8	61.5	62.1	62.6	63.2	63.8	64.4	65.0	65.6
	F FLOW	LB/H/ENG	1071	983	968	951	936	922	909	896	884	872
	IAS	KT	226	220	218	217	216	214	213	212	211	209
	TAS	KT	241	252	255	257	259	261	264	267	269	272
	INDICATED	MACH	0.374	0.398	0.403	0.408	0.413	0.419	0.425	0.431	0.437	0.443
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.113	0.128	0.132	0.135	0.138	0.142	0.145	0.149	0.152	0.156
28000	N1	%	56.8	59.4	60.0	60.6	61.2	61.8	62.4	63.0	63.6	64.2
	F FLOW	LB/H/ENG	1029	939	923	908	894	878	864	851	839	827
	IAS	KT	222	215	214	212	211	210	208	207	206	205
	TAS	KT	236	246	249	251	253	256	258	261	263	266
	INDICATED	MACH	0.367	0.389	0.395	0.400	0.405	0.410	0.415	0.421	0.427	0.433
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.115	0.131	0.135	0.138	0.142	0.145	0.149	0.153	0.157	0.161

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
	N1	%	77.3	78.1	78.8	79.6	80.3	81.0	81.6	82.2	82.9	83.6
	F FLOW	LB/H/ENG	1352	1346	1341	1336	1330	1327	1325	1322	1322	1326
	IAS	KT	248	247	245	244	244	243	243	242	241	242
50000	TAS	KT	329	332	336	340	344	349	354	358	364	370
	INDICATED	MACH	0.532	0.540	0.548	0.556	0.566	0.576	0.587	0.597	0.608	0.621
	BUFFET MARGIN	G	2.42	2.37	2.33	2.28	2.23	2.19	2.14	2.09	2.04	1.99
	SR	NM/LB	0.122	0.123	0.125	0.127	0.129	0.131	0.134	0.136	0.138	0.139
	N1	%	76.3	77.1	77.8	78.6	79.3	80.1	80.7	81.3	82.0	82.7
	F FLOW	LB/H/ENG	1299	1293	1287	1284	1276	1272	1269	1265	1265	1266
	IAS	KT	245	243	242	241	240	239	238	238	237	237
48000	TAS	KT	324	327	331	335	338	343	348	352	357	363
	INDICATED	MACH	0.525	0.533	0.540	0.549	0.557	0.567	0.577	0.587	0.598	0.610
	BUFFET MARGIN	G	2.47	2.42	2.37	2.33	2.27	2.23	2.18	2.13	2.09	2.04
	SR	NM/LB	0.125	0.127	0.129	0.130	0.133	0.135	0.137	0.139	0.141	0.143
	N1	%	75.2	76.0	76.7	77.5	78.2	79.0	79.7	80.4	81.0	81.7
	F FLOW	LB/H/ENG	1247	1240	1233	1229	1224	1218	1214	1210	1209	1207
	IAS	KT	241	240	238	237	236	235	234	233	233	233
46000	TAS	KT	319	323	326	330	333	337	342	346	351	356
	INDICATED	MACH	0.517	0.525	0.532	0.541	0.549	0.557	0.567	0.577	0.588	0.599
	BUFFET MARGIN	G	2.52	2.47	2.42	2.37	2.32	2.27	2.23	2.18	2.13	2.08
	SR	NM/LB	0.128	0.130	0.132	0.134	0.136	0.138	0.141	0.143	0.145	0.148
	N1	%	74.2	74.9	75.6	76.4	77.1	77.9	78.6	79.4	80.1	80.7
	F FLOW	LB/H/ENG	1196	1188	1181	1176	1170	1166	1160	1155	1154	1150
	IAS	KT	237	236	235	234	232	231	230	229	229	228
44000	TAS	KT	314	318	321	325	328	332	335	340	345	350
	INDICATED	MACH	0.510	0.517	0.525	0.533	0.541	0.549	0.557	0.567	0.578	0.588
	BUFFET MARGIN	G	2.56	2.52	2.47	2.43	2.37	2.33	2.27	2.23	2.18	2.13
	SR	NM/LB	0.131	0.134	0.136	0.138	0.140	0.142	0.145	0.147	0.149	0.152
	N1	%	73.1	73.8	74.5	75.2	76.0	76.7	77.5	78.2	79.0	79.6
	F FLOW	LB/H/ENG	1146	1137	1130	1124	1117	1112	1108	1102	1100	1095
	IAS	KT	233	232	231	230	229	227	226	225	225	224
42000	TAS	KT	309	312	316	319	323	326	330	333	339	343
	INDICATED	MACH	0.502	0.509	0.517	0.525	0.532	0.540	0.549	0.557	0.568	0.578
	BUFFET MARGIN	G	2.56	2.56	2.53	2.48	2.43	2.38	2.33	2.27	2.23	2.18
	SR	NM/LB	0.135	0.137	0.140	0.142	0.144	0.147	0.149	0.151	0.154	0.157

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
	N1	%	72.0	72.7	73.3	74.0	74.7	75.5	76.3	77.0	77.8	78.5
	F FLOW	LB/H/ENG	1096	1087	1080	1072	1065	1059	1054	1050	1047	1041
	IAS	KT	230	228	227	226	225	224	222	221	220	219
40000	TAS	KT	304	307	310	314	317	321	324	328	332	336
	INDICATED	MACH	0.494	0.501	0.509	0.516	0.524	0.532	0.540	0.548	0.558	0.567
	BUFFET MARGIN	G	2.56	2.56	2.56	2.53	2.48	2.43	2.38	2.33	2.28	2.23
	SR	NM/LB	0.139	0.141	0.144	0.146	0.149	0.151	0.154	0.156	0.159	0.161
	N1	%	70.9	71.5	72.2	72.8	73.5	74.2	75.0	75.8	76.6	77.3
	F FLOW	LB/H/ENG	1048	1038	1031	1022	1015	1008	1002	998	995	988
	IAS	KT	226	224	223	222	221	220	218	217	216	215
38000	TAS	KT	299	302	305	308	312	315	318	322	326	329
	INDICATED	MACH	0.486	0.493	0.500	0.507	0.515	0.523	0.531	0.539	0.548	0.555
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.54	2.49	2.44	2.39	2.35	2.28
	SR	NM/LB	0.142	0.145	0.148	0.151	0.153	0.156	0.159	0.161	0.164	0.167
	N1	%	69.8	70.4	71.0	71.6	72.3	73.0	73.7	74.5	75.2	76.0
	F FLOW	LB/H/ENG	1000	990	981	972	966	958	952	948	941	938
	IAS	KT	222	220	219	218	217	216	214	214	212	211
36000	TAS	KT	293	296	299	302	306	309	312	316	320	323
	INDICATED	MACH	0.477	0.484	0.491	0.498	0.506	0.514	0.521	0.530	0.538	0.546
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.51	2.46	2.40	2.35
	SR	NM/LB	0.146	0.149	0.152	0.155	0.158	0.161	0.164	0.167	0.170	0.172
	N1	%	68.6	69.2	69.8	70.4	71.0	71.7	72.4	73.1	73.8	74.6
	F FLOW	LB/H/ENG	953	943	934	925	918	910	903	897	890	888
	IAS	KT	217	216	215	214	213	212	210	209	208	207
34000	TAS	KT	287	290	294	297	300	303	307	310	313	317
	INDICATED	MACH	0.468	0.475	0.482	0.489	0.497	0.504	0.512	0.520	0.527	0.537
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.53	2.47	2.43
	SR	NM/LB	0.151	0.154	0.157	0.160	0.164	0.167	0.170	0.173	0.176	0.179
	N1	%	67.4	68.0	68.6	69.1	69.7	70.4	71.0	71.7	72.4	73.1
	F FLOW	LB/H/ENG	907	897	888	878	870	863	855	846	840	835
	IAS	KT	213	212	211	210	208	208	206	205	204	203
32000	TAS	KT	281	285	288	291	294	297	301	303	307	310
	INDICATED	MACH	0.459	0.466	0.473	0.480	0.487	0.495	0.502	0.509	0.517	0.525
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.54	2.49
	SR	NM/LB	0.155	0.159	0.162	0.166	0.169	0.172	0.176	0.179	0.182	0.186

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
30000	N1	%	66.2	66.7	67.2	67.8	68.4	69.0	69.6	70.2	71.0	71.6
	F FLOW	LB/H/ENG	861	850	840	831	823	815	806	798	793	785
	IAS	KT	208	207	206	205	204	203	201	200	199	198
	TAS	KT	275	278	281	284	287	290	293	296	300	303
	INDICATED	MACH	0.449	0.456	0.462	0.469	0.477	0.484	0.491	0.498	0.506	0.513
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.160	0.163	0.167	0.171	0.175	0.178	0.182	0.186	0.189	0.193
28000	N1	%	64.8	65.3	65.9	66.4	67.0	67.6	68.2	68.8	69.4	70.1
	F FLOW	LB/H/ENG	816	805	794	785	775	767	758	751	745	737
	IAS	KT	203	202	201	200	199	198	196	195	195	193
	TAS	KT	269	271	274	277	280	283	286	289	293	296
	INDICATED	MACH	0.439	0.445	0.452	0.458	0.465	0.472	0.479	0.487	0.495	0.502
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.165	0.169	0.173	0.177	0.181	0.185	0.189	0.193	0.197	0.201

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)								
			29000	30000	31000	32000	33000	34000	35000	36000	37000
	N1	%	84.2	84.9	85.6	85.6	86.1	86.6	86.8	-	-
	F FLOW	LB/H/ENG	1327	1330	1335	1312	1303	1285	1198	-	-
	IAS	KT	241	241	241	236	234	230	210	-	-
50000	TAS	KT	375	381	388	386	390	390	364	-	-
	INDICATED	MACH	0.633	0.646	0.659	0.660	0.669	0.672	0.630	-	-
	BUFFET MARGIN	G	1.94	1.88	1.82	1.74	1.68	1.60	1.47	-	-
	SR	NM/LB	0.141	0.143	0.145	0.147	0.150	0.152	0.152	-	-
	N1	%	83.3	84.0	84.7	85.3	86.1	86.6	86.6	86.8	-
	F FLOW	LB/H/ENG	1266	1270	1273	1278	1285	1311	1236	1163	-
	IAS	KT	237	237	237	237	237	240	226	210	-
48000	TAS	KT	368	375	380	387	394	405	390	371	-
	INDICATED	MACH	0.622	0.635	0.648	0.661	0.676	0.700	0.676	0.646	-
	BUFFET MARGIN	G	1.98	1.93	1.87	1.81	1.75	1.69	1.60	1.48	-
	SR	NM/LB	0.145	0.147	0.149	0.151	0.153	0.155	0.158	0.160	-
	N1	%	82.3	83.0	83.7	84.4	85.1	85.8	86.8	86.6	-
	F FLOW	LB/H/ENG	1207	1208	1213	1215	1221	1229	1236	1190	-
	IAS	KT	232	232	232	232	232	233	233	224	-
46000	TAS	KT	362	367	373	379	386	393	400	392	-
	INDICATED	MACH	0.611	0.623	0.636	0.649	0.663	0.679	0.694	0.684	-
	BUFFET MARGIN	G	2.03	1.98	1.93	1.87	1.81	1.75	1.68	1.59	-
	SR	NM/LB	0.150	0.152	0.154	0.156	0.158	0.160	0.162	0.165	-
	N1	%	81.4	82.0	82.7	83.4	84.1	84.7	85.5	86.5	86.3
	F FLOW	LB/H/ENG	1151	1151	1152	1156	1158	1162	1171	1178	1098
	IAS	KT	228	228	227	227	227	227	228	228	211
44000	TAS	KT	355	360	366	372	378	384	392	399	380
	INDICATED	MACH	0.601	0.612	0.624	0.638	0.650	0.664	0.681	0.696	0.663
	BUFFET MARGIN	G	2.09	2.03	1.98	1.93	1.87	1.80	1.74	1.67	1.56
	SR	NM/LB	0.154	0.157	0.159	0.161	0.163	0.165	0.167	0.170	0.173
	N1	%	80.4	81.0	81.6	82.3	83.0	83.7	84.4	85.1	86.1
	F FLOW	LB/H/ENG	1097	1094	1092	1094	1098	1101	1105	1112	1117
	IAS	KT	224	223	223	222	222	223	222	223	221
42000	TAS	KT	349	354	358	364	370	377	383	390	396
	INDICATED	MACH	0.590	0.601	0.612	0.624	0.638	0.652	0.665	0.681	0.692
	BUFFET MARGIN	G	2.14	2.09	2.03	1.98	1.93	1.87	1.80	1.74	1.66
	SR	NM/LB	0.159	0.162	0.164	0.166	0.169	0.171	0.173	0.175	0.177

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)								
			29000	30000	31000	32000	33000	34000	35000	36000	37000
40000	N1	%	79.2	79.9	80.5	81.2	81.9	82.6	83.3	84.0	85.4
	F FLOW	LB/H/ENG	1039	1037	1036	1035	1036	1040	1045	1048	1058
	IAS	KT	219	218	218	218	217	217	218	217	218
	TAS	KT	341	346	351	356	362	368	375	381	390
	INDICATED	MACH	0.578	0.588	0.600	0.612	0.624	0.638	0.652	0.666	0.681
	BUFFET MARGIN	G	2.19	2.14	2.09	2.04	1.98	1.93	1.87	1.81	1.74
	SR	NM/LB	0.164	0.167	0.170	0.172	0.175	0.177	0.179	0.182	0.184
38000	N1	%	78.1	78.7	79.4	80.1	80.8	81.4	82.1	82.8	84.2
	F FLOW	LB/H/ENG	985	982	981	980	979	980	982	987	995
	IAS	KT	214	214	213	213	213	212	212	212	212
	TAS	KT	334	338	344	349	354	360	366	373	381
	INDICATED	MACH	0.566	0.576	0.588	0.600	0.611	0.623	0.637	0.651	0.666
	BUFFET MARGIN	G	2.24	2.19	2.15	2.10	2.04	1.99	1.93	1.87	1.81
	SR	NM/LB	0.169	0.172	0.175	0.178	0.181	0.184	0.186	0.189	0.191
36000	N1	%	76.7	77.5	78.3	78.9	79.6	80.2	80.9	81.6	83.0
	F FLOW	LB/H/ENG	932	929	928	926	924	923	923	925	932
	IAS	KT	209	209	209	208	208	207	207	207	207
	TAS	KT	326	331	336	342	347	352	357	363	371
	INDICATED	MACH	0.554	0.564	0.576	0.587	0.598	0.610	0.622	0.635	0.649
	BUFFET MARGIN	G	2.29	2.25	2.21	2.16	2.11	2.05	2.00	1.94	1.88
	SR	NM/LB	0.175	0.178	0.181	0.184	0.188	0.191	0.193	0.196	0.199
34000	N1	%	75.4	76.1	76.9	77.7	78.3	79.0	79.7	80.3	81.8
	F FLOW	LB/H/ENG	881	878	875	873	870	868	867	867	874
	IAS	KT	206	205	204	203	203	202	202	202	202
	TAS	KT	320	324	329	334	338	343	349	354	362
	INDICATED	MACH	0.544	0.553	0.563	0.574	0.585	0.596	0.608	0.620	0.634
	BUFFET MARGIN	G	2.37	2.31	2.27	2.22	2.17	2.12	2.06	2.01	1.95
	SR	NM/LB	0.182	0.185	0.188	0.191	0.195	0.198	0.201	0.204	0.207
32000	N1	%	73.9	74.7	75.5	76.2	77.0	77.7	78.4	79.0	80.4
	F FLOW	LB/H/ENG	831	828	823	819	817	814	813	812	815
	IAS	KT	202	201	199	198	198	197	197	196	196
	TAS	KT	314	318	321	325	330	335	340	345	352
	INDICATED	MACH	0.534	0.543	0.551	0.560	0.571	0.582	0.594	0.606	0.618
	BUFFET MARGIN	G	2.44	2.39	2.33	2.28	2.23	2.18	2.13	2.08	2.02
	SR	NM/LB	0.189	0.192	0.195	0.199	0.202	0.206	0.209	0.213	0.216

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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LONG RANGE CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)								
			29000	30000	31000	32000	33000	34000	35000	36000	37000
30000	N1	%	72.4	73.1	73.9	74.7	75.5	76.3	77.0	77.6	79.0
	F FLOW	LB/H/ENG	782	775	771	767	764	762	760	758	759
	IAS	KT	197	196	195	193	192	192	191	191	190
	TAS	KT	307	310	314	318	321	326	331	336	342
	INDICATED	MACH	0.523	0.530	0.538	0.547	0.556	0.567	0.578	0.590	0.601
	BUFFET MARGIN	G	2.52	2.46	2.40	2.35	2.29	2.25	2.20	2.15	2.09
	SR	NM/LB	0.197	0.200	0.204	0.207	0.210	0.214	0.218	0.222	0.226
28000	N1	%	70.8	71.5	72.2	73.0	73.8	74.6	75.4	76.2	77.6
	F FLOW	LB/H/ENG	731	725	721	717	713	711	707	705	706
	IAS	KT	192	191	190	189	188	187	186	185	185
	TAS	KT	299	303	306	310	314	318	322	327	333
	INDICATED	MACH	0.510	0.518	0.526	0.535	0.543	0.553	0.562	0.574	0.585
	BUFFET MARGIN	G	2.56	2.54	2.49	2.44	2.38	2.33	2.27	2.22	2.17
	SR	NM/LB	0.205	0.209	0.212	0.216	0.220	0.224	0.228	0.232	0.236

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
50000	N1	%	66.7	78.1	78.9	79.8	80.1	80.6	80.8	82.1	82.5	83.6
	F FLOW	LB/H/ENG	1425	1968	1969	1970	1942	1916	1872	1903	1876	1922
	IAS	KT	250	318	318	318	316	313	309	310	307	310
	TAS	KT	269	368	373	379	380	382	383	391	393	403
	INDICATED	MACH	0.414	0.574	0.584	0.595	0.600	0.606	0.609	0.624	0.630	0.648
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.095	0.093	0.095	0.096	0.098	0.100	0.102	0.103	0.105	0.105
48000	N1	%	66.1	77.7	78.5	79.4	80.1	80.6	80.8	82.0	82.5	83.6
	F FLOW	LB/H/ENG	1398	1947	1947	1948	1945	1922	1876	1909	1882	1929
	IAS	KT	250	319	319	319	318	316	311	314	311	314
	TAS	KT	269	368	373	379	383	386	386	395	397	407
	INDICATED	MACH	0.413	0.575	0.585	0.596	0.605	0.612	0.614	0.631	0.637	0.655
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.096	0.095	0.096	0.097	0.098	0.100	0.103	0.103	0.105	0.105
46000	N1	%	65.6	77.4	78.2	79.0	79.8	80.6	80.8	82.0	82.5	83.6
	F FLOW	LB/H/ENG	1375	1926	1925	1926	1928	1927	1882	1912	1886	1936
	IAS	KT	250	320	320	320	320	318	314	316	313	317
	TAS	KT	268	368	373	379	384	388	389	397	399	410
	INDICATED	MACH	0.413	0.576	0.586	0.597	0.608	0.617	0.621	0.636	0.642	0.662
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.098	0.096	0.097	0.098	0.100	0.101	0.103	0.104	0.106	0.106
44000	N1	%	65.0	77.1	77.9	78.7	79.5	80.2	80.8	82.0	82.4	83.4
	F FLOW	LB/H/ENG	1352	1905	1904	1905	1906	1909	1886	1916	1893	1932
	IAS	KT	250	320	320	320	320	320	317	319	317	320
	TAS	KT	268	368	373	379	384	390	392	400	403	413
	INDICATED	MACH	0.413	0.576	0.587	0.598	0.609	0.620	0.625	0.641	0.649	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.099	0.097	0.098	0.099	0.101	0.102	0.104	0.104	0.106	0.107
42000	N1	%	64.5	76.7	77.5	78.3	79.1	79.8	80.6	81.5	82.4	83.0
	F FLOW	LB/H/ENG	1331	1880	1878	1878	1879	1881	1884	1889	1897	1902
	IAS	KT	250	320	320	320	320	320	320	320	319	320
	TAS	KT	268	367	373	378	383	389	395	400	406	412
	INDICATED	MACH	0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.654	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.101	0.098	0.099	0.101	0.102	0.103	0.105	0.106	0.107	0.108

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
40000	N1	%	64.1	76.4	77.1	77.9	78.7	79.4	80.2	81.0	81.9	82.7
	F FLOW	LB/H/ENG	1310	1855	1853	1852	1853	1854	1857	1861	1866	1872
	IAS	KT	250	320	320	320	320	320	320	320	320	320
	TAS	KT	268	367	372	377	383	388	394	400	406	412
	INDICATED	MACH	0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.102	0.099	0.100	0.102	0.103	0.105	0.106	0.107	0.109	0.110
38000	N1	%	63.5	76.0	76.7	77.5	78.3	79.0	79.8	80.6	81.4	82.3
	F FLOW	LB/H/ENG	1289	1832	1829	1828	1827	1828	1830	1833	1838	1843
	IAS	KT	250	320	320	320	320	320	320	320	320	320
	TAS	KT	267	366	371	377	382	388	394	399	405	411
	INDICATED	MACH	0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.104	0.100	0.102	0.103	0.105	0.106	0.107	0.109	0.110	0.112
36000	N1	%	62.9	75.6	76.4	77.1	77.9	78.6	79.4	80.2	81.0	81.9
	F FLOW	LB/H/ENG	1270	1809	1805	1803	1803	1803	1804	1807	1810	1815
	IAS	KT	250	320	320	320	320	320	320	320	320	320
	TAS	KT	267	366	371	376	382	387	393	399	405	411
	INDICATED	MACH	0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.105	0.101	0.103	0.104	0.106	0.107	0.109	0.110	0.112	0.113
34000	N1	%	62.4	75.3	76.0	76.7	77.5	78.2	79.0	79.7	80.6	81.4
	F FLOW	LB/H/ENG	1251	1786	1782	1780	1778	1778	1779	1781	1784	1788
	IAS	KT	250	320	320	320	320	320	320	320	320	320
	TAS	KT	267	365	370	376	381	387	392	398	404	410
	INDICATED	MACH	0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.107	0.102	0.104	0.105	0.107	0.109	0.110	0.112	0.113	0.115
32000	N1	%	61.9	75.0	75.6	76.4	77.1	77.8	78.6	79.3	80.1	81.0
	F FLOW	LB/H/ENG	1232	1764	1759	1756	1754	1753	1754	1755	1757	1761
	IAS	KT	250	320	320	320	320	320	320	320	320	320
	TAS	KT	266	365	370	375	381	386	392	398	403	409
	INDICATED	MACH	0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.108	0.103	0.105	0.107	0.108	0.110	0.112	0.113	0.115	0.116

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 5000 FT TO 18000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			5000	10000	11000	12000	13000	14000	15000	16000	17000	18000
30000	N1	%	61.4	74.7	75.3	76.0	76.7	77.4	78.2	78.9	79.7	80.5
	F FLOW	LB/H/ENG	1214	1741	1737	1733	1730	1729	1728	1729	1731	1733
	IAS	KT	250	320	320	320	320	320	320	320	320	320
	TAS	KT	266	364	369	374	380	385	391	397	403	409
	INDICATED	MACH	0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.110	0.104	0.106	0.108	0.110	0.112	0.113	0.115	0.116	0.118
28000	N1	%	60.9	74.3	75.0	75.6	76.3	77.0	77.7	78.5	79.2	80.0
	F FLOW	LB/H/ENG	1197	1719	1714	1710	1707	1705	1704	1704	1705	1707
	IAS	KT	250	320	320	320	320	320	320	320	320	320
	TAS	KT	266	363	369	374	379	385	390	396	402	408
	INDICATED	MACH	0.413	0.576	0.587	0.598	0.608	0.620	0.631	0.643	0.655	0.667
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SPECIFIC RANGE	NM/LB	0.111	0.106	0.107	0.109	0.111	0.113	0.115	0.116	0.118	0.119

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
	N1	%	83.7	84.3	85.1	85.4	85.4	86.0	85.9	86.7	86.1	86.4
	F FLOW	LB/H/ENG	1873	1866	1881	1851	1802	1803	1732	1767	1639	1616
	IAS	KT	305	304	304	301	297	297	290	293	280	277
50000	TAS	KT	402	407	413	415	415	421	419	430	417	421
	INDICATED	MACH	0.650	0.660	0.672	0.679	0.682	0.696	0.695	0.715	0.698	0.707
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.55	2.44	2.34	2.24	2.14
	SR	NM/LB	0.107	0.109	0.110	0.112	0.115	0.117	0.121	0.122	0.127	0.130
	N1	%	83.7	84.3	85.1	85.4	85.4	86.0	85.8	86.7	86.0	86.3
	F FLOW	LB/H/ENG	1879	1872	1889	1859	1807	1808	1737	1772	1647	1624
	IAS	KT	309	308	308	304	299	299	292	295	283	281
48000	TAS	KT	406	411	417	419	418	424	422	433	422	425
	INDICATED	MACH	0.657	0.667	0.680	0.686	0.688	0.701	0.700	0.721	0.706	0.715
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.54	2.43	2.33	2.22
	SR	NM/LB	0.108	0.110	0.110	0.113	0.116	0.117	0.121	0.122	0.128	0.131
	N1	%	83.7	84.2	85.1	85.3	85.4	85.9	85.8	86.7	86.0	86.3
	F FLOW	LB/H/ENG	1885	1879	1896	1868	1815	1813	1743	1777	1655	1629
	IAS	KT	312	311	311	308	303	301	295	298	287	283
46000	TAS	KT	410	415	421	423	422	427	425	436	427	428
	INDICATED	MACH	0.664	0.674	0.687	0.694	0.695	0.706	0.705	0.726	0.714	0.721
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.53	2.42	2.31
	SR	NM/LB	0.109	0.110	0.111	0.113	0.116	0.118	0.122	0.122	0.129	0.132
	N1	%	83.6	84.2	85.0	85.3	85.4	85.9	85.8	86.6	86.0	86.3
	F FLOW	LB/H/ENG	1889	1883	1904	1876	1822	1821	1748	1782	1661	1637
	IAS	KT	315	314	315	312	306	305	297	300	289	287
44000	TAS	KT	413	417	425	427	427	431	428	439	430	433
	INDICATED	MACH	0.669	0.680	0.695	0.701	0.703	0.714	0.711	0.732	0.720	0.729
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.53	2.41
	SR	NM/LB	0.109	0.111	0.112	0.114	0.117	0.118	0.122	0.123	0.129	0.132
	N1	%	83.6	84.2	85.0	85.3	85.3	85.9	85.7	86.6	86.0	86.2
	F FLOW	LB/H/ENG	1895	1890	1912	1885	1828	1826	1755	1784	1666	1642
	IAS	KT	318	317	318	315	309	308	301	302	292	289
42000	TAS	KT	417	421	429	431	429	434	432	440	433	436
	INDICATED	MACH	0.676	0.687	0.702	0.709	0.709	0.720	0.719	0.735	0.726	0.735
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.51
	SR	NM/LB	0.110	0.112	0.112	0.114	0.117	0.119	0.123	0.123	0.130	0.133

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
	N1	%	83.3	84.2	84.8	85.3	85.3	85.8	85.7	86.5	85.9	86.2
	F FLOW	LB/H/ENG	1879	1894	1898	1890	1836	1835	1763	1791	1671	1647
	IAS	KT	320	320	320	318	312	311	305	306	294	292
40000	TAS	KT	418	424	430	434	434	439	436	444	436	439
	INDICATED	MACH	0.680	0.692	0.706	0.714	0.717	0.728	0.727	0.744	0.732	0.741
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.111	0.112	0.113	0.115	0.118	0.119	0.124	0.124	0.130	0.133
	N1	%	83.0	83.7	84.4	85.1	85.3	85.8	85.7	86.5	85.9	86.2
	F FLOW	LB/H/ENG	1850	1858	1867	1876	1844	1843	1769	1798	1679	1649
	IAS	KT	320	320	320	320	316	315	307	309	298	293
38000	TAS	KT	417	423	430	436	438	443	439	449	440	441
	INDICATED	MACH	0.680	0.693	0.706	0.719	0.724	0.736	0.733	0.752	0.740	0.744
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.113	0.114	0.115	0.116	0.119	0.120	0.124	0.125	0.131	0.134
	N1	%	82.6	83.3	84.0	84.7	85.2	85.8	85.6	86.4	85.8	86.1
	F FLOW	LB/H/ENG	1821	1828	1836	1845	1850	1852	1777	1803	1687	1656
	IAS	KT	320	320	320	320	319	319	311	312	302	297
36000	TAS	KT	417	423	429	436	441	447	444	452	445	445
	INDICATED	MACH	0.680	0.693	0.706	0.719	0.730	0.744	0.741	0.758	0.749	0.753
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.114	0.116	0.117	0.118	0.119	0.121	0.125	0.125	0.132	0.134
	N1	%	82.2	82.9	83.6	84.3	84.9	85.5	85.6	86.3	85.8	86.0
	F FLOW	LB/H/ENG	1793	1799	1807	1815	1824	1834	1785	1809	1693	1663
	IAS	KT	320	320	320	320	320	320	315	316	304	301
34000	TAS	KT	416	422	429	435	442	448	448	456	448	450
	INDICATED	MACH	0.680	0.693	0.706	0.719	0.733	0.747	0.750	0.766	0.755	0.762
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.116	0.117	0.119	0.120	0.121	0.122	0.126	0.126	0.132	0.135
	N1	%	81.8	82.5	83.2	83.9	84.5	85.1	85.5	86.3	85.7	85.9
	F FLOW	LB/H/ENG	1765	1771	1777	1785	1793	1802	1790	1814	1700	1670
	IAS	KT	320	320	320	320	320	320	317	318	308	305
32000	TAS	KT	415	422	428	434	441	448	451	459	452	454
	INDICATED	MACH	0.680	0.693	0.706	0.719	0.733	0.747	0.755	0.773	0.763	0.771
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.118	0.119	0.120	0.122	0.123	0.124	0.126	0.127	0.133	0.136

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 19000 FT TO 28000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)									
			19000	20000	21000	22000	23000	24000	25000	26000	27000	28000
30000	N1	%	81.4	82.1	82.8	83.5	84.1	84.7	85.3	86.1	85.7	85.9
	F FLOW	LB/H/ENG	1737	1742	1748	1754	1762	1770	1779	1809	1708	1675
	IAS	KT	320	320	320	320	320	320	320	322	312	307
	TAS	KT	415	421	427	434	440	447	454	463	457	458
	INDICATED	MACH	0.680	0.693	0.706	0.719	0.733	0.747	0.761	0.780	0.772	0.777
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.119	0.121	0.122	0.124	0.125	0.126	0.128	0.128	0.134	0.137
28000	N1	%	80.9	81.7	82.4	83.0	83.7	84.3	84.9	85.7	85.6	85.4
	F FLOW	LB/H/ENG	1710	1714	1719	1725	1732	1739	1747	1776	1714	1645
	IAS	KT	320	320	320	320	320	320	320	322	315	309
	TAS	KT	414	420	426	433	439	446	453	462	460	458
	INDICATED	MACH	0.680	0.693	0.706	0.719	0.733	0.747	0.761	0.780	0.779	0.780
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
	SR	NM/LB	0.121	0.123	0.124	0.126	0.127	0.128	0.130	0.130	0.134	0.139

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)								
			29000	30000	31000	32000	33000	34000	35000	36000	37000
50000	N1	%	86.1	85.7	85.8	85.6	86.1	86.6	86.8	-	-
	F FLOW	LB/H/ENG	1525	1439	1391	1312	1303	1285	1198	-	-
	IAS	KT	266	256	249	236	234	230	210	-	-
	TAS	KT	412	402	399	386	390	390	364	-	-
	INDICATED	MACH	0.695	0.682	0.680	0.660	0.669	0.672	0.630	-	-
	BUFFET MARGIN	G	2.04	1.94	1.85	1.74	1.68	1.60	1.47	-	-
	SR	NM/LB	0.135	0.140	0.144	0.147	0.150	0.152	0.152	-	-
48000	N1	%	86.0	85.7	85.7	85.6	86.0	86.6	86.6	86.8	-
	F FLOW	LB/H/ENG	1535	1454	1405	1335	1326	1311	1236	1163	-
	IAS	KT	271	261	255	245	243	240	226	210	-
	TAS	KT	418	410	408	400	403	405	390	371	-
	INDICATED	MACH	0.706	0.696	0.694	0.684	0.693	0.700	0.676	0.646	-
	BUFFET MARGIN	G	2.13	2.03	1.94	1.84	1.77	1.69	1.60	1.48	-
	SR	NM/LB	0.136	0.141	0.145	0.150	0.152	0.155	0.158	0.160	-
46000	N1	%	86.0	85.7	85.7	85.5	86.0	86.5	86.5	86.6	-
	F FLOW	LB/H/ENG	1543	1466	1417	1349	1340	1329	1259	1190	-
	IAS	KT	275	266	259	251	249	247	236	224	-
	TAS	KT	423	417	414	408	412	416	406	392	-
	INDICATED	MACH	0.714	0.707	0.706	0.698	0.708	0.718	0.704	0.684	-
	BUFFET MARGIN	G	2.21	2.12	2.02	1.93	1.84	1.76	1.68	1.59	-
	SR	NM/LB	0.137	0.142	0.146	0.151	0.154	0.156	0.161	0.165	-
44000	N1	%	85.9	85.7	85.7	85.5	86.0	86.5	86.4	86.4	86.3
	F FLOW	LB/H/ENG	1550	1475	1428	1361	1355	1343	1275	1208	1098
	IAS	KT	278	269	264	255	255	253	243	233	211
	TAS	KT	427	422	420	414	420	424	416	407	380
	INDICATED	MACH	0.723	0.716	0.717	0.710	0.723	0.733	0.723	0.709	0.663
	BUFFET MARGIN	G	2.31	2.21	2.11	2.02	1.92	1.82	1.75	1.67	1.56
	SR	NM/LB	0.138	0.143	0.147	0.152	0.155	0.158	0.163	0.168	0.173
42000	N1	%	85.9	85.7	85.7	85.5	85.9	86.5	86.3	86.2	86.1
	F FLOW	LB/H/ENG	1555	1484	1436	1372	1366	1356	1289	1222	1117
	IAS	KT	280	273	267	260	259	257	249	240	221
	TAS	KT	430	426	425	421	427	431	425	417	396
	INDICATED	MACH	0.729	0.725	0.726	0.722	0.735	0.746	0.739	0.728	0.692
	BUFFET MARGIN	G	2.41	2.31	2.20	2.11	2.00	1.89	1.81	1.74	1.66
	SR	NM/LB	0.139	0.144	0.148	0.153	0.156	0.159	0.165	0.171	0.177

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)								
			29000	30000	31000	32000	33000	34000	35000	36000	37000
40000	N1	%	85.8	85.6	85.6	85.5	85.9	86.5	86.3	86.1	86.0
	F FLOW	LB/H/ENG	1559	1493	1444	1381	1375	1369	1301	1231	1133
	IAS	KT	283	276	271	264	263	262	254	244	229
	TAS	KT	434	431	430	426	432	438	432	424	409
	INDICATED	MACH	0.735	0.733	0.735	0.731	0.744	0.758	0.751	0.741	0.715
	BUFFET MARGIN	G	2.52	2.41	2.30	2.20	2.08	1.96	1.88	1.81	1.74
	SR	NM/LB	0.139	0.144	0.149	0.154	0.157	0.160	0.166	0.172	0.181
38000	N1	%	85.8	85.6	85.6	85.4	85.9	86.5	86.3	86.1	85.9
	F FLOW	LB/H/ENG	1563	1499	1450	1389	1384	1380	1314	1242	1144
	IAS	KT	286	279	274	267	266	266	259	249	235
	TAS	KT	437	434	433	431	437	443	439	432	418
	INDICATED	MACH	0.741	0.740	0.741	0.740	0.754	0.768	0.764	0.754	0.732
	BUFFET MARGIN	G	2.56	2.52	2.40	2.30	2.17	2.03	1.95	1.88	1.82
	SR	NM/LB	0.140	0.145	0.149	0.155	0.158	0.161	0.167	0.174	0.183
36000	N1	%	85.8	85.6	85.6	85.4	85.9	86.5	86.3	86.0	85.8
	F FLOW	LB/H/ENG	1565	1505	1455	1398	1394	1391	1326	1255	1157
	IAS	KT	287	282	276	271	270	270	262	254	241
	TAS	KT	438	437	437	436	442	448	444	439	427
	INDICATED	MACH	0.744	0.746	0.748	0.750	0.763	0.778	0.774	0.768	0.748
	BUFFET MARGIN	G	2.56	2.56	2.52	2.40	2.26	2.10	2.02	1.95	1.90
	SR	NM/LB	0.140	0.145	0.150	0.156	0.159	0.161	0.168	0.175	0.185
34000	N1	%	85.6	85.6	85.5	85.4	85.9	86.1	86.0	86.0	85.8
	F FLOW	LB/H/ENG	1573	1514	1461	1404	1400	1375	1319	1267	1166
	IAS	KT	292	285	279	273	273	271	264	258	245
	TAS	KT	445	442	440	439	445	449	447	445	433
	INDICATED	MACH	0.756	0.755	0.754	0.756	0.770	0.780	0.780	0.780	0.759
	BUFFET MARGIN	G	2.56	2.56	2.56	2.52	2.36	2.21	2.11	2.01	1.98
	SR	NM/LB	0.141	0.146	0.150	0.156	0.159	0.163	0.169	0.176	0.186
32000	N1	%	85.6	85.5	85.5	85.4	85.9	85.7	85.6	85.5	85.9
	F FLOW	LB/H/ENG	1577	1523	1469	1407	1406	1355	1299	1246	1179
	IAS	KT	295	289	283	275	275	271	264	258	250
	TAS	KT	448	447	445	441	449	448	447	445	440
	INDICATED	MACH	0.762	0.764	0.764	0.760	0.777	0.780	0.780	0.780	0.772
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.47	2.35	2.24	2.13	2.06
	SR	NM/LB	0.142	0.147	0.151	0.157	0.160	0.165	0.172	0.178	0.187

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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MAXIMUM SPEED CRUISE - ALL ENGINES OPERATING

AE3007A1 and AE3007A1P ENGINES

ALTITUDE: 29000 FT TO 37000 FT

CRUISE CONFIGURATION
BLEED: OPEN
ANTI ICE: ON (Engine or all)
ISA CONDITION

WEIGHT (LB)			ALTITUDE (FT)								
			29000	30000	31000	32000	33000	34000	35000	36000	37000
30000	N1	%	85.5	85.5	85.4	85.3	85.6	85.4	85.2	85.1	85.7
	F FLOW	LB/H/ENG	1582	1532	1478	1419	1396	1337	1280	1226	1180
	IAS	KT	298	293	286	280	277	271	264	258	252
	TAS	KT	452	452	450	447	450	448	446	444	444
	INDICATED	MACH	0.771	0.774	0.773	0.773	0.780	0.780	0.780	0.780	0.780
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.50	2.38	2.27	2.16
	SR	NM/LB	0.143	0.147	0.152	0.158	0.161	0.168	0.174	0.181	0.188
28000	N1	%	85.3	85.2	85.1	85.1	85.0	85.0	84.9	84.7	85.3
	F FLOW	LB/H/ENG	1583	1523	1467	1413	1361	1311	1262	1207	1160
	IAS	KT	302	296	289	283	277	271	264	258	252
	TAS	KT	457	455	453	451	449	447	445	443	443
	INDICATED	MACH	0.780	0.780	0.780	0.780	0.780	0.780	0.780	0.780	0.780
	BUFFET MARGIN	G	2.56	2.56	2.56	2.56	2.56	2.56	2.54	2.43	2.31
	SR	NM/LB	0.144	0.149	0.154	0.160	0.165	0.171	0.176	0.184	0.191

INCREASE/DECREASE N1% BY 1.1% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE FUEL FLOW BY 1.2% PER 5°C ABOVE/BELOW ISA CONDITION.
INCREASE/DECREASE TAS BY 4 KT PER 5°C ABOVE/BELOW ISA CONDITION.

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SECTION 1-06

WEIGHT AND BALANCE

TABLE OF CONTENTS

Page Block
Introduction 1-06-00
Standard Terms and Definitions 1-06-10
General Data 1-06-15
Index System 1-06-30
Center of Gravity Curtailments 1-06-40
Balance Chart 1-06-50
Sample Balance Chart (*) 1-06-55

NOTE: Items marked with an asterisk (*) may not be present in this manual.

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INTRODUCTION

This Section contains information equivalent to the Weight and Balance manual and is intended to assist the operator in defining the weight and balance system and constrained CG limits.

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STANDARD TERMS AND DEFINITIONS

EQUIPPED EMPTY WEIGHT (EEW) OR MANUFACTURER EMPTY WEIGHT (MEW)

It is the weight of structure, power plant, instruments, interior furnishings, systems, optional, portable, and emergency equipment and other items of equipment that are an integral part of the airplane configuration. It is essentially a dry weight, including only those fluids contained in closed systems such as oxygen, fire extinguisher agent, landing gear shock absorber fluid, etc...

BASIC EMPTY WEIGHT (BEW)

It is the MEW plus the weight of the following items:

- APU oil
- Engine oil
- Hydraulic fluid
- Unusable fuel

OPERATIONAL EMPTY WEIGHT (OEW) OR DRY OPERATING WEIGHT (DOW)

It is the BEW plus the weight of the operational items.

Operational items are those necessary for airplane operation and not included in the BEW.

The operational items are:

- Crew and crew baggage
- Navigation kit (manuals, charts, etc.)
- Catering (beverages and foods) and removable service equipment for galley (such as standard units, etc.)
- Lavatory rinse water
- Lavatory chemical fluid

ACTUAL ZERO FUEL WEIGHT (AZFW)

This is the OEW plus actual payload.

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PAYLOAD OR TOTAL TRAFFIC LOAD

This is the weight of passengers, baggage and cargo.

MAXIMUM ALLOWABLE PAYLOAD

It is the maximum approved weight that can be loaded into the airplane. Maximum payload is the Maximum Zero Fuel Weight (MZFW) less Operational Empty Weight (OEW).

MAXIMUM DESIGN ZERO FUEL WEIGHT (MZFW)

This is the maximum authorized weight before usable fuel be loaded. The MZFW is related to airplane structural limitations.

MAXIMUM DESIGN RAMP WEIGHT (MRW)

This is the maximum authorized ramp weight.

MAXIMUM DESIGN TAKEOFF WEIGHT (MTOW)

This is the maximum authorized weight for takeoff.

MAXIMUM DESIGN LANDING WEIGHT (MLW)

This is the maximum authorized weight for landing.

MINIMUM OPERATING WEIGHT (MOW)

This is the minimum authorized weight to operate the airplane.

CENTER OF GRAVITY (CG)

This is the position where the mass of the aircraft is considered concentrated for balance purposes. It is normally referred to in terms of %MAC.

AIRPLANE DATUM

This is a plane perpendicular to the fuselage centerline from where all arm measurements are taken.

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MEAN AERODYNAMIC CHORD (MAC)

This is the chord of an imaginary rectangular airfoil with the same area of the actual wing and which produces the same resulting force vectors of the actual wing. The aircraft forward and aft CG limits are referred to in terms of %MAC.

INDEX SYSTEM

This is a convention for presenting aircraft or body moments. It is the moment of the body converted to a different measuring system.

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GENERAL DATA

The general data presented in this section is intended to be used for specific weight and balance calculations and is equivalent to the information contained in the Weight & Balance Manual.

MAXIMUM GROSS WEIGHTS AND CENTER OF GRAVITY LIMITS

Refer to section 1-01-05.

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BALANCE REFERENCE SYSTEM (EMB-145 MODELS)

BALANCE ARMS/BODY STATION

Longitudinal location of the Centers of Gravity (CG) identified throughout this Manual regarding airplane and components will be referred to as Balance Arms. Balance Arms are the distance in inches from the Airplane Datum which is located at the zero station of the fuselage.

Balance Arms (BA) are equivalent to Body Station (BS) on the EMB-145 models.

AIRPLANE DATUM

The Airplane Datum is a plane, perpendicular to the fuselage centerline, located at 535.47 in ahead of the wing stub front spar.

For external reference, the Datum is located at 649.61 in ahead of the wing jack points.

WING MEAN AERODYNAMIC CHORD (MAC)

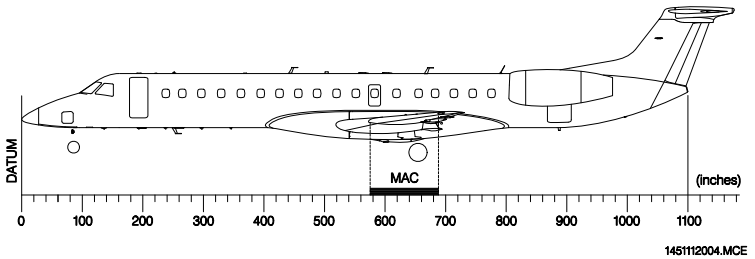
The length of the MAC is 112.80 in.

The leading edge of the MAC (LEMAC) is Balance Arm 574.80 in.

Percentage of MAC is obtained using the following formula:

$$\%MAC = \frac{(X - 574.80) \times 100}{112.80}$$

where X = Balance Arm of airplane CG measured in inches.



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BALANCE REFERENCE SYSTEM (ERJ-140 ER AND LR MODELS)

BALANCE ARMS/BODY STATION

Longitudinal location of the Centers of Gravity (CG) identified throughout this Manual regarding airplane and components will be referred to as Balance Arms. Balance Arms are the distance in inches from the Airplane Datum which is located at the zero station of the fuselage.

Balance Arms (BA) are equivalent to Body Station (BS) on the ERJ-140 ER and LR models.

AIRPLANE DATUM

The Airplane Datum is a plane, perpendicular to the fuselage centerline, located at 499.45 in ahead of the wing stub front spar.

For external reference, the Datum is located at 613.58 in ahead of the wing jack points.

WING MEAN AERODYNAMIC CHORD (MAC)

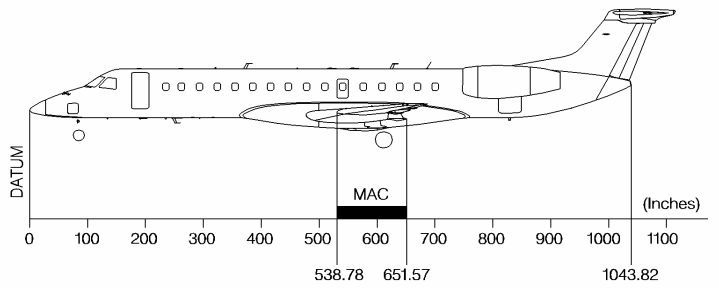
The length of the MAC is 112.80 in.

The leading edge of the MAC (LEMAC) is Balance Arm 538.78 in.

Percentage of MAC is obtained using the following formula:

$$\%MAC = \frac{(X - 538.78) \times 100}{112.80}$$

where X = Balance Arm of airplane CG measured in inches.



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BALANCE REFERENCE SYSTEM (EMB-135 ER AND LR MODELS)

BALANCE ARMS/BODY STATION

Longitudinal location of the Centers of Gravity (CG) identified throughout this Manual regarding airplane and components will be referred to as Balance Arms. Balance Arms are the distance in inches from the Airplane Datum which is located at the zero station of the fuselage.

Balance Arms (BA) are equivalent to Body Station (BS) on the EMB-135 ER and LR models.

AIRPLANE DATUM

The Airplane Datum is a plane, perpendicular to the fuselage centerline, located at 456.50 in ahead of the wing stub front spar.

For external reference, the Datum is located at 570.63 in ahead of the wing jack points.

WING MEAN AERODYNAMIC CHORD (MAC)

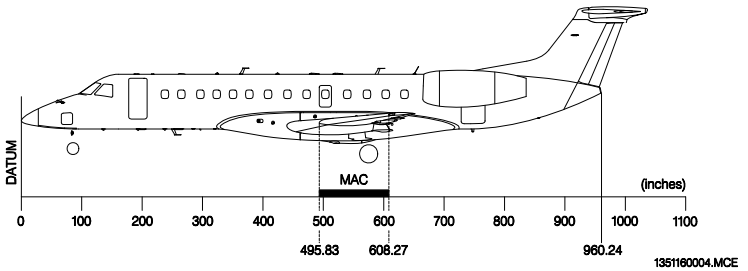
The length of the MAC is 112.80 in.

The leading edge of the MAC (LEMAC) is Balance Arm 495.83 in.

Percentage of MAC is obtained using the following formula:

$$\%MAC = \frac{(X - 495.83) \times 100}{112.80}$$

where X = Balance Arm of airplane CG measured in inches.



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FUEL DATA

FUEL DEFINITIONS

- USABLE FUEL - Is the fuel to be effectively consumed by the engines.
- UNUSABLE FUEL - Is the fuel remaining after total usable fuel has been consumed.
- DRAINABLE FUEL - Is that portion of fuel which can be drawn off through fuel drains with the airplane leveled.
- UNDRAINABLE FUEL - Is that portion of fuel which can not be drawn off by standard draining procedures.

FUEL QUANTITIES (EMB-145 MODELS)

EMB-145 ER, EP and MP Models:

FUEL CATEGORY	VOLUME (US Gal)	WEIGHT (lb)	CG BALANCE ARM (in)
UNUSABLE UNDRAINABLE	1.6	11	580.31
UNUSABLE DRAINABLE	12.6	85	580.31
TOTAL UNUSABLE	14.2	96	580.31
USABLE	1359.6	9200	603.62

EMB-145 LR Model:

FUEL CATEGORY	VOLUME (US Gal)	WEIGHT (lb)	CG BALANCE ARM (in)
UNUSABLE UNDRAINABLE	2.6	17.6	580.31
UNUSABLE DRAINABLE	9.0	60.8	580.31
TOTAL UNUSABLE	11.6	78.4	580.31
USABLE	1689.8	11434.8	596.57

NOTE: Fuel density may range from 6.550 to 6.770 lb/US Gal. The values above have been determined for an adopted fuel density of 6.767 lb/US Gal.

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EMB-145 XR Model:

Wing Tank

FUEL CATEGORY	VOLUME (US Gal)	WEIGHT (lb)	CG BALANCE ARM (in)
UNUSABLE UNDRAINABLE	2.6	17.6	580.31
UNUSABLE DRAINABLE	9.0	60.8	580.31
TOTAL UNUSABLE	11.6	78.4	580.31
USABLE	1689.8	11434.8	596.57

Ventral Tank

FUEL CATEGORY	VOLUME (US Gal)	WEIGHT (lb)	CG BALANCE ARM (in)
UNUSABLE UNDRAINABLE	0.7	5.0	678.43
UNUSABLE DRAINABLE	2.4	16.1	680.63
TOTAL UNUSABLE	3.1	21.1	680.91
USABLE	275.3	1862.7	696.38

NOTE: The values above have been determined for an adopted fuel density of 6.767 lb/US Gal.

FUEL QUANTITIES (ERJ-140 MODELS)

ERJ-140 ER Model:

FUEL CATEGORY	VOLUME (US Gal)	WEIGHT (lb)	CG BALANCE ARM (in)
UNUSABLE UNDRAINABLE	1.6	11	544.29
UNUSABLE DRAINABLE	12.6	85	544.29
TOTAL UNUSABLE	14.2	96	544.29
USABLE	1359.6	9200	567.60

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ERJ-140 LR Model:

FUEL CATEGORY	VOLUME (US Gal)	WEIGHT (lb)	CG BALANCE ARM (in)
UNUSABLE UNDRAINABLE	2.6	17.6	544.29
UNUSABLE DRAINABLE	9.0	60.8	544.29
TOTAL UNUSABLE	11.6	78.4	544.29
USABLE	1689.8	11434.8	560.55

NOTE: Fuel density may range from 6.550 to 6.770 lb/US Gal. The values above have been determined for an adopted fuel density of 6.767 lb/US Gal.

FUEL QUANTITIES (EMB-135 MODELS)

EMB-135 ER Model:

FUEL CATEGORY	VOLUME (US Gal)	WEIGHT (lb)	CG BALANCE ARM (in)
UNUSABLE UNDRAINABLE	1.6	11	501.34
UNUSABLE DRAINABLE	12.6	85	501.34
TOTAL UNUSABLE	14.2	96	501.34
USABLE	1359.6	9200	524.65

EMB-135 LR Model:

FUEL CATEGORY	VOLUME (US Gal)	WEIGHT (lb)	CG BALANCE ARM (in)
UNUSABLE UNDRAINABLE	2.6	17.6	501.34
UNUSABLE DRAINABLE	9.0	60.8	501.34
TOTAL UNUSABLE	11.6	78.4	501.34
USABLE	1689.8	11434.8	518.00

NOTE: Fuel density may range from 6.550 to 6.770 lb/US Gal. The values above have been determined for an adopted fuel density of 6.767 lb/US Gal.

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MISCELLANEOUS FLUIDS (EMB-145 MODELS)

FLUID	WEIGHT (lb)	BALANCE ARM (in)
ENGINE OIL (1)	53.0	879.13
APU OIL (1)	4.4	1070.47
HYDRAULIC (2)		
• *WITH THRUST REVERSER*	79.4	735.43
• *WITHOUT THRUST REVERSER*	72.8	716.54
LAVATORY CHEMICAL FLUID	15.4	810.24
LAVATORY RINSE WATER	44.1	813.39

(ERJ-140 MODELS)

FLUID	WEIGHT (lb)	BALANCE ARM (in)
ENGINE OIL (1)	53.0	823.43
APU OIL (1)	4.4	1014.76
HYDRAULIC (2)		
WITH THRUST REVERSER	75.0	699.2
WITHOUT THRUST REVERSER	68.3	684.2
LAVATORY CHEMICAL FLUID	15.4	754.13
LAVATORY RINSE WATER	44.1	716.57

(EMB-135 MODELS)

FLUID	WEIGHT (lb)	BALANCE ARM (in)
ENGINE OIL (1)	53.0	739.65
APU OIL (1)	4.4	930.71
HYDRAULIC (2)		
WITH THRUST REVERSER	75.0	608.27
WITHOUT THRUST REVERSER	68.3	594.49
LAVATORY CHEMICAL FLUID	15.4	670.47
LAVATORY RINSE WATER	44.1	673.62

NOTE: (1) Adopted engine oil density (ref. MIL-L-7808): 8.17 lb/US Gal.
(2) Adopted hydraulic fluid density (ref. SAE AS 1241A TYPE IV): 8.26 lb/US Gal.

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PITCH TRIM SETTING

NOTE: For takeoff when setting pitch trim to 8, first select 7 and stop trimming immediately when the value 8 is displayed. When setting pitch trim to 4, first select 5 and stop trimming immediately when the value 4 is displayed.

EMB-145 MODELS

CG POSITION (%)	LESS THAN OR EQUAL TO 27.5	27.6 UP TO 32.5	32.6 UP TO 36.5	36.6 UP TO 41.5	ABOVE OR EQUAL TO 41.6
PITCH TRIM UNITS	8	7	6	5	4

ERJ-140 MODELS

CG POSITION (%)	LESS THAN OR EQUAL TO 27	27.1 UP TO 31.0	31.1 UP TO 34.0	34.1 UP TO 39.0	ABOVE OR EQUAL TO 39.1
PITCH TRIM UNITS	8	7	6	5	4

EMB-135 MODELS

CG POSITION (%)	LESS THAN OR EQUAL TO 26.5	26.6 UP TO 30.0	30.1 UP TO 33.0	33.1 UP TO 36.5	ABOVE OR EQUAL TO 36.6
PITCH TRIM UNITS	8	7	6	5	4

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PASSENGERS

PASSENGER LOCATION

The passenger location and respective balance arm are shown in the applicable Interior Arrangement (Section 1-07-30).

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PASSENGER WEIGHT

Actual or average passenger weights may be used to compute passenger loads.

Actual passenger weights should be used in case of flights carrying large groups of passengers whose average weight obviously does not conform with the normal standard weight such as athletic squads or other groups which are smaller or larger than the local average. The actual passenger weight may be either determined by scale weighing of each passenger, or by asking each passenger their weight and adding there to a predetermined constant to compensate the handcarried articles and clothing.

According to AC 120-27E, the following standard average weights may be adopted:

Summer Operation

- Adult passenger (*) ..... 190 lb
- Male ..... 200 lb
- Female ..... 179 lb
- Children (age 2-12) ..... 82 lb

Winter Operation

- Adult passenger (*) ..... 195 lb
- Male ..... 205 lb
- Female ..... 184 lb
- Children (age 2-12) ..... 87 lb

(*) Adult passenger weights are applicable only where the mix of male and female passengers is 60% / 40% respectively.

NOTE: - All passengers weights, except children, include 16 lb of carry-on baggage.
- Children under age 2 are considered "babies-in-arms" and children over age 12 should be treated as adult passengers for purposes of standard average weights.

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FLIGHT CREW ITEMS

(EMB-145 MODELS)

ITEM	WEIGHT (lb)	BALANCE ARM (in)
PILOT	190	145.08
COPILOT	190	145.08
OBSERVER	190	167.64
FWD ATTENDANT	170	185.00
AFT ATTENDANT	170	787.44
PILOT FLIGHT BAG	20	152.87

(ERJ-140 MODELS)

ITEM	WEIGHT (lb)	BALANCE ARM (in)
PILOT	190	145.08
COPILOT	190	145.08
OBSERVER	190	167.64
FWD ATTENDANT	170	185.00
AFT ATTENDANT	170	731.97
PILOT FLIGHT BAG	20	152.87

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(EMB-135 MODELS)

ITEM	WEIGHT (lb)	BALANCE ARM (in)
PILOT	190	145.08
COPILOT	190	145.08
OBSERVER	190	167.64
FWD ATTENDANT	170	185.00
AFT ATTENDANT	170	646.46
PILOT FLIGHT BAG	20	152.87

NOTE: - The adopted flight crew items are in accordance with the approved average weight, not including the respective carry-on baggage.
- The crewmembers and attendants weights presented herein refer to male. (FAA AC120-27E).
- The balance arm of the Crewmember Roller Bag and the Flight Attendant Kit is the same as the balance arm of the Wardrobe or Galley in which they are located (refer to section 1-07-30 for more information).

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INDEX SYSTEM

When determining the airplane center of gravity position it is necessary to make calculations adding and/or subtracting the moment caused by each individual item loaded in the airplane.

Moment, per definition, is weight multiplied by the distance to a reference point. If the moment of the airplane and of the items loaded on it are computed in reference to the airplane datum, very long numeric expressions would result.

As the operational usage of long numeric expressions may result in safety problems (since personnel may get confused with the long numbers), airlines usually adopt an **Index System** for weight and balance purposes.

The Index System is just a convention for presenting airplane or body moments on a different measuring system. When using the Index System, short numeric expressions result.

The Index System formula is presented below:

$$I = \frac{W \times (Arm - A)}{B} + C$$

where:

I = Index

W = Airplane or body weight

Arm = Airplane or body center of gravity

A = Reference arm. Selected arm around which all index values are calculated. On the balance chart CG envelope, the Reference Arm CG% line is the only vertical CG% line. (*)

B = Constant used as a denominator to convert moment values into index values. On the balance chart CG envelope, B controls the CG% lines splay (splay decreases with increasing B). (*)

C = Constant used as a plus value to avoid negative index figures. It is only used when computing the airplane Operating Empty Weight Index (OEI), and is not used when computing individual bodies index influence. On the balance chart CG envelope, the Reference Arm CG% vertical line is at C index units. (*)

(*) - Values for A, B and C may be chosen at the operator discretion.

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The Embraer recommended Index System formulas are:

EMB-145 Models: $$I = \frac{W \times (Arm - 590)}{17400} + 13$$

ERJ-140 Models: $$I = \frac{W \times (Arm - 550)}{17400} + 13$$

EMB-135 Models: $$I = \frac{W \times (Arm - 515)}{17400} + 13$$

INDEX INFLUENCE

Index influence is the variation of index when a body is loaded or unloaded from the airplane. It is usually referred in index units per kilogram for variable weight bodies (cargo, catering, etc.), index units per passenger when computing passenger influence or index units for fixed weight bodies (flight attendant, cockpit observer, etc.).

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The following tables show the index influence for various items:

INDEX INFLUENCE FOR EMB-145 MODELS

Item	Arm (in)	Reference Weight (lb)	Index Influence
Cargo / Baggage	889.76	1	+ 0.017 IU/lb
Forward Galley (*)	218.50	1	- 0.021 IU/lb
Aft Galley (*)	267.72	1	- 0.018 IU/lb
Wardrobe (*)	196.85	1	- 0.023 IU/lb
RH Fwd Stowage Compt.	218.50	1	- 0.021 IU/lb
LH Fwd Stowage Compt.	210.63	1	- 0.022 IU/lb
Emerg. Equip. Stowage Unit	210.63	1	- 0.022 IU/lb
RH Aft Stowage Compt.	728.40	1	- 0.008 IU/lb
LH Aft Stowage Compt.	728.40	1	- 0.008 IU/lb
2nd Flight Attendant	782.68	180	+ 1.99 IU
Cockpit Observer	165.35	190	- 4.64 IU
Pax Cabin A (**)	338.98	190	- 2.74 IU/Pax
Pax Cabin B (**)	508.66	190	- 0.89 IU/Pax
Pax Cabin C (**)	702.36	190	+ 1.23 IU/Pax

(*) The galley and wardrobe arms are for the standard configuration. Check the airplane actual configuration arms in the AOM Loading Section.

(**) For the purposes of this table, the passenger cabin was divided in three sections. On a standard configuration (50 seats) airplane, section A refers to rows 1 to 6, section B refers to rows 7 to 12 and section C refers to rows 13 to 18.

Example: Computation of cargo index influence for the EMB-145.
The EMB-145 cargo compartment centroid is located 889.76 inches from the airplane datum.

The index influence per lb is:

$$I = \frac{1 \times (889.76 - 590)}{17400} = 0.017 IU/lb$$

So, for each lb of cargo loaded in the cargo compartment, the index increases by 0.017 index units.

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INDEX INFLUENCE FOR ERJ-140 MODELS

Item	Arm (in)	Reference Weight (lb)	Index Influence
Cargo / Baggage	833.66	1	+ 0.016 IU/lb
Forward Galley (*)	208.58	1	- 0.020 IU/lb
Aft Galley (*)	258.26	1	- 0.017 IU/lb
Wardrobe (*)	190.55	1	- 0.021 IU/lb
RH Aft Stowage Cmpt.	728.43	1	+ 0.010 IU/lb
LH Aft Stowage Cmpt.	728.43	1	+ 0.010 IU/lb
Cockpit Observer	165.35	190	- 4.20 IU
Pax Cabin A (**)	337.37	190	- 2.32 IU/Pax
Pax Cabin B (**)	491.88	190	- 0.63 IU/Pax
Pax Cabin C (**)	654.02	190	+ 1.14 IU/Pax

(*) The galley and wardrobe arms are for the standard configuration. Check the airplane actual configuration arms in the AOM Loading Section.

(**) For the purposes of this table, the passenger cabin was divided in three sections. On a standard configuration (44 seats) airplane, section A refers to rows 1 to 6, section B refers to rows 7 to 11 and section C refers to rows 12 to 16.

Example: Computation of cargo index influence for the ERJ-140.
The ERJ-140 cargo compartment centroid is located 833.66 inches from the airplane datum.

The index influence per lb is:

$$I = \frac{1 \times (833.66 - 550)}{17400} = 0.016 \text{IU/lb}$$

So, for each lb of cargo loaded in the cargo compartment, the index increases by 0.016 index units.

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INDEX INFLUENCE FOR EMB-135 MODELS

Item	Arm (in)	Reference Weight (lb)	Index Influence
Cargo / Baggage	750.00	1	+ 0.014 IU/lb
Forward Galley (*)	190.55	1	- 0.019 IU/lb
Aft Galley (*)	216.54	1	- 0.017 IU/lb
Wardrobe (*)	216.54	1	- 0.017 IU/lb
Cockpit Observer	165.35	190	- 3.82 IU
Pax Cabin A (**)	330.71	190	- 2.01 IU/Pax
Pax Cabin B (**)	462.99	190	- 0.57 IU/Pax
Pax Cabin C (**)	593.70	190	+ 0.86 IU/Pax

(*) The galley and wardrobe arms are for the option 1 configuration. Check the airplane actual configuration arms in the AOM Loading Section.

(**) For the purposes of this table, the passenger cabin was divided in three sections. On a standard configuration (37 seats) airplane, section A refers to rows 1 to 5, section B refers to rows 6 to 9 and section C refers to rows 10 to 13.

Example: Computation of cargo index influence for the EMB-135.
The EMB-135 cargo compartment centroid is located 750 inches from the airplane datum.

The index influence per lb is:

$$I = \frac{1 \times (750 - 515)}{17400} = 0.014 \text{IU/lb}$$

So, for each lb of cargo loaded in the cargo compartment, the index increases by 0.014 index units.

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FUEL INDEX VARIATION

EMB-145 ER, EP AND MP MODEL

Volume (US Gal)	Weight (lb)	Arm (in)	Index (IU)
50	335	575.28	-0.3
100	670	577.01	-0.5
150	1005	578.43	-0.7
200	1340	579.61	-0.8
250	1675	580.67	-0.9
300	2010	581.65	-1.0
350	2345	582.52	-1.0
400	2680	583.35	-1.0
450	3015	584.17	-1.0
500	3350	585.04	-1.0
550	3685	585.91	-0.9
600	4020	586.81	-0.7
650	4355	587.68	-0.6
700	4690	588.54	-0.4
750	5025	589.37	-0.2
800	5360	590.20	0.1
850	5695	591.02	0.3
900	6030	591.77	0.6
950	6365	592.56	0.9
1000	6700	593.39	1.3
1050	7035	594.37	1.8
1100	7370	595.43	2.3
1150	7705	596.69	3.0
1200	8040	598.07	3.7
1250	8375	599.65	4.6
1300	8710	601.34	5.7
1350	9045	603.23	6.9
1359.6	9109	603.62	7.1

NOTE: Adopted fuel density of 6.7 lb/US Gal.

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EMB-145 LR MODEL

Volume (US Gal)	Weight (lb)	Arm (in)	Index (IU)
50	335	570.00	-0.4
100	670	570.89	-0.7
150	1005	571.77	-1.1
200	1340	572.55	-1.3
250	1675	573.34	-1.6
300	2010	574.01	-1.8
350	2345	574.78	-2.1
400	2680	575.44	-2.2
450	3015	576.01	-2.4
500	3350	576.77	-2.5
550	3685	577.33	-2.7
600	4020	577.89	-2.8
650	4355	578.44	-2.9
700	4690	579.00	-3.0
750	5025	579.66	-3.0
800	5360	580.22	-3.0
850	5695	580.89	-3.0
900	6030	581.55	-2.9
950	6365	582.12	-2.9
1000	6700	582.78	-2.8
1050	7035	583.34	-2.7
1100	7370	584.00	-2.5
1150	7705	584.66	-2.4
1200	8040	585.22	-2.2
1250	8375	585.88	-2.0
1300	8710	586.55	-1.7
1350	9045	587.33	-1.4
1400	9380	588.33	-0.9
1450	9715	589.44	-0.3
1500	10050	590.66	0.4
1550	10385	591.99	1.2
1600	10720	593.44	2.1
1650	11055	595.04	3.2
1690	11323	596.58	4.3

NOTE: Adopted fuel density of 6.7 lb/US Gal.

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EMB-145 XR MODEL

Wing Tank

Volume (US Gal)	Weight (lb)	Arm (in)	Index (IU)
50	335	570.00	-0.4
100	670	570.89	-0.7
150	1005	571.77	-1.1
200	1340	572.55	-1.3
250	1675	573.34	-1.6
300	2010	574.01	-1.8
350	2345	574.78	-2.1
400	2680	575.44	-2.2
450	3015	576.01	-2.4
500	3350	576.77	-2.5
550	3685	577.33	-2.7
600	4020	577.89	-2.8
650	4355	578.44	-2.9
700	4690	579.00	-3.0
750	5025	579.66	-3.0
800	5360	580.22	-3.0
850	5695	580.89	-3.0
900	6030	581.55	-2.9
950	6365	582.12	-2.9
1000	6700	582.78	-2.8
1050	7035	583.34	-2.7
1100	7370	584.00	-2.5
1150	7705	584.66	-2.4
1200	8040	585.22	-2.2
1250	8375	585.88	-2.0
1300	8710	586.55	-1.7
1350	9045	587.33	-1.4
1400	9380	588.33	-0.9
1450	9715	589.44	-0.3
1500	10050	590.66	0.4
1550	10385	591.99	1.2
1600	10720	593.44	2.1
1650	11055	595.04	3.2
1690	11323	596.58	4.3

NOTE: Adopted fuel density of 6.7 lb/US Gal.

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EMB-145 XR MODEL

Ventral Tank

Volume (US Gal)	Weight (lb)	Arm (in)	Index (IU)
50	335	691.70	2.0
100	670	695.58	4.1
150	1005	697.72	6.2
200	1340	698.69	8.4
250	1675	696.81	10.3
275	1843	695.79	11.2

NOTE: Adopted fuel density of 6.7 lb/US Gal.

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ERJ-140 ER MODEL

Volume (US Gal)	Weight (lb)	Arm (in)	Index (IU)
50	335	539.32	-0.2
100	670	540.95	-0.3
150	1005	542.36	-0.4
200	1340	543.55	-0.5
250	1675	544.62	-0.5
300	2010	545.59	-0.5
350	2345	546.49	-0.5
400	2680	547.34	-0.4
450	3015	548.16	-0.3
500	3350	549.00	-0.2
550	3685	549.87	0.0
600	4020	550.77	0.2
650	4355	551.65	0.4
700	4690	552.51	0.7
750	5025	553.36	1.0
800	5360	554.17	1.3
850	5695	554.96	1.6
900	6030	555.77	2.0
950	6365	556.56	2.4
1000	6700	557.36	2.8
1050	7035	558.31	3.4
1100	7370	559.39	4.0
1150	7705	560.67	4.7
1200	8040	562.03	5.6
1250	8375	563.58	6.5
1300	8710	565.23	7.6
1350	9045	567.22	9.0
1359.4	9107.98	567.60	9.2

NOTE: Adopted fuel density of 6.7 lb/US Gal.

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ERJ-140 LR MODEL

Volume (US Gal)	Weight (lb)	Arm (in)	Index (IU)
50	335	534.00	-0.3
100	670	534.83	-0.6
150	1005	535.68	-0.8
200	1340	536.50	-1.0
250	1675	537.30	-1.2
300	2010	538.02	-1.4
350	2345	538.73	-1.5
400	2680	539.40	-1.6
450	3015	540.05	-1.7
500	3350	540.68	-1.8
550	3685	541.28	-1.8
600	4020	541.86	-1.9
650	4355	542.43	-1.9
700	4690	543.03	-1.9
750	5025	543.62	-1.8
800	5360	544.23	-1.8
850	5695	544.90	-1.7
900	6030	545.53	-1.5
950	6365	546.13	-1.4
1000	6700	546.76	-1.2
1050	7035	547.40	-1.1
1100	7370	547.99	-0.9
1150	7705	548.63	-0.6
1200	8040	549.23	-0.4
1250	8375	549.77	-0.1
1300	8710	550.44	0.2
1350	9045	551.33	0.7
1400	9380	552.26	1.2
1450	9715	553.35	1.9
1500	10050	554.52	2.6
1550	10385	555.80	3.5
1600	10720	557.21	4.4
1650	11055	559.07	5.8
1690	11323	560.56	6.9

NOTE: Adopted fuel density of 6.7 lb/US Gal.

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EMB-135 ER MODEL

Volume (US Gal)	Weight (lb)	Arm (in)	Index (IU)
50	335	496.37	-0.4
100	670	498.00	-0.7
150	1005	499.41	-0.9
200	1340	500.60	-1.1
250	1675	501.67	-1.3
300	2010	502.64	-1.4
350	2345	503.54	-1.5
400	2680	504.39	-1.6
450	3015	505.21	-1.7
500	3350	506.05	-1.7
550	3685	506.92	-1.7
600	4020	507.82	-1.7
650	4355	508.70	-1.6
700	4690	509.56	-1.5
750	5025	510.41	-1.3
800	5360	511.22	-1.2
850	5695	512.01	-1.0
900	6030	512.82	-0.8
950	6365	513.61	-0.5
1000	6700	514.41	-0.2
1050	7035	515.36	0.1
1100	7370	516.44	0.6
1150	7705	517.72	1.2
1200	8040	519.08	1.9
1250	8375	520.63	2.7
1300	8710	522.28	3.6
1350	9045	524.27	4.8
1359.4	9107.98	524.65	5.1

NOTE: Adopted fuel density of 6.7 lb/US Gal.

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EMB-135 LR MODEL

Volume (US Gal)	Weight (lb)	Arm (in)	Index (IU)
50	335	491.05	-0.5
100	670	491.88	-0.9
150	1005	492.73	-1.3
200	1340	493.55	-1.7
250	1675	494.35	-2.0
300	2010	495.07	-2.3
350	2345	495.78	-2.6
400	2680	496.45	-2.9
450	3015	497.10	-3.1
500	3350	497.73	-3.3
550	3685	498.33	-3.5
600	4020	498.91	-3.7
650	4355	499.48	-3.9
700	4690	500.08	-4.0
750	5025	500.67	-4.1
800	5360	501.28	-4.2
850	5695	501.95	-4.3
900	6030	502.58	-4.3
950	6365	503.18	-4.3
1000	6700	503.81	-4.3
1050	7035	504.45	-4.3
1100	7370	505.04	-4.2
1150	7705	505.68	-4.1
1200	8040	506.28	-4.0
1250	8375	506.82	-3.9
1300	8710	507.49	-3.8
1350	9045	508.38	-3.4
1400	9380	509.31	-3.1
1450	9715	510.40	-2.6
1500	10050	511.57	-2.0
1550	10385	512.85	-1.3
1600	10720	514.26	-0.5
1650	11055	516.12	0.7
1690	11323	517.61	1.7

NOTE: Adopted fuel density of 6.7 lb/US Gal.

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OEW/OEI DETERMINATION

The OEW (Operational Empty Weight) is the BEW plus the weight of the operational items (crew, catering, lavatory fluid, etc.). The OEI (Operational Empty Index) is the index for the OEW.
In order to determine the OEW and OEI, it is necessary to add to the BEW all the weight and moment variations referent to the operational items. The BEW is obtained from the airplane weighting record.

Example: Computation of OEW/OEI for the EMB-145.

For a BEW equal 26572 lb and BEW moment equal 16546149.55 lb.in:

Item	Weight (lb)	Arm (in)	Moment (lb.in)
BEW	26572	-	16546149.55
Lavatory fluid	44 15.43	813.38 810.24	35788.72 12502.00
Pilot & Co-Pilot	380	142.91	54305.80
Flight attendant (fwd)	170	188.97	32124.90
CREWMEMBER ROLLER BAG	30	196.85	5905.50
PILOT FLIGHT BAG	20	155.51	3110.20
FLIGHT ATTENDANT KIT	10	196.85	1968.50
OEW (not including catering)	**27241.43**	**-**	**16691855.17**

Airplane arm = $16691855.17 / 27241.43 = 612.74$ inches

$$\text{Airplane Index} = \frac{27241.43 \times (612.74 - 590)}{17400} + 13 = 49\text{IU}$$

(not including catering)

NOTE: - Catering weight was not considered above because its weight is not constant. In our example we are considering catering as a separate item (see Index Influences).
- Unusable fuel, hydraulic fluid, engine and APU oil are considered included in the BEW.
- The values above are an example. Use the airplane actual BEW for determining the OEW.

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CENTER OF GRAVITY CURTAILMENTS

The airplane weight and balance calculations are normally performed assuming that passengers are evenly distributed along the airplane cabin and that the crew, passengers and movable items are fixed in a pre-determined position.

For all practical purposes, however, it is known that passengers may not be evenly seated, flight attendants move along the cabin, the landing gear retracts, etc. All these movements, not previously expected in the weight and balance calculations, may result in deviations from the assumed load distribution.

For these reasons, some aeronautical authorities (including FAA AC120-27E) require that airlines use an Operational CG envelope, which is the AFM certified CG envelope reduced by a CG margin to account for the possible deviations from the assumed load distribution. This process is known as Center of Gravity Curtailment.

There are 3 basic types of CG curtailments:

- Takeoff and landing allowances: These are the deviations that affect the CG position for takeoff and landing. Uneven distribution of passengers, flap and landing gear movement and cargo/baggage shift are considered takeoff and landing allowances.
- Flight allowances: These are the deviations that affect the CG position in flight. All takeoff and landing allowances plus flight attendant and catering service movement are considered in-flight allowances.
- Fuel allowances: If the airline does not wish to check the CG position at the landing weight, it is necessary to consider a fuel allowance due to CG shift caused by the reduction of fuel quantity during the flight. In addition, it may be necessary to consider an allowance due to variations in the fuel density.

The CG curtailment process is a critical procedure because the amount of CG margin (curtailment) depends on the possible deviations considered by the airline. If excessive deviations (allowances) are considered by the airline, a very thin Operational CG envelope may be obtained, resulting in huge difficulties to balance the airplane during airline operations. On the other hand, if few deviations (allowances) are considered, a large Operational CG envelope is obtained, but safety may be jeopardized by CG deviations from the assumed load distribution.

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NOTE: For Ferry and Training flights, in which passenger or flight attendant movement is not an issue, a constrained center of gravity envelope without the seat and flight allowances may be used so as not to limit these types of flight unnecessarily. For flights with more than 33 or 45 passengers (with the unoccupied seats at the forward portion of the cabin), for EMB-135 and EMB-145, respectively, a constrained center of gravity envelope without the seat allowances may be used so as not to limit these types of flight unnecessarily.

FLAP MOVEMENT ALLOWANCES

Flap movement has negligible effects on the airplane Center of Gravity.

FUEL DENSITY ALLOWANCES

The variation of fuel density has negligible effects on the airplane Center of Gravity.

LANDING GEAR ALLOWANCES

When the landing gear is retracted, there is a reduction of -10155.15 lb.in of the moment in respect to the airplane datum.

FORWARD FLIGHT ALLOWANCES

Considers the movement of the forward flight attendant to the cockpit.

Example:

EMB-135LR

Forward Allowance	Weight (lb)	from Arm (in)	to Arm (in)	Moment (lb.in)
Fwd attendant to cockpit	170	188.98	165.35	-4017

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EMB-145LR

Forward Allowance	Weight (lb)	from Arm (in)	to Arm (in)	Moment (lb.in)
Fwd attendant to cockpit	170	188.98	165.35	- 4017

AFT FLIGHT ALLOWANCES

A reasonable aft flight allowance is to consider the movement of the forward flight attendant and a trolley to the aftermost row combined with the movement of a mid cabin passenger to the lavatory.

Example:

EMB-135ER

Aft Allowance	Weight (lb)	from Arm (in)	to Arm (in)	Moment (lb.in)
Mid cabin pax to lavatory	170 *	429.53	672.05	+41228
Fwd attendant to aft cabin	170	188.98	609.06	+71414
Trolley to aft cabin	88	190.55	624.90	+38223
			Total =	+150865
* Passenger is assumed to have no hand baggage when moving to lavatory.				

So, the aft flight allowance will be +109637 lb.in, adopting the most restrictive situation.

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EMB-145LR

Aft Allowance	Weight (lb)	from Arm (in)	to Arm (in)	Moment (lb.in)
Mid cabin pax to lavatory	170 *	522.83	811.02	+48992
Fwd attendant to aft cabin	170	188.98	748.02	+95037
Trolley to aft cabin	88	218.50	767.72	+48331
			Total =	+192360
* Passenger is assumed to have no hand baggage when moving to lavatory.				

So the aft flight allowance will be +143368 lb.in taking the most restrictive situation.

SEATING ALLOWANCES

Seating allowance is a result of uneven passenger distribution along the cabin. If the mass of all passengers is assumed to be equally distributed along the cabin, a margin (called seating allowance) must be considered to compensate for the variation in passenger seating locations. Manual load sheets usually use the Cabin Area Trim method, where passengers are considered evenly distributed along the passenger cabin, thus requiring seating allowance consideration.

The typical passenger loading sequence is based on the window and aisle seating concept, according to which, for forward seating allowances, window seats are filled from forward to aft and, after all windows are occupied, the aisle seats are filled from the most forward to the most aft. For aft seating allowances, the same concept is used but with an aft-to-front filling sequence.

In order to determine the total seating allowance of the aircraft the operator may divide the passenger cabin into zones. Each zone has its own centroid where the total weight of the related passengers may be concentrated. The centroid is determined by the weight average arms of each passenger position considered inside each zone.

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The seating allowance applied to the CG envelope is the sum of the largest moment variation of each cabin zone. The moment variation is defined by the difference between the actual pax distribution moment and the moment of the same amount of passengers concentrated in the centroid of the cabin zone considered.

NOTE: Seating allowance does not need to be considered if passenger index influence is calculated by seat row, i.e., if the individual moment variation for each passenger is considered. Seat Row Trim is normally used on computerized weight and balance systems, like Departure Control Systems (DCS).

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FUEL ALLOWANCES

There are some conditions under which it is possible to have both ZFW-CG and TOW-CG located inside the CG envelope and the LW-CG outside of the CG envelope. This behavior is caused by the particular fuel loading characteristics of the aircraft, where the initial fuel loaded causes a forward moment and then higher fuel loading causes an aft moment (see the fuel index tables, where light fuel loads result in negative indexes and high fuel loads results in positive indexes).

In order to prevent the LW CG from being located outside of the CG envelope, the idea is to determine a constrained ZFW envelope, in which the fuel loading curve is always located inside the CG envelope.

CONSTRAINED CENTER OF GRAVITY LIMITS

In order to determine the constrained CG envelope, the allowances must be added to the certified CG envelope.

CONSTRAINED ZFW LIMITS

In order to determine the constrained ZFW CG envelope, it is necessary to convert the constrained CG envelope to the index system and then apply the fuel allowances.

When the fuel quantity is equal to or less than the one specified in the table below, the ZFW envelope without constraint may be used, because fuel burn always makes the CG move backward. In this case, it must be checked if ZFW-CG, TOW-CG and LW-CG are located inside the CG envelope.

Model	Fuel Weight (lb)
EMB-135 ER	3527
EMB-135 LR	6349
EMB-145 STD, EU, EP, ER, MP and MK	3175
EMB-145 LU and LR	5291

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EXAMPLE 1 (EMB-135 MODEL LR):

For the EMB-135 LR on an option 1 configuration (37 seats), with the passenger cabin divided in three sections.

Section A refers to rows 1 to 4, section B refers to rows 5 to 8 and section C refers to rows 9 to 13.

Considering the window and aisle seating concept, the first seat to be occupied is window-row 1, then window-row 2, then windows-row 3, then windows-row 4, ..., then windows-row 13, then aisle-row 2, then aisle-row 3, ..., then aisle-row 13.

When window-row 1 is occupied, there is a moment margin of the passenger weight times the distance between cabin A centroid and row 1 centroid. When window-row 2 is occupied, the moment margin is increased by the passenger weight times the distance between cabin A centroid and row 2 centroid. The moment margin keeps increasing until the seats aft of the cabin centroid start being filled and then moment margin decreases.

When cabin B starts being filled, the moment margin starts increasing again and then decreases when the seats aft of cabin B centroid are filled. The same occurs with cabin C.

The forward seating allowance to be used in the determination of the constrained CG envelope is the sum of the most negative moment change of each cabin section.

For the aft seating allowance, a very similar procedure is performed, but considering the aircraft being loaded from the aft portion of the cabin.

The following tables show the determination of the forward and aft seating allowances:

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FORWARD SEATING ALLOWANCE:

Seat type & row number	Arm (in)	Cab Arm (in)	Weight (lb)	PAX Total	Moment (lb.in)	Accumul. (lb.in)	Minimum Accumul.
Windows 01	261.23	327.64	0	1	0.00	0.00	
Windows 02	292.48	327.64	190	1	-6681.38	-6681.38	
Windows 03	323.72	327.64	380	2	-1489.78	-8171.16	
Windows 04	355.01	327.64	380	2	10398.29	2227.13	-8171.16
Aisle 02	292.48	327.64	190	1	-6681.38	-4454.25	
Aisle 03	323.72	327.64	190	1	-744.89	-5199.14	
Aisle 04	355.01	327.64	190	1	5199.14	0.00	
Windows 05	386.25	450.59	380	2	-24448.99	-24448.99	
Windows 06	417.54	450.59	380	2	-12560.92	-37009.91	
Windows 07	448.78	450.59	380	2	-687.94	-37697.85	
Windows 08	480.02	450.59	380	2	11185.04	-26512.80	
Windows 09	520.36	450.59	380	2	26512.80	0.00	
Aisle 05	386.25	450.59	190	1	-12224.49	-12224.49	-37697.85
Aisle 06	417.54	450.59	190	1	-6280.46	-18504.95	
Aisle 07	448.78	450.59	190	1	-343.97	-18848.92	
Aisle 08	480.02	450.59	190	1	5592.52	-13256.40	
Aisle 09	520.36	450.59	190	1	13256.40	0.00	
Windows 10	551.65	598.53	380	1	-17817.01	-17817.01	
Windows 11	582.89	598.53	380	1	-5944.03	-23761.05	
Windows 12	614.17	598.53	380	1	5944.03	-17817.01	
Windows 13	645.42	598.53	380	1	17817.01	0.00	
Aisle 10	551.65	598.53	190	1	-8908.51	-8908.51	-23761.05
Aisle 11	582.89	598.53	190	1	-2972.02	-11880.52	
Aisle 12	614.17	598.53	190	1	2972.02	-8908.51	
Aisle 13	645.42	598.53	190	1	8908.51	0.00	
Forward Seating Allowance							**-69630.06**

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AFT SEATING ALLOWANCE:

Seat type & row number	Arm (in)	Cab Arm (in)	Weight (lb)	PAX Total	Moment (lb.in)	Accumul. (lb.in)	Maximum Accumul.
Windows 13	645.42	598.53	380	2	17817.01	17817.01	
Windows 12	614.17	598.53	380	2	5944.03	23761.05	
Windows 11	582.89	598.53	380	2	-5944.03	17817.01	
Windows 10	551.65	598.53	380	2	-17817.01	0.00	
Aisle 13	645.42	598.53	190	1	8908.51	8908.51	23761.05
Aisle 12	614.17	598.53	190	1	2972.02	11880.52	
Aisle 11	582.89	598.53	190	1	-2972.02	8908.51	
Aisle 10	551.65	598.53	190	1	-8908.51	0.00	
Windows 9	520.36	450.59	380	2	26512.80	26512.80	
Windows 8	480.02	450.59	380	2	11185.04	37697.85	
Windows 7	448.78	450.59	380	2	-687.94	37009.91	
Windows 6	417.54	450.59	380	2	-12560.92	24448.99	
Windows 5	386.25	450.59	380	2	-24448.99	0.00	
Aisle 9	520.36	450.59	190	1	13256.40	13256.40	37697.85
Aisle 8	480.02	450.59	190	1	5592.52	18848.92	
Aisle 7	448.78	450.59	190	1	-343.97	18504.95	
Aisle 6	417.54	450.59	190	1	-6280.46	12224.49	
Aisle 5	386.25	450.59	190	1	-12224.49	0.00	
Windows 4	355.01	327.64	380	2	10398.29	10398.29	
Windows 3	323.72	327.64	380	2	-1489.78	8908.51	
Windows 2	292.48	327.64	190	1	-6681.38	2227.13	
Windows 1	261.23	327.64	0	0	0.00	2227.13	10398.29
Aisle 4	355.01	327.64	190	1	5199.14	7426.27	
Aisle 3	323.72	327.64	190	1	-744.89	6681.38	
Aisle 2	292.48	327.64	190	1	-6681.38	0.00	
Aft Seating Allowance							**71857.19**

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FUEL ALLOWANCES:

There are some conditions under which it is possible to have both ZFW-CG and TOW-CG located inside the CG envelope and the LW-CG outside of the CG envelope (see Figure 1).

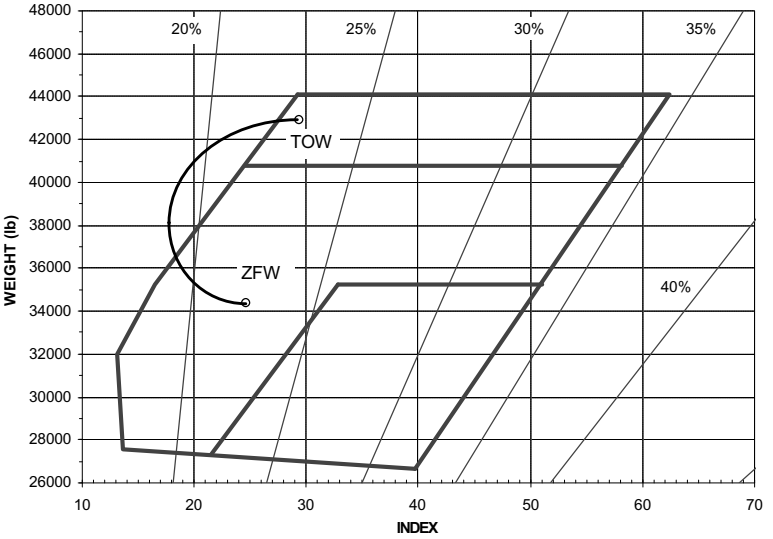

Figure 1

In order to prevent the LW CG from being located outside of the CG envelope, the idea is to determine a constrained ZFW envelope.

CONSTRAINED ZFW LIMITS

In order to determine the constrained ZFW CG envelope, it is necessary to convert the constrained CG envelope to the index system and then apply the fuel allowances.

Converting the previously defined forward and aft limits to the index system using the formula:

$$I = \frac{W \times (arm - 515)}{17500} + 13$$

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Forward limits

Weight (lb)	Arm (in)	CG (%)	Index (IU)
25353	529.67	30.0	34.3
27558	512.75	15.0	9.5
31967	512.75	15.0	8.9
35274	514.44	16.5	11.9
44092	519.63	21.1	24.7

Aft limits

Weight (lb)	Arm (in)	CG (%)	Index (IU)
25353	529.67	30.0	34.3
26455	538.69	38.0	48.8
35274	538.69	38.0	60.8
44092	538.69	38.0	72.7

Drawing the fuel index lines over the constrained CG envelope and searching for the tangency points, we determine the following constrained ZFW CG points (see Figure 2):

Weight (lb)	Index (IU)
27360	22.7
35273	32.9

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EMB-135LR Constrained CG Envelope (Standard)

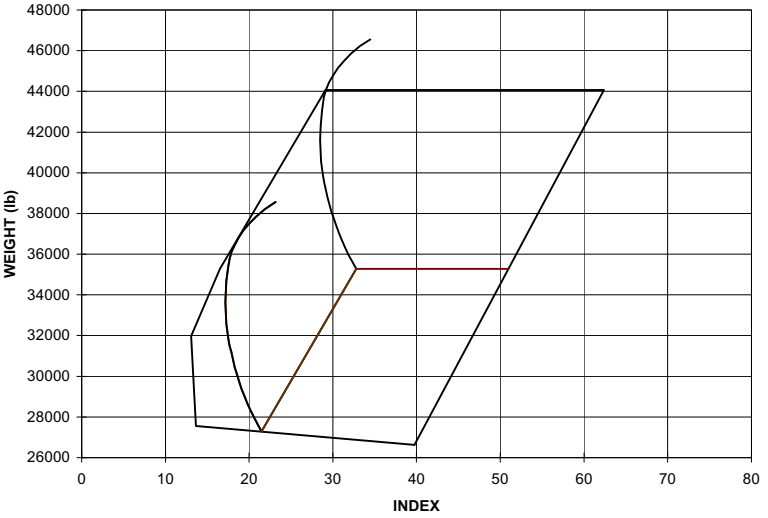

Figure 2

CONSTRAINED CENTER OF GRAVITY LIMITS

In order to determine the constrained CG envelope, the allowances must be added to the certified CG envelope.

The table below shows the determination of the forward constrained limit for the EMB-135LR model.

For Takeoff & Landing & In-flight limits the allowance used was:

- -10155.15 lb.in (landing gear)
- -4017.00 lb.in (forward flight allowance)
- -69630.06 lb.in (forward seating allowance)
  -83802.21 lb.in = total fwd allowance

NOTE: The allowance at 25353 lb is -10155.15 lb.in, because in this range of weight it is impossible to have passengers loaded, so the seating allowance was disregarded and also the flight allowance.

For Takeoff & Landing limits the allowance used was:

- -69630.06 lb.in (forward seating allowance)

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Forward Center of Gravity Limits:

AFM values				Allow-ance	Constrained values		
Wt. (lb)	CG (%)	arm (in)	Mom. (lb.in)	(lb.in)	Mom. (lb.in)	arm (in)	CG (%)
Takeoff & Landing & In-flight limits:							
25353	30.0	529.67	13428724	-10155	13438879	530.07	30.4
27558	15.0	512.75	14130365	-83802	14214167	515.79	17.7
31967	15.0	512.75	16391079	-83802	16474881	515.37	17.3
Takeoff & Landing limits:							
35274	16.5	514.44	18146357	-69630	18215987	516.41	18.3*
44092	21.1	519.63	22911526	-69630	22981156	521.21	22.5*
In-flight limit:							
35274	15.0	514.44	18146357	-83802	18230159	516.82	18.6
44092	18.9	519.63	22911526	-83802	22995328	521.53	22.8

* points disregarded because of the existence of more limiting points at the same weight.

The table below shows the determination of the aft constrained limit for the EMB-135LR model.

For Takeoff & Landing & In-flight limits the allowance used was:

- +150865.00 lb.in (aft flight allowance)
- + 71857.19 lb.in (aft seating allowance)
  +222722.19 lb.in = total aft allowance

NOTE: The allowance at 25353 lb is zero because in this weight range it is impossible to have passengers loaded, so the seating allowance was disregarded and also the flight allowance.

Aft Center of Gravity Limits:

AFM values				Allow-ance	Constrained values		
Wt. (lb)	CG (%)	arm (in)	Mom. (lb.in)	(lb.in)	Mom. (lb.in)	arm (in)	CG (%)
Takeoff & Landing & In-flight limits:							
25353	30.0	529.67	13428724	0.0	13428724	529.67	30.0
26455	38.0	538.69	14251044	222722	14028322	530.27	30.5
35274	38.0	538.69	19001751	222722	18779029	532.38	32.4
44092	38.0	538.69	23751919	222722	23529197	533.64	33.5

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EMB-135LR - CONSTRAINED ENVELOPE

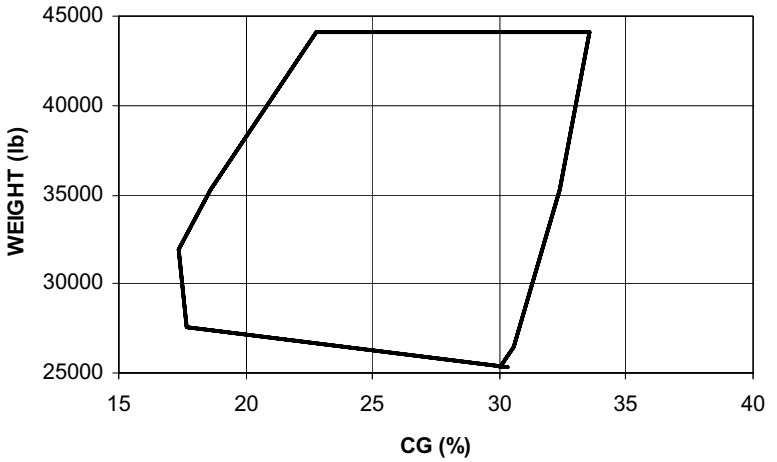

Figure 3

The complete constrained CG envelope for the EMB-135LR is shown in Figure 4:

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EMB-135LR Constrained CG Envelope (Standard)

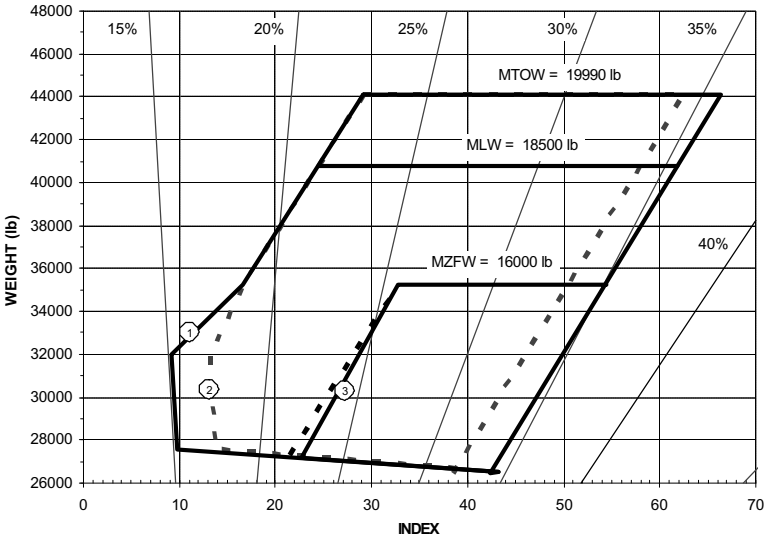

Figure 4

1 - TOW limit (more than 33 paxs).

2 - TOW limit (with 33 paxs or less).

3 - ZFW limit.

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EXAMPLE 2 (EMB-145 MODEL LR):

For the EMB-145LR on a standard configuration (50 seats) with the passenger cabin divided in three sections.

Section A refers to rows 1 to 6, section B refers to rows 7 to 12 and section C refers to rows 13 to 18.

Considering the window and aisle seating concept, the first seat to be occupied is window-row 1, then window-row 2, then windows-row 3, then windows-row 4, ..., then windows-row 18, then aisle-row 3, then aisle-row 4, ..., then aisle-row 18.

When window-row 1 is occupied, there is a moment margin of the passenger weight times the distance between cabin A centroid and row 1 centroid. When window-row 2 is occupied, the moment margin is increased by the passenger weight times the distance between cabin A centroid and row 2 centroid. The moment margin keeps increasing until the seats aft of the cabin centroid start being filled and then moment margin decreases.

When cabin B starts being filled, the moment margin starts increasing again and then decreases when the seats aft of cabin B centroid are filled. The same occurs with cabin C.

The forward seating allowance to be used in the determination of the constrained CG envelope is the summation of the most negative moment change of each cabin section.

For the aft seating allowance, a very similar procedure is performed, but considering the aircraft being loaded from the aft portion of the cabin, and considering the most positive moment change of each cabin section.

The following tables show the determination of the forward and aft seating allowances:

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FORWARD SEATING ALLOWANCE:

Seat type & row number	Arm (in)	Cab Arm (in)	Weight (lb)	PAX Total	Moment (lb.in)	Accumul. (lb.in)	Maximum Accumul.
Windows 01	245.87	341.89	190	1	-18243.21	-18243.21	
Windows 02	277.11	341.89	190	1	-12306.71	-30549.92	
Windows 03	308.40	341.89	380	2	-12725.36	-43275.28	
Windows 04	339.64	341.89	380	2	-852.38	-44127.66	
Windows 05	370.93	341.89	380	2	11035.69	-33091.97	
Windows 06	402.17	341.89	380	2	22908.67	-10183.31	-44127.66
Aisle 03	308.40	341.89	190	1	-6362.68	-16545.99	
Aisle 04	339.64	341.89	190	1	-426.19	-16972.18	
Aisle 05	370.93	341.89	190	1	5517.84	-11454.33	
Aisle 06	402.17	341.89	190	1	11454.33	0.00	
Windows 07	433.42	513.10	380	2	-30278.36	-30278.36	
Windows 08	464.70	513.10	380	2	-18390.30	-48668.66	
Windows 09	495.94	513.10	380	2	-6517.32	-55185.98	
Windows 10	527.23	513.10	380	2	5370.75	-49815.23	
Windows 11	558.47	513.10	380	2	17243.73	-32571.49	
Windows 12	598.81	513.10	380	2	32571.49	0.00	
Aisle 07	433.42	513.10	190	1	-15139.18	-15139.18	-55185.98
Aisle 08	464.70	513.10	190	1	-9195.15	-24334.33	
Aisle 09	495.94	513.10	190	1	-3258.66	-27592.99	
Aisle 10	527.23	513.10	190	1	2685.38	-24907.61	
Aisle 11	558.47	513.10	190	1	8621.87	-16285.75	
Aisle 12	598.81	513.10	190	1	16285.75	0.00	
Windows 13	630.05	708.22	380	2	-29702.57	-29702.57	
Windows 14	661.34	708.22	380	2	-17814.50	-47517.07	
Windows 15	692.58	708.22	380	2	-5941.52	-53458.59	
Windows 16	723.87	708.22	380	2	5946.55	-47512.04	
Windows 17	755.11	708.22	380	2	17819.53	-29692.51	
Windows 18	786.36	708.22	380	2	29692.51	0.00	
Aisle 13	630.05	708.22	190	1	-14851.28	-14851.28	-53458.59
Aisle 14	661.34	708.22	190	1	-8907.25	-23758.53	
Aisle 15	692.58	708.22	190	1	-2970.76	-26729.29	
Aisle 16	723.87	708.22	190	1	2973.27	-23756.02	
Aisle 17	755.11	708.22	190	1	8909.76	-14846.26	
Aisle 18	786.36	708.22	190	1	14846.26	0.00	
Forward Seating Allowance							**-152772.23**

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AFT SEATING ALLOWANCE:

Seat type & row number	Arm (in)	Cab Arm (in)	Weight (lb)	PAX Total	Moment (lb.in)	Accumul. (lb.in)	Maximum Accumul.
Windows 18	786.36	708.22	380	2	29692.51	29692.51	
Windows 17	755.11	708.22	380	2	17819.53	47512.04	
Windows 16	723.87	708.22	380	2	5946.55	53458.59	
Windows 15	692.58	708.22	380	2	-5941.52	47517.07	
Windows 14	661.34	708.22	380	2	-17814.50	29702.57	
Windows 13	630.05	708.22	380	2	-29702.57	0.00	
Aisle 18	786.36	708.22	190	1	14846.26	14846.26	53458.59
Aisle 17	755.11	708.22	190	1	8909.76	23756.02	
Aisle 16	723.87	708.22	190	1	2973.27	26729.29	
Aisle 15	692.58	708.22	190	1	-2970.76	23758.53	
Aisle 14	661.34	708.22	190	1	-8907.25	14851.28	
Aisle 13	630.05	708.22	190	1	-14851.28	0.00	
Windows 12	598.81	513.10	380	2	32571.49	32571.49	
Windows 11	558.47	513.10	380	2	17243.73	49815.23	
Windows 10	527.23	513.10	380	2	5370.75	55185.98	
Windows 09	495.94	513.10	380	2	-6517.32	48668.66	
Windows 08	464.70	513.10	380	2	-18390.30	30278.36	
Windows 07	433.42	513.10	380	2	-30278.36	0.00	
Aisle 12	598.81	513.10	190	1	16285.75	16285.75	55185.98
Aisle 11	558.47	513.10	190	1	8621.87	24907.61	
Aisle 10	527.23	513.10	190	1	2685.38	27592.99	
Aisle 09	495.94	513.10	190	1	-3258.66	24334.33	
Aisle 08	464.70	513.10	190	1	-9195.15	15139.18	
Aisle 07	433.42	513.10	190	1	-15139.18	0.00	
Windows 06	402.17	341.89	380	2	22908.67	22908.67	
Windows 05	370.93	341.89	380	2	11035.69	33944.35	
Windows 04	339.64	341.89	380	2	-852.38	33091.97	
Windows 03	308.40	341.89	380	2	-12725.36	20366.61	
Windows 02	277.11	341.89	190	1	-12306.71	8059.90	
Windows 01	245.87	341.89	190	1	-18243.21	-10183.31	33944.35
Aisle 06	402.17	341.89	190	1	11454.33	1271.03	
Aisle 05	370.93	341.89	190	1	5517.84	6788.87	
Aisle 04	339.64	341.89	190	1	-426.19	6362.68	
Aisle 03	308.40	341.89	190	1	-6362.68	0.00	
Aft Seating Allowance							**142588.92**

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FUEL ALLOWANCES:

There are some conditions under which it is possible to have both ZFW-CG and TOW-CG located inside the CG envelope and the LW-CG outside of the CG envelope (see Figure 1).

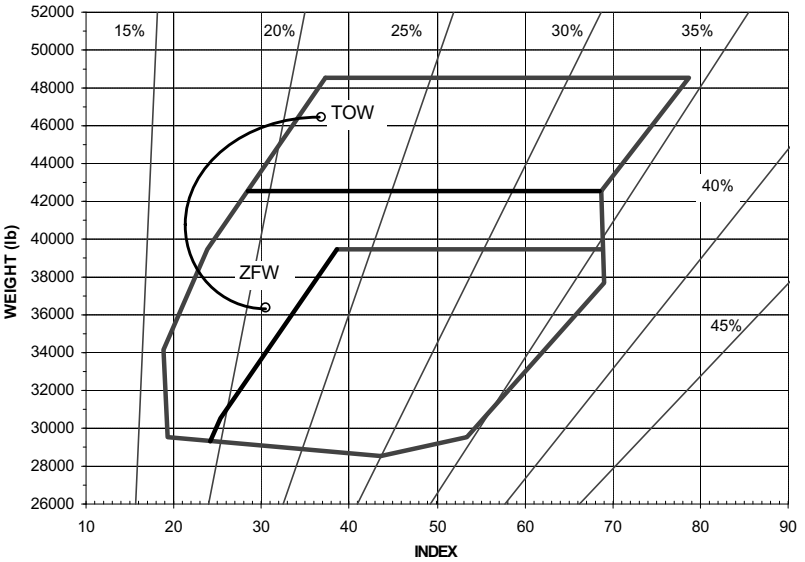

Figure 1

In order to prevent the LW CG from being located outside of the CG envelope, the idea is to determine a constrained ZFW envelope.

CONSTRAINED ZFW LIMITS

In order to determine the constrained ZFW CG envelope, it is necessary to convert the constrained CG envelope to the index system and then apply the fuel allowances.

Converting the previously defined forward and aft limits to the index system using the formula:

$$I = \frac{W \times (arm - 590)}{17400} + 13$$

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Forward limits

Weight (lb)	Arm (in)	CG (%)	Index (IU)
27337	608.64	30.0	42.3
29542	588.34	12.0	10.2
34170	588.34	12.0	9.7
38000	588.34	12.0	9.4
48501	595.56	18.4	28.5

Aft limits

Weight (lb)	Arm (in)	CG (%)	Index (IU)
27337	608.64	30.0	42.3
29542	623.30	43.0	69.5
34170	623.30	43.0	78.4
38000	619.36	39.5	77.1
48501	619.36	39.5	94.8

Drawing the fuel index lines over the constrained CG envelope and searching for the tangency points, we determine the following constrained ZFW CG points (see Figure 2):

Weight (lb)	Index (IU)
29414	27.7
31252	28.7
39462	38.5

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EMB-145LR Constrained CG Envelope

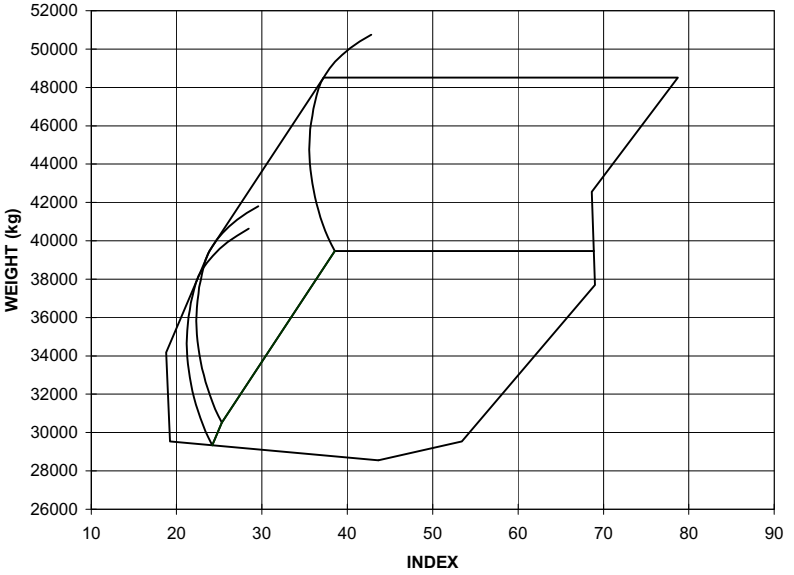

Figure 2

CONSTRAINED CENTER OF GRAVITY LIMITS

In order to determine the constrained CG envelope, the allowances must be added to the certified CG envelope.

The table below shows the determination of the forward constrained limit for the EMB-145LR.

For Takeoff & Landing & In-flight limits the allowance used was:

- -10155.15 lb.in (landing gear)
- -4017.00 lb.in (forward flight allowance)
- -152772.23 lb.in (forward seating allowance)
  -166944.38 lb.in = total fwd allowance

NOTE: The allowance at 27337 lb is -10155.15 lb.in , because in this range of weight it is impossible to have passengers loaded, so the seating allowance was disregarded and also the flight allowance.

For Takeoff & Landing limits the allowance used was:

- -152772.23 lb.in (forward seating allowance)

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Forward Center of Gravity Limits:

AFM values				Allow-	Constrained values		
Wt. (lb)	CG (%)	arm (in)	Mom. (lb.in)	ance (lb.in)	Mom. (lb.in)	arm (in)	CG (%)
Takeoff & Landing & In-flight limits:							
27337	30.0	608.64	16638392	-10155	16648547	609.01	30.3
29542	12.0	588.34	17380740	-166944	17547684	593.99	17.0
34170	12.0	588.34	20103578	-166944	20270522	593.23	16.3
Takeoff & Landing limits:							
38000	14.0	588.34	22356920	-152772	22509692	592.36	15.6 *
48501	18.4	595.56	28885256	-152772	29038028	598.71	21.2 *
In-flight limit:							
38000	12.0	588.34	22356920	-166944	22523864	592.73	15.9
48501	16.2	595.56	28885256	-166944	29052200	599.00	21.5

* points disregarded because of the existence of more limiting points at the same weight.

The table below shows the determination of the aft constrained limit for the EMB-145LR.

For Takeoff & Landing & In-flight limits the allowance used was:

- +192360.00 lb.in (aft flight allowance)
- +142588.92 lb.in (aft seating allowance)

  +334948.92 lb.in = total aft allowance

NOTE: The allowance at 27337 lb is zero because in this weight range it is impossible to have passengers loaded, so the seating allowance was disregarded and also the flight allowance.

Aft Center of Gravity Limits:

AFM values				Allow-	Constrained values		
Wt. (lb)	CG (%)	arm (in)	Mom. (lb.in)	ance (lb.in)	Mom. (lb.in)	arm (in)	CG (%)
Takeoff & Landing & In-flight limits:							
27337	30.0	608.64	16638392	0.0	16638392	608.64	30.0
29542	43.0	623.30	18413529	334948	18078581	611.96	32.9
37698	43.0	623.30	23497163	334948	23162215	614.41	35.1
42594	39.5	619.36	26381020	334948	26046072	611.50	32.5
48501	39.5	619.36	30039579	334948	29704631	612.45	33.4

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EMB-145LR - CONSTRAINED ENVELOPE

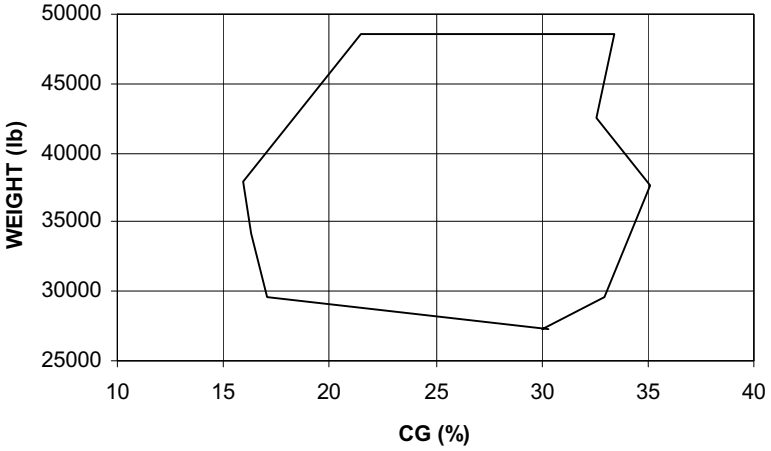

Figure 3

The complete constrained CG envelope for the EMB-145LR is shown in Figure 4:

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EMB-145LR Constrained CG Envelope

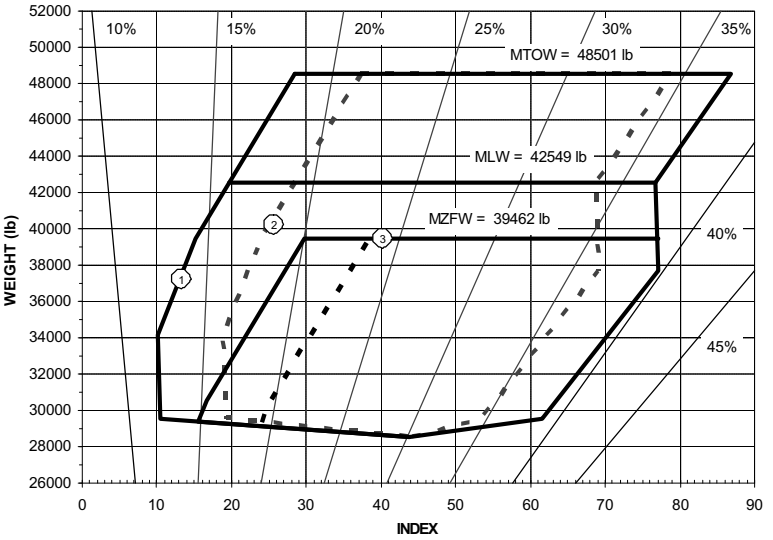

Figure 4

1 - TOW limit (more than 45 paxs).

2 - TOW limit (with 45 paxs or less).

3 - ZFW limit.

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BALANCE CHART

The balance chart is a document used to check whether the aircraft center of gravity is located within the approved limits.

Balance charts may be prepared in two basic formats:

- Diagram format: is a balance chart with vertical lines for the moment scales, in which the pitch between each line refers to a predetermined load. To determine the aircraft trim it is necessary to draw vertical lines moving to the left and right depending on aircraft load.
- Table format: is a balance chart with index influence tables for each compartment or passenger cabin. To determine the aircraft trim it is necessary to perform addition and subtraction calculations and then draw the result into the CG envelope.

The example shown in the next page is a diagram format balance chart. In order to use it, the following steps must be followed:

1. Enter the aircraft OEI in the Basic Index scale.

2. Write the wardrobe (WRDB), cargo compartment (CGO 1) and number of passengers per cabin (PAX A, B and C) into the appropriate boxes.

3. Draw from the BOI value in the Basic Index scale the CG shift due to WRDB load. From the WRDB final point draw the CG shift due to CGO 1 and so subsequently for PAX A, B and C. The direction for each CG shift is indicated by the arrow.

4. Enter the aircraft OEW in the Basic Weight box and the total payload in the Payload box. Add the values to obtain the ZFW, enter the takeoff fuel weight into the Fuel box and add them to obtain the TOW.

5. From the last position determined in step 3, draw a vertical line into the CG envelope until it crosses a horizontal line at the ZFW. The crossing point determines the ZFW-CG and if it is located outside of the ZFW envelope, a new loading distribution must be made.

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6. Enter the Fuel Index table with the fuel weight and read the fuel index.
7. Enter the Fuel box with the fuel weight and index and draw the CG shift from the last position determined in step 3.
8. From the position determined in step 7, draw a vertical line into the CG envelope until it crosses a horizontal line at the TOW. The crossing point determines the TOW-CG, and if it is located outside of the TOW envelope, a new loading distribution must be made.
9. Enter the Stab Trim table with the TOW-CG and read the stab trim setting (pitch trim).
10. Complete the flight identification box with Flight Number, Date, Origin airport, Destination airport, Aircraft Registration and Crew Configuration.
11. Complete the results box with the ZFW, ZFW-CG, TOW, TOW-CG and Stab Trim setting and sign the load sheet in the Prepared By box.

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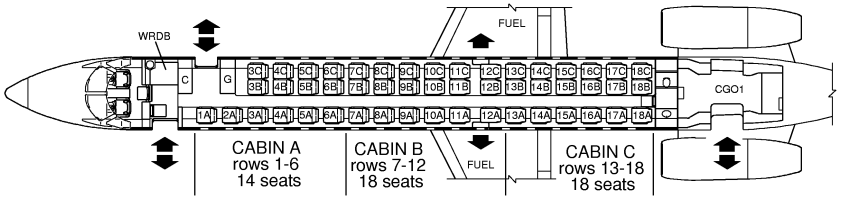
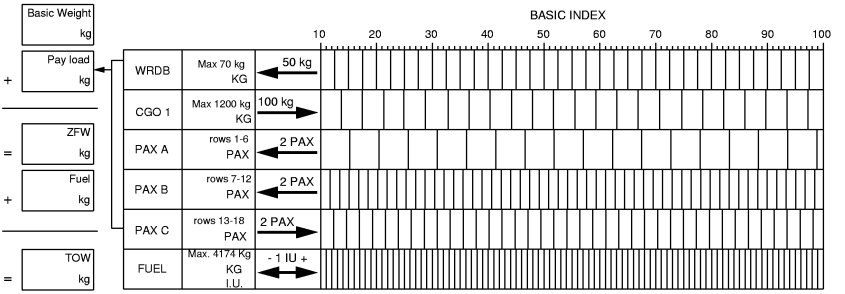
SAMPLE EMB-145 EP BALANCE CHART

EMBRAER

BALANCE CHART EMB-145 EP

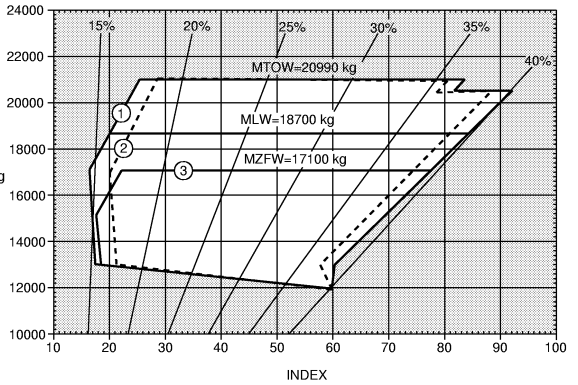
FLIGHT	DATE
FROM	TO
A/C REG	CREW Config





FUEL INDEX	
kg	IU
0	0
500	-1
1000	-1
1500	-1
2000	-1
2500	0
3000	1
3500	3
4000	6
4200	7

STAB TRIM	
CG %	units
< 25	8
30	7
35	6
40	5
43	4



ZFW	CG	kg %
TOW	CG	kg %
STAB TRIM		Units

Prepared by:

1-TOW limit (more than 45 paxs) 2-TOW limit (with 45 paxs or less) 3-ZFW limit

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SECTION 1-07

LOADING

Introduction 1-07-00
External Dimensions 1-07-10
Cabin Cross Section 1-07-20
Interior Arrangement 1-07-30
Carry-on baggage 1-07-50
Baggage Door 1-07-60
Baggage Compartment 1-07-70
Cargo Nets 1-07-80
Live Animals Transportation 1-07-90
Dry Ice Transportation 1-07-95

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INTRODUCTION

This Section contains airplane dimensions, interior arrangement data for loading purposes and loading capacity information in the passenger cabin and baggage compartment.

Instructions for loading and unloading the airplane, live animals and dry ice transportation are also included in this Section.

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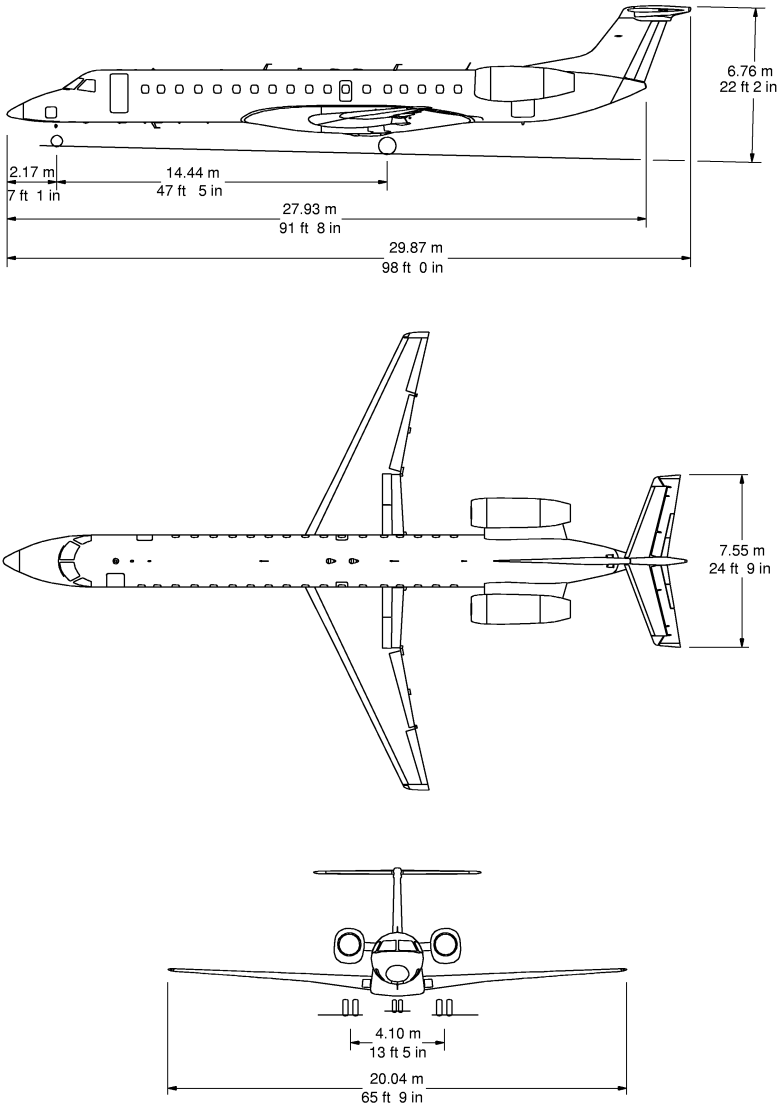
EXTERNAL DIMENSIONS

EMB-145 THREE VIEW DRAWING



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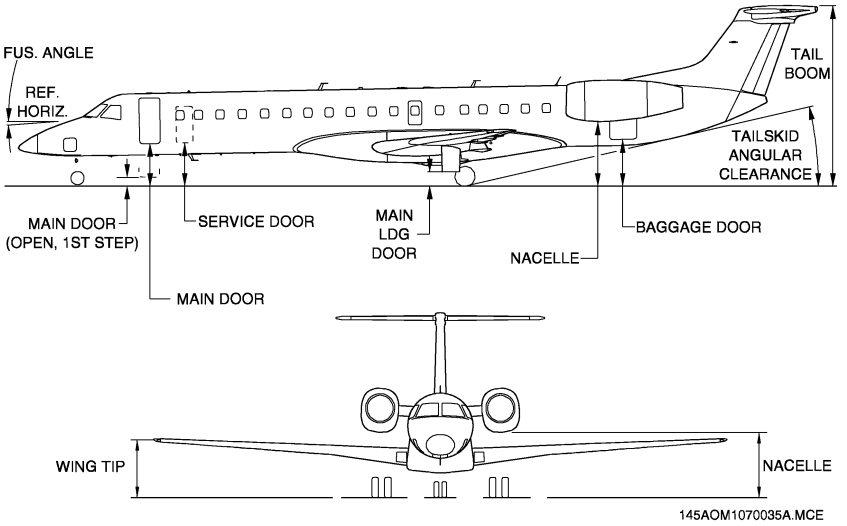
EMB-145 GROUND CLEARANCES



Vertical Clearance	Maximum	Minimum
Fuselage Angle	1° 21’ 24”	0° 52’ 00”
Main Door	1.598 m 5 ft 3 in	1.481 m 4 ft 10 in
Main Door Open (1st step)	0.480 m 1 ft 7 in	0.360 m 1 ft 2¼ in
Service Door	1.595 m 5 ft 3 in	1.408 m 4 ft 7 in
Main Landing Gear Door	0.471 m 1 ft 6½ in	0.398 m 1 ft 3¾ in
Nacelle	2.425 m 7 ft 11 in	2.315 m 7 ft 7 in
Baggage Door	1.806 m 5 ft 11 in	1.663 m 5 ft 5 in
Tail Boom	6.810 m 22 ft 4 in	6.619 m 21 ft 9 in
Wing Tip	2.022 m 6 ft 8 in	1.920 m 6 ft 4 in
Tailskid Angular Clearance	12° 41’ 00”	11° 43’ 59”

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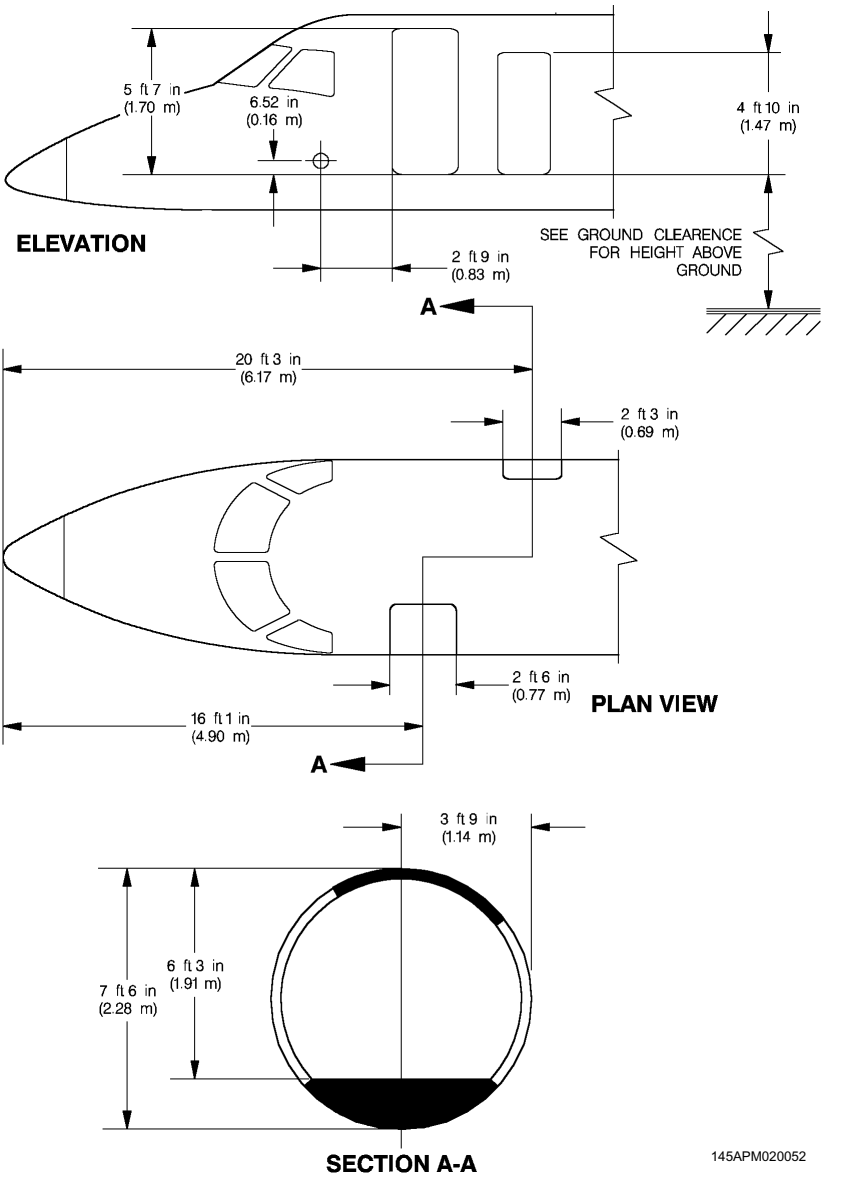
EMB-145 DOOR CLEARANCES



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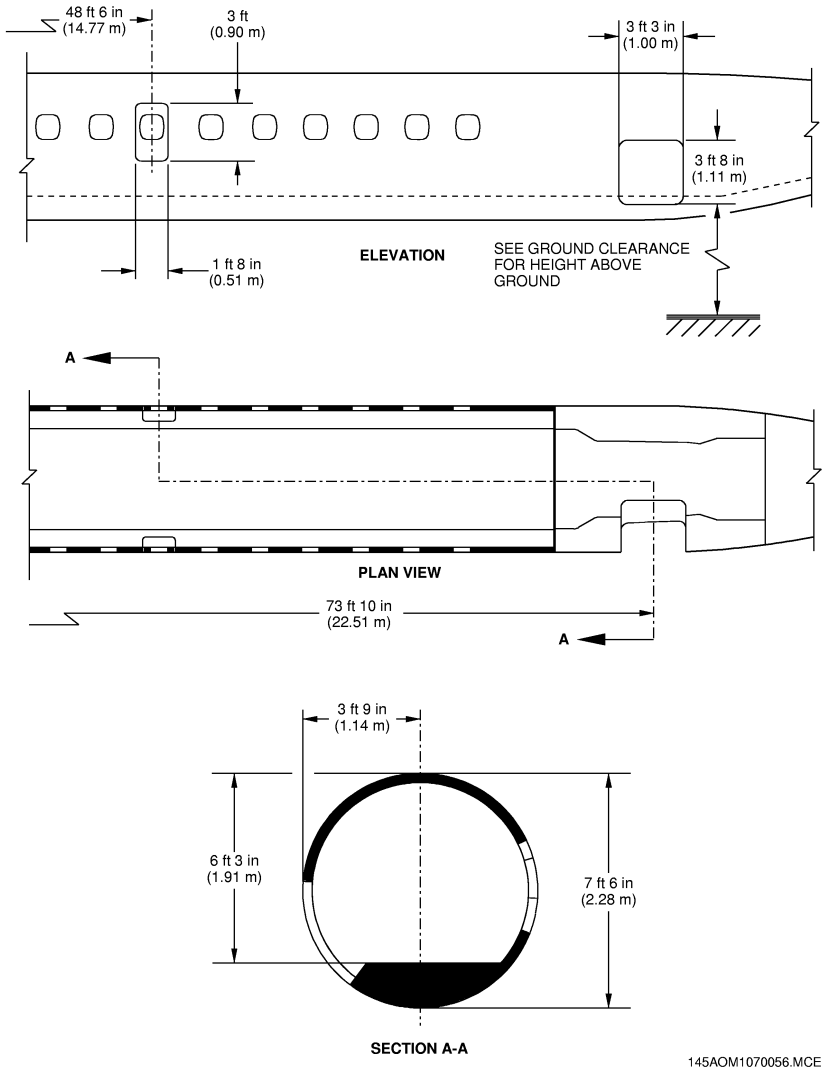
EMB-145 DOOR CLEARANCES



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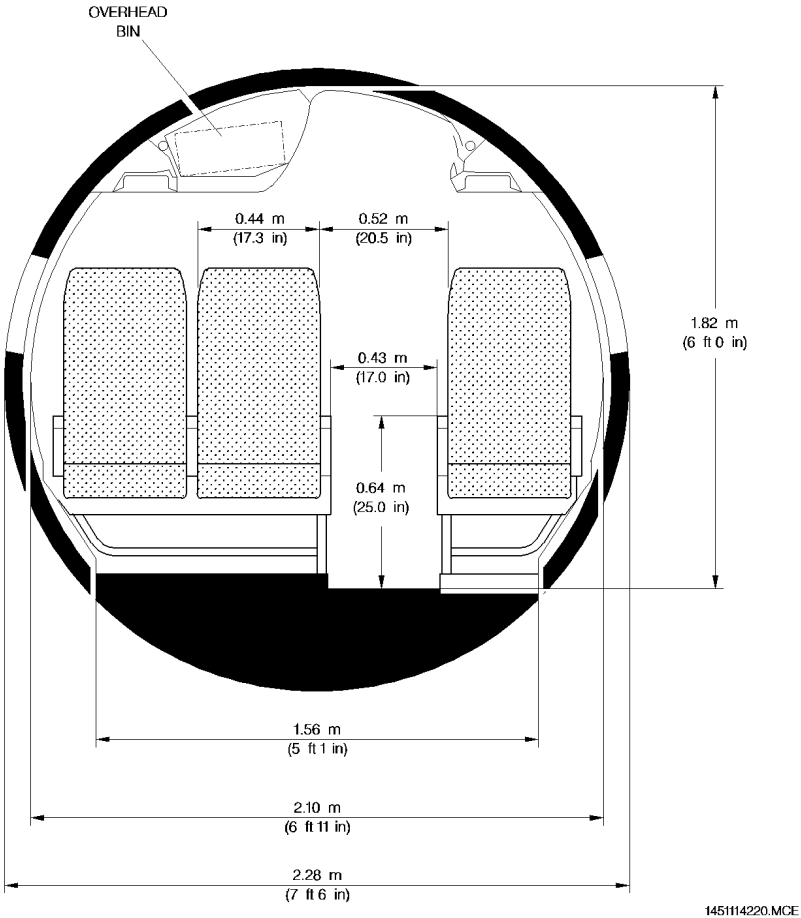
CABIN CROSS SECTION



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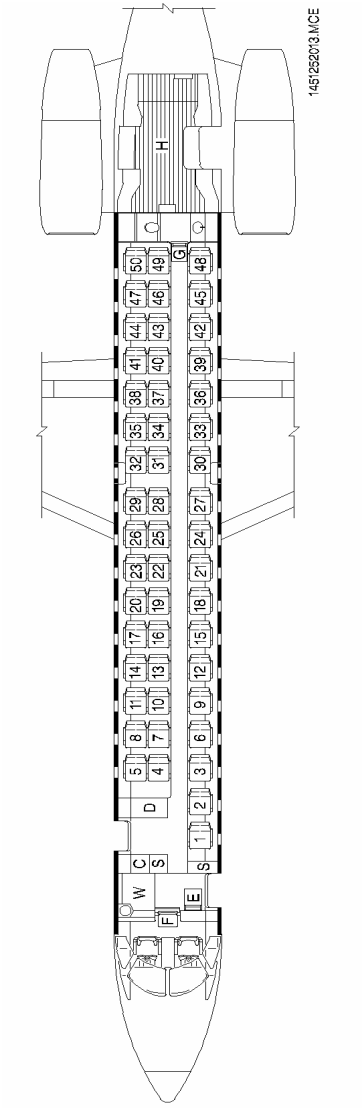
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 1A



W: Wardrobe

S: Stowage Compartment

C: Forward Galley

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

50 seats

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EMB-145 CONFIGURATION OPTION 1A

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1	6.324	248.98
2	2	7.111	279.96
3	3, 4, 5	7.899	310.98
4	6, 7, 8	8.686	341.97
5	9, 10, 11	9.474	372.99
6	12, 13, 14	10.261	403.98
7	15, 16, 17	11.048	434.96
8	18, 19, 20	11.836	465.98
9	21, 22, 23	12.623	496.97
10	24, 25, 26	13.411	527.99
11	27, 28, 29	14.198	558.98
12	30, 31, 32	15.163	596.97
13	33, 34, 35	15.951	627.99
14	36, 37, 38	16.738	658.98
15	39, 40, 41	17.525	689.96
16	42, 43, 44	18.313	720.98
17	45, 46, 47	19.100	751.97
18	48, 49, 50	19.888	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
WARDROBE	4.90 (192.91)	0.93 (32.9)	70 (154) **
RH STOWAGE COMPARTMENT	5.53 (217.72)	0.17 (6.0)	61 (135) **
LH STOWAGE COMPARTMENT	5.38 (211.81)	0.11 (3.9)	2.3 (5.1) **
FWD GALLEY	5.53 (217.72)	*	51 (113) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 1.27 m^3 (44.7 cu.ft)/3 half trolleys.

** Reference values. Check airplane placards for actual values.

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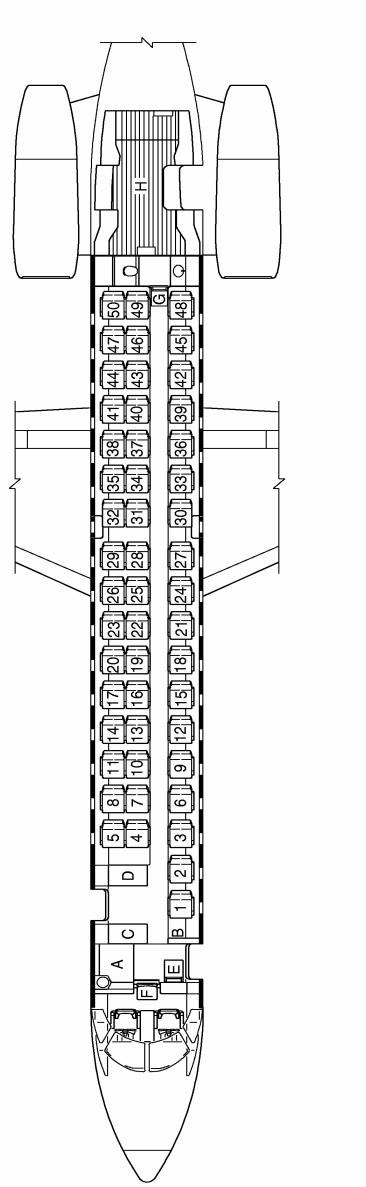
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 2



A: Wardrobe

B: Stowage Compartment

C: Forward Galley

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

50 seats

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EMB-145 CONFIGURATION OPTION 2

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	BALANCE ARM (in)
1	1	6.324	248.98
2	2	7.111	279.96
3	3,4,5	7.899	310.98
4	6,7,8	8.686	341.97
5	9,10,11	9.474	372.99
6	12,13,14	10.261	403.98
7	15,16,17	11.048	434.96
8	18,19,20	11.836	465.98
9	21,22,23	12.623	496.97
10	24,25,26	13.411	527.99
11	27,28,29	14.198	558.98
12	30,31,32	15.163	596.97
13	33,34,35	15.951	627.99
14	36,37,38	16.738	658.98
15	39,40,41	17.525	689.96
16	42,43,44	18.313	720.98
17	45,46,47	19.100	751.97
18	48,49,50	19.888	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
WARDROBE	4.90 (192.91)	0.93 (32.9)	70 (154) **
LH STOWAGE COMPARTMENT	5.38 (211.81)	0.11 (3.9)	2.3 (5.1) **
FWD GALLEY	5.53 (217.72)	*	113 (249) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 1.49 m^3 (52.7 cu.ft) / 4 half trolleys.
** Reference values. Check aircraft placards for actual values.

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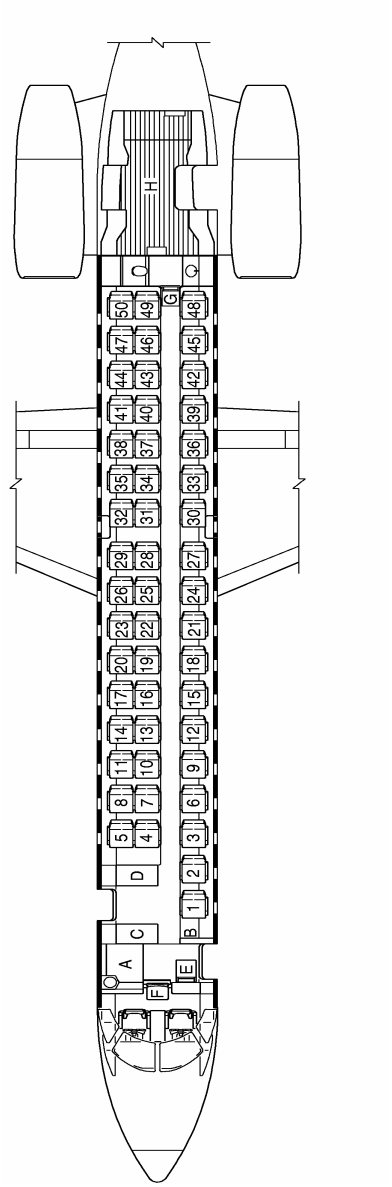
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 3



A: Outboard Galley

B: Stowage Compartment

C: Fwd Galley

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

50 seats

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EMB-145 CONFIGURATION OPTION 3

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	BALANCE ARM (in)
1	1	6.324	248.98
2	2	7.111	279.96
3	3, 4, 5	7.899	310.98
4	6, 7, 8	8.686	341.97
5	9, 10, 11	9.474	372.99
6	12, 13, 14	10.261	403.98
7	15, 16, 17	11.048	434.96
8	18, 19, 20	11.836	465.98
9	21, 22, 23	12.623	496.97
10	24, 25, 26	13.411	527.99
11	27, 28, 29	14.198	558.98
12	30, 31, 32	15.163	596.97
13	33, 34, 35	15.951	627.99
14	36, 37, 38	16.738	658.98
15	39, 40, 41	17.525	689.96
16	42, 43, 44	18.313	720.98
17	45, 46, 47	19.100	751.97
18	48, 49, 50	19.888	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
LH STOWAGE COMPARTMENT	5.38 (211.81)	0.11 (3.9)	2.3 (5.1) **
OUTBOARD GALLEY	4.90 (192.91)	*	82 (181) **
FWD GALLEY	5.53 (217.72)	*	113 (249) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 2.42 m^3 (85.4 cu.ft)/6 or 4 half trolleys.

** Reference values. Check airplane placards for actual values.

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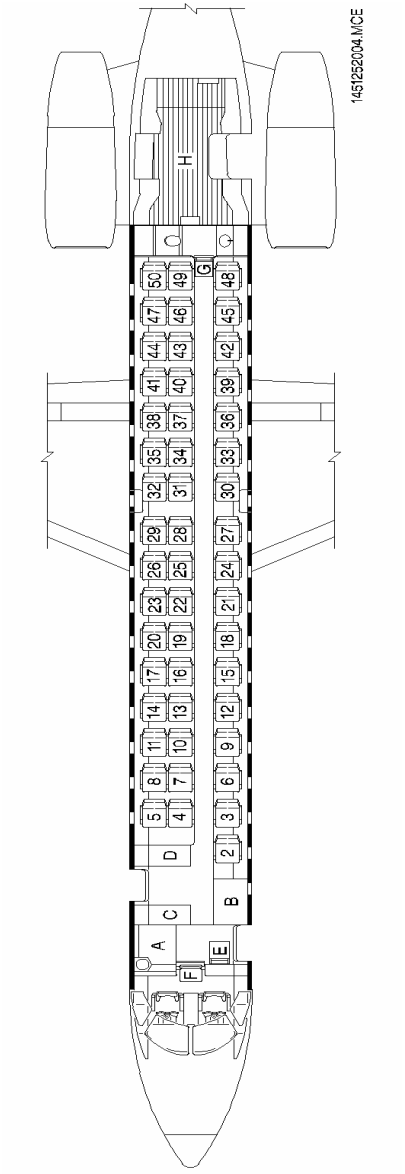
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 4



A: Forward Galley

B: Wardrobe

C: Mid Galley

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

49 seats

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EMB-145 CONFIGURATION OPTION 4

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	-	-	-
2	2	7.111	279.96
3	3,4,5	7.898	310.98
4	6,7,8	8.686	341.97
5	9,10,11	9.473	372.99
6	12,13,14	10.261	403.98
7	15,16,17	11.048	434.96
8	18,19,20	11.835	465.98
9	21,22,23	12.623	496.97
10	24,25,26	13.410	527.99
11	27,28,29	14.198	558.98
12	30,31,32	15.163	596.97
13	33,34,35	15.950	627.99
14	36,37,38	16.738	658.98
15	39,40,41	17.525	689.96
16	42,43,44	18.312	720.98
17	45,46,47	19.100	751.97
18	48,49,50	19.887	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
WARDROBE	5.78 (227.48)	0.57 (20.2)	57 (126) **
FWD GALLEY	4.90 (192.91)	*	82 (181) **
MID GALLEY	5.53 (217.72)	*	113 (249) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 2.42 m^3 (85.4 cu.ft) / 6 half trolleys.
** Reference values. Check aircraft placards for actual values.

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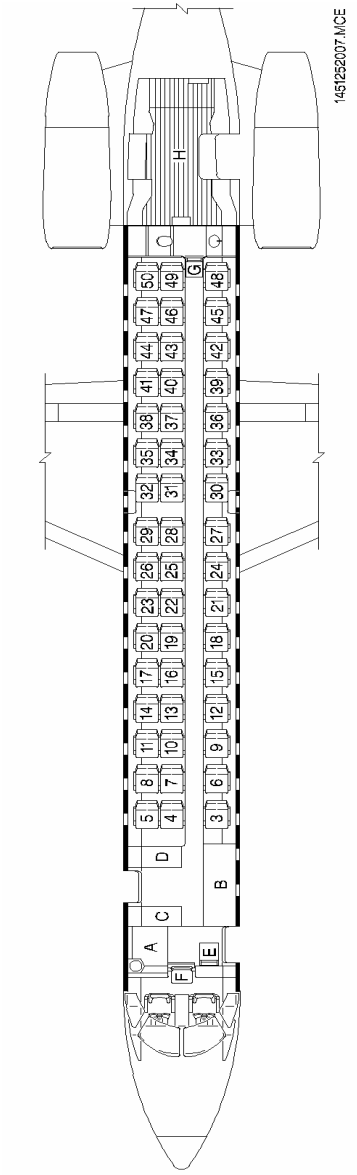
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 5



A: Forward Galley

B: Wardrobe

C: Mid Galley

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

48 seats

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EMB-145 CONFIGURATION OPTION 5

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	BALANCE ARM (in)
1	-	-	-
2	-	-	-
3	3,4,5	7.898	310.98
4	6,7,8	8.685	341.97
5	9,10,11	9.473	372.99
6	12,13,14	10.260	403.98
7	15,16,17	11.048	434.96
8	18,19,20	11.835	465.98
9	21,22,23	12.622	496.97
10	24,25,26	13.410	527.99
11	27,28,29	14.197	558.98
12	30,31,32	15.162	596.97
13	33,34,35	15.950	627.99
14	36,37,38	16.737	658.98
15	39,40,41	17.525	689.96
16	42,43,44	18.312	720.98
17	45,46,47	19.099	751.97
18	48,49,50	19.887	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
WARDROBE	6.153 (242.24)	1.07 (37.6)	80 (176) **
FWD GALLEY	4.90 (192.91)	*	82 (181) **
MID GALLEY	5.53 (217.72)	*	113 (249) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 2.42 m^3 (85.4 cu.ft)/6 half trolleys.

** Reference values. Check airplane placards for actual values.

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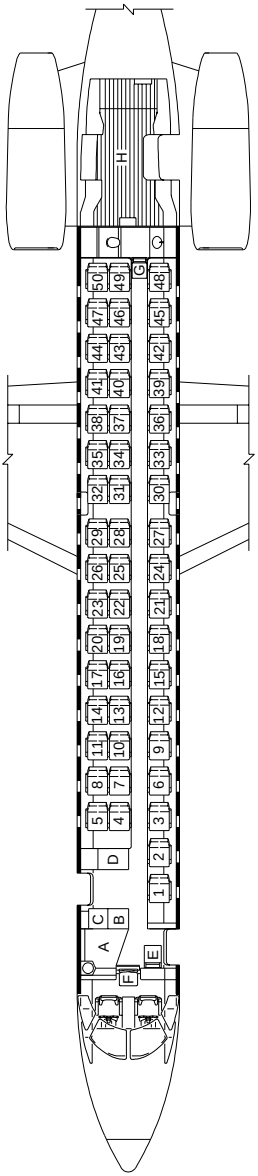
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 6



A: WARDROBE
B: STOWAGE COMPARTMENT
C: FORWARD GALLEY
D: AFT GALLEY
E: FORWARD FLIGHT ATTENDANT
F: COCKPIT OBSERVER
G: AFT FLIGHT ATTENDANT
H: BAGGAGE COMPARTMENT

50 SEATS
BUYER FURNISHED INTERIOR

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EMB-145 CONFIGURATION OPTION 6

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1	6.324	248.98
2	2	7.111	279.96
3	3, 4, 5	7.899	310.98
4	6, 7, 8	8.686	341.97
5	9, 10, 11	9.474	372.99
6	12, 13, 14	10.261	403.98
7	15, 16, 17	11.048	434.96
8	18, 19, 20	11.836	465.98
9	21, 22, 23	12.623	496.97
10	24, 25, 26	13.411	527.99
11	27, 28, 29	14.198	558.98
12	30, 31, 32	15.163	596.97
13	33, 34, 35	15.951	627.99
14	36, 37, 38	16.738	658.98
15	39, 40, 41	17.525	689.96
16	42, 43, 44	18.313	720.98
17	45, 46, 47	19.100	751.97
18	48, 49, 50	19.888	782.99

NOTE: Passenger seats are installed by the operator.

PASSENGER AVERAGE CG: 13.596 m / 535.26 in

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity Kg (lb)
WARDROBE	5.014 (197.40)	1.12 (39.6)	66 (145.5) **
RH STOWAGE COMPARTMENT	5.380 (211.81)	0.17 (6.0)	67 (147.7) **
FWD GALLEY	5.530 (217.72)	*	106 (233.7) **
AFT GALLEY	6.790 (267.32)	*	191 (421) **

* Total Galley Volume: 1.27 m^3 (44.7 cu.ft) / 3 half trolleys.
** Reference values. Check aircraft placards for actual values.

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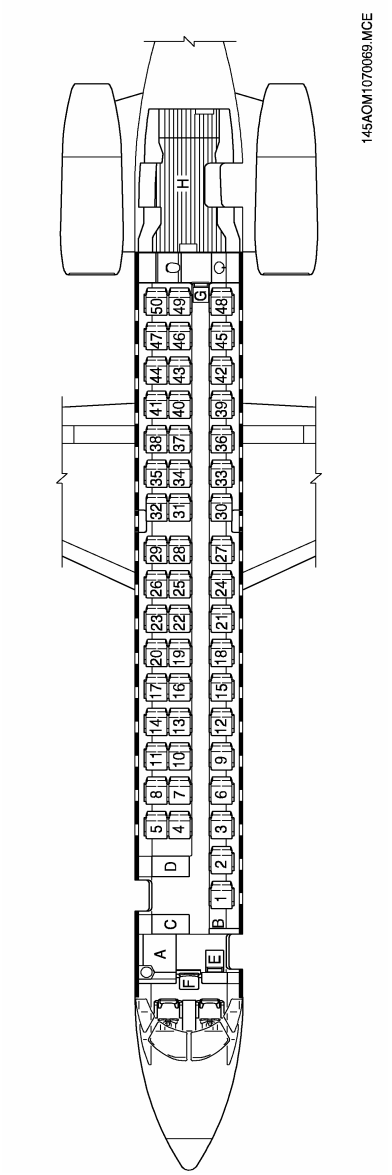
INTERIOR ARRANGEMENT

EMB-145 STD CONFIGURATION



A: Wardrobe

B: Stowage Unit

C: Stowage Compartment

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

50 seats

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EMB-145 STD CONFIGURATION

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	BALANCE ARM (in)
1	1	6.324	248.98
2	2	7.111	279.96
3	3, 4, 5	7.899	310.98
4	6, 7, 8	8.686	341.97
5	9, 10, 11	9.474	372.99
6	12, 13, 14	10.261	403.98
7	15, 16, 17	11.048	434.96
8	18, 19, 20	11.836	465.98
9	21, 22, 23	12.623	496.97
10	24, 25, 26	13.411	527.99
11	27, 28, 29	14.198	558.98
12	30, 31, 32	15.163	596.97
13	33, 34, 35	15.951	627.99
14	36, 37, 38	16.738	658.98
15	39, 40, 41	17.525	689.96
16	42, 43, 44	18.313	720.98
17	45, 46, 47	19.100	751.97
18	48, 49, 50	19.888	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
WARDROBE	4.90 (192.91)	0.93 (32.9)	70 (154) **
RH STOWAGE COMPARTMENT	5.53 (217.72)	0.45 (16.0)	**
STOWAGE UNIT	5.38 (211.81)	0.17 (6.0)	61 (135)**
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 0.99 m^3 (34.8 cu.ft)/2 half trolleys.

** Reference values. Check airplane placards for actual values.

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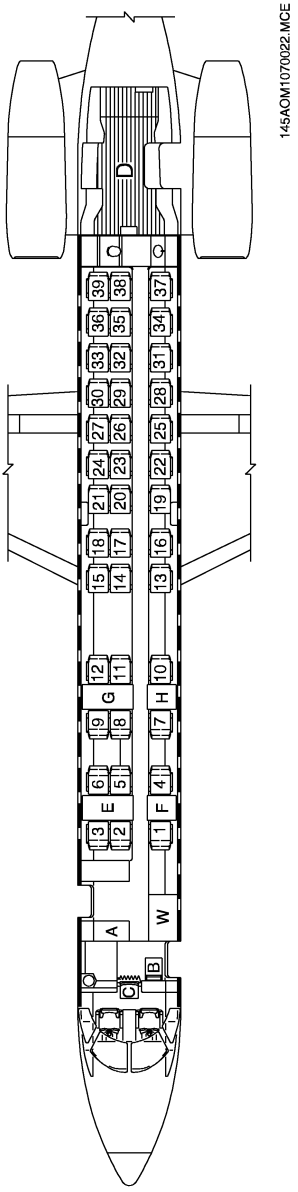
INTERIOR ARRANGEMENT

EMB-145 BAF CORPORATE CONFIGURATION



A: Galley

B: Flight Attendant Seat

C: Cockpit Observer

D: Baggage Compartment

E, G: Double Table

F, H: Single Table

W: Wardrobe

39 seats

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EMB-145 BAF CORPORATE CONFIGURATION

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1, 2, 3	7.538	296.77
2	4, 5, 6	8.884	349.76
3	7, 8, 9	10.114	398.19
4	10, 11, 12	11.460	451.18
5	13, 14, 15	13.280	522.83
6	16, 17, 18	14.067	553.82
7	19, 20, 21	15.083	593.82
8	22, 23, 24	15.870	624.80
9	25, 26, 27	16.658	655.83
10	28, 29, 30	17.445	686.81
11	31, 32, 33	18.233	717.84
12	34, 35, 36	19.020	748.82
13	37, 38, 39	19.807	779.80

PASSENGER AVERAGE CG: 14.420 m / 567.72 in

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
FWD GALLEY	5.55 (218.50)	0.085 (3.00)	184 (406) *
WARDROBE	5.76 (226.77)	0.490 (17.30)	45 (99.2)

* Reference values. Check aircraft placards for actual values.

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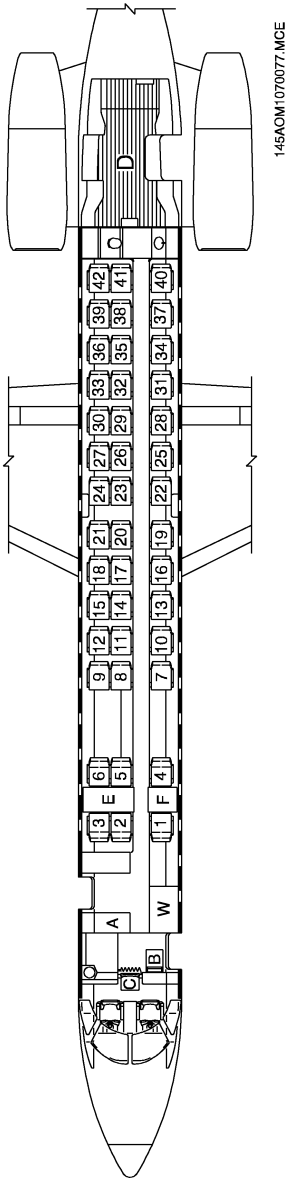
EMB-145 BAF SECOND CORPORATE CONFIGURATION



A: Galley

B: Flight Attendant Seat

C: Cockpit Observer

D: Baggage Compartment

E: Double Table

F: Single Table

W: Wardrobe

42 seats

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EMB-145 BAF SECOND CORPORATE CONFIGURATION

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1, 2, 3	7.538	296.77
2	4, 5, 6	8.884	349.76
3	7, 8, 9	10.917	429.80
4	10, 11, 12	11.705	460.83
5	13, 14, 15	12.492	491.81
6	16, 17, 18	13.280	522.83
7	19, 20, 21	14.067	553.82
8	22, 23, 24	15.083	593.82
9	25, 26, 27	15.870	624.80
10	28, 29, 30	16.658	655.83
11	31, 32, 33	17.445	686.81
12	34, 35, 36	18.233	717.84
13	37, 38, 39	19.020	748.82
14	40, 41, 42	19.807	779.80

PASSENGER AVERAGE CG: 14.357 m / 565.24 in

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
FWD GALLEY	5.55 (218.50)	0.085 (3.00)	184 (405) *
WARDROBE	5.76 (226.77)	0.490 (17.30)	45 (99.2)

* Reference values. Check aircraft placards for actual values.

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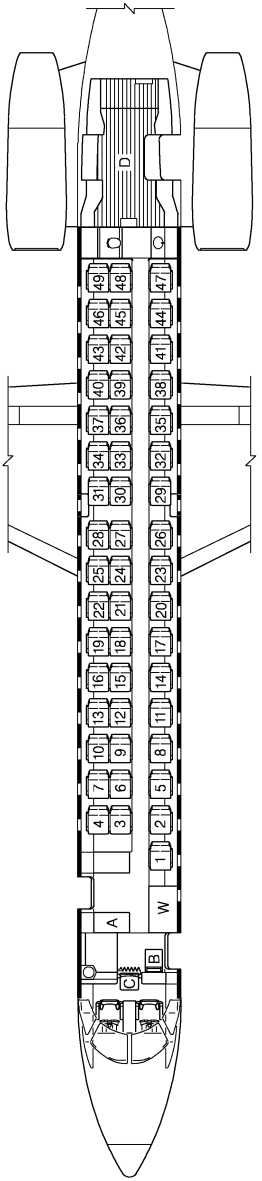
INTERIOR ARRANGEMENT

EMB-145 BAF SHUTTLE CONFIGURATION



A: Galley

B: Flight Attendant Seat

C: Cockpit Observer

D: Baggage Compartment

W: Wardrobe

49 seats

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EMB-145 BAF SHUTTLE CONFIGURATION

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1	6.980	274.80
2	2,3,4	7.768	305.83
3	5,6,7	8.555	336.81
4	8,9,10	9.343	367.83
5	11,12,13	10.130	398.82
6	14, 15,16	10.917	429.80
7	17, 18,19	11.705	460.83
8	20, 21,22	12.492	491.81
9	23,24,25	13.280	522.83
10	26, 27,28	14.067	553.82
11	29,30,31	15.083	593.82
12	32, 33,34	15.870	624.80
13	35, 36,37	16.658	655.83
14	38, 39,40	17.445	686.81
15	41, 42,43	18.233	717.84
16	44, 45,46	19.020	748.82
17	47, 48,49	19.807	779.80

PASSENGER AVERAGE CG: 13.374 m / 526.524 in

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity Kg (lb)
FWD GALLEY	5.55 (218.50)	0.085 (3.0)	184 (405)*
WARDROBE	5.76 (226.77)	0.490 (17.30)	45 (99.2)

* Reference values. Check aircraft placards for actual values.

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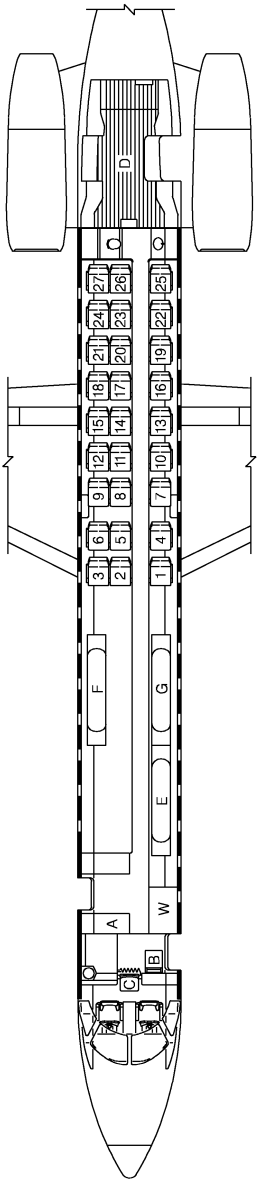
INTERIOR ARRANGEMENT

EMB-145 BAF MEDEVAC CONFIGURATION



A: Galley

B: Flight Attendant Seat

C: Cockpit Observer

D: Baggage Compartment

E,F,G: Stretcher

W: Wardrobe

27 seats

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EMB-145 BAF MEDEVAC CONFIGURATION

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1, 2, 3	13.280	522.83
2	4, 5, 6	14.067	553.82
3	7, 8, 9	15.083	593.82
4	10, 11, 12	15.870	624.80
5	13, 14, 15	16.658	655.83
6	16, 17, 18	17.445	686.81
7	19, 20, 21	18.233	717.84
8	22, 23, 24	19.020	748.82
9	25, 26, 27	19.807	779.80

PASSENGER AVERAGE CG: 16.607 m / 653.819 in

STRETCHER	BALANCE ARM (m)	(in)
E	8.235	324.21
F	10.673	420.20
G	10.673	420.20

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity Kg (lb)
FWD GALLEY	5.55 (218.50)	0.085 (3.0)	184 (405)*
WARDROBE	5.76 (226.77)	0.490 (17.30)	45 (99.2)

* Reference values. Check aircraft placards for actual values.

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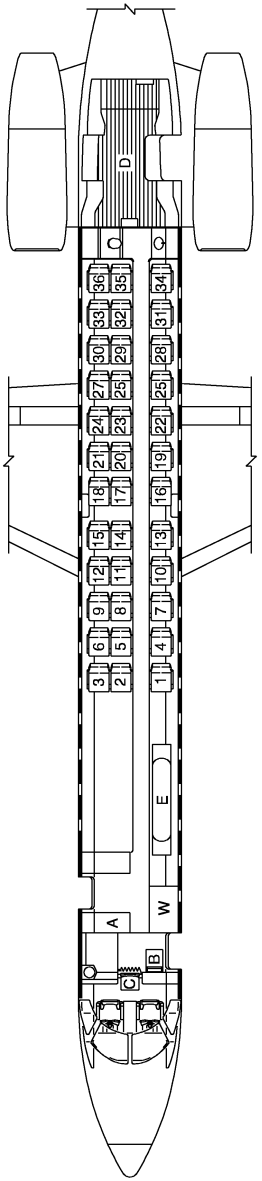
EMB-145 BAF SECOND MEDEVAC CONFIGURATION



A: Galley

B: Flight Attendant Seat

C: Cockpit Observer

D: Baggage Compartment

E: Stretcher

W: Wardrobe

36 seats

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EMB-145 BAF SECOND MEDEVAC CONFIGURATION

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1, 2, 3	10.917	429.80
2	4, 5, 6	11.705	460.83
3	7, 8, 9	12.492	491.81
4	10, 11, 12	13.280	522.83
5	13, 14, 15	14.067	553.82
6	16, 17, 18	15.083	593.82
7	19, 20, 21	15.870	624.80
8	22, 23, 24	16.658	655.83
9	25, 26, 27	17.445	686.81
10	28, 29, 30	18.233	717.84
11	31, 32, 33	19.020	748.82
12	34, 35, 36	19.807	779.80

PASSENGER AVERAGE CG: 15.381 m / 605.57 in

STRETCHER	BALANCE ARM (m)	(in)
E	8.235	324.21

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity Kg (lb)
FWD GALLEY	5.55 (218.50)	0.085 (3.0)	184 (405)*
WARDROBE	5.76 (226.77)	0.490 (17.30)	45 (99.2)

* Reference values. Check aircraft placards for actual values.

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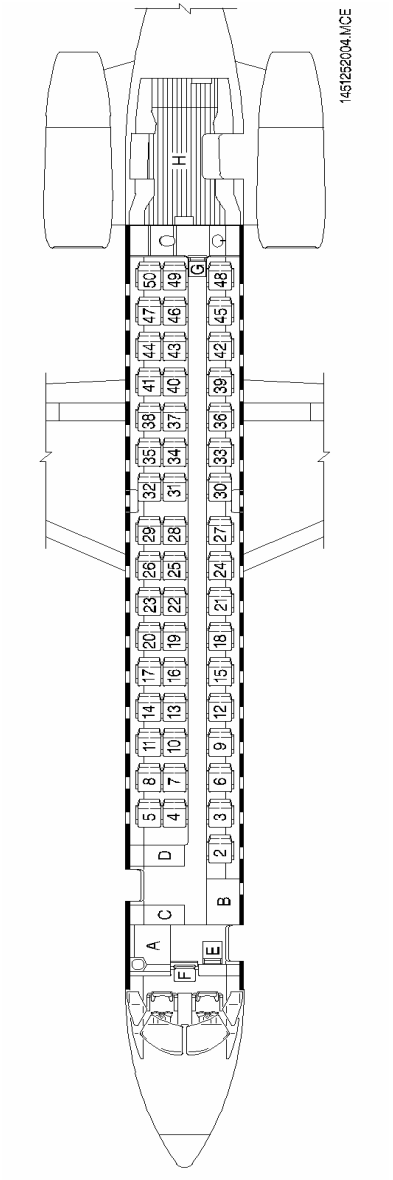
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 4A



A: Outboard Galley

B: Wardrobe

C: Forward Galley

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

49 seats

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EMB-145 CONFIGURATION OPTION 4A

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	BALANCE ARM (in)
1	-	-	-
2	2	7.111	279.96
3	3,4,5	7.898	310.98
4	6,7,8	8.686	341.97
5	9,10,11	9.473	372.99
6	12,13,14	10.261	403.98
7	15,16,17	11.048	434.96
8	18,19,20	11.835	465.98
9	21,22,23	12.623	496.97
10	24,25,26	13.410	527.99
11	27,28,29	14.198	558.98
12	30,31,32	15.163	596.97
13	33,34,35	15.950	627.99
14	36,37,38	16.738	658.98
15	39,40,41	17.525	689.96
16	42,43,44	18.312	720.98
17	45,46,47	19.100	751.97
18	48,49,50	19.887	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
WARDROBE	5.78 (227.48)	0.57 (20.2)	57 (126) **
OUTBOARD GALLEY	4.90 (192.91)	*	82 (181) **
FORWARD GALLEY	5.53 (217.72)	*	113 (249) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 2.42 m^3 (85.4 cu.ft)/6 half trolleys.

** Reference values. Check airplane placards for actual values.

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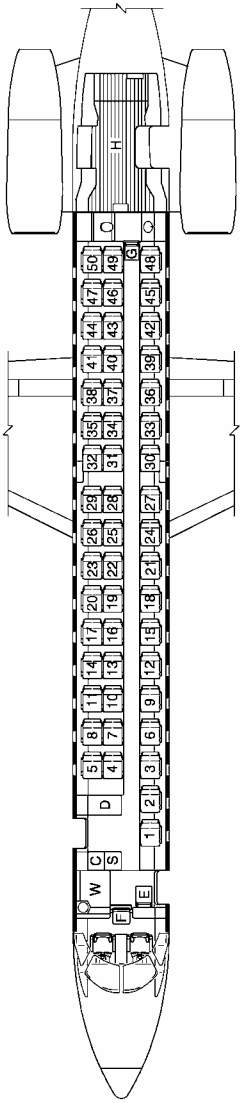
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 1



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W: Wardrobe

S: Stowage Compartment

C: Forward Galley

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

50 seats

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EMB-145 CONFIGURATION OPTION 1

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1	6.324	248.98
2	2	7.111	279.96
3	3, 4, 5	7.899	310.98
4	6, 7, 8	8.686	341.97
5	9, 10, 11	9.474	372.99
6	12, 13, 14	10.261	403.98
7	15, 16, 17	11.048	434.96
8	18, 19, 20	11.836	465.98
9	21, 22, 23	12.623	496.97
10	24, 25, 26	13.411	527.99
11	27, 28, 29	14.198	558.98
12	30, 31, 32	15.163	596.97
13	33, 34, 35	15.951	627.99
14	36, 37, 38	16.738	658.98
15	39, 40, 41	17.525	689.96
16	42, 43, 44	18.313	720.98
17	45, 46, 47	19.100	751.97
18	48, 49, 50	19.888	782.99

PASSENGER AVERAGE CG: 13.595 m / 535.26 in.

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
WARDROBE	4.90 (192.91)	0.93 (32.9)	70 (154) **
RH STOWAGE COMPARTMENT	5.53 (217.72)	0.17 (6.0)	61 (135)**
FWD GALLEY	5.53 (217.72)	*	51 (113) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 1.27 m^3 (44.7 cu.ft) / 3 half trolleys.
** Reference values. Check aircraft placards for actual values.

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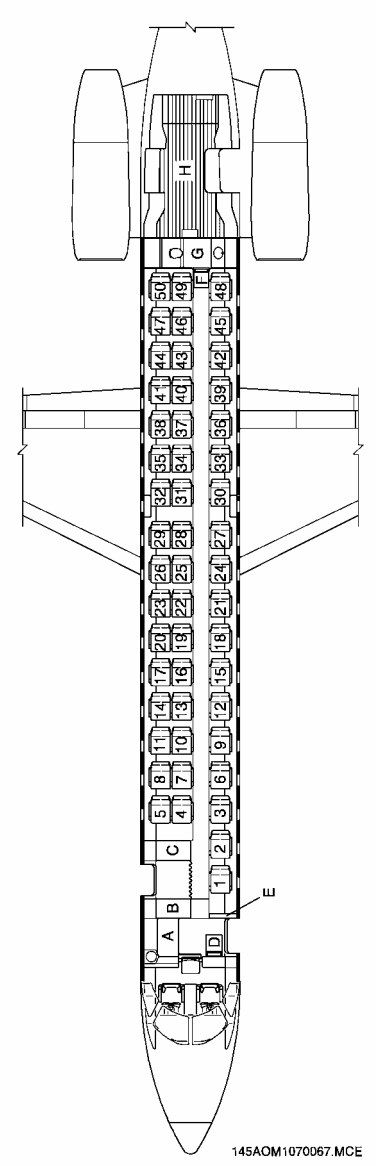
INTERIOR ARRANGEMENT

EMB-145XR CONFIGURATION



A: Wardrobe

B: Forward Galley

C: Aft Galley

D: Forward Flight Attendant

E: Stowage Compartment

F: Aft Flight Attendant

G: Lavatory

H: Baggage Compartment

50 seats

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EMB-145XR CONFIGURATION

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1	6.324	248.98
2	2	7.111	279.96
3	3, 4, 5	7.899	310.98
4	6, 7, 8	8.686	341.97
5	9, 10, 11	9.474	372.99
6	12, 13, 14	10.261	403.98
7	15, 16, 17	11.048	434.96
8	18, 19, 20	11.836	465.98
9	21, 22, 23	12.623	496.97
10	24, 25, 26	13.411	527.99
11	27, 28, 29	14.198	558.98
12	30, 31, 32	15.163	596.97
13	33, 34, 35	15.951	627.99
14	36, 37, 38	16.738	658.98
15	39, 40, 41	17.525	689.96
16	42, 43, 44	18.313	720.98
17	45, 46, 47	19.100	751.97
18	48, 49, 50	19.888	782.99

PASSENGER AVERAGE CG: 13.595 m / 535.26 in.

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
WARDROBE	4.90 (192.91)	0.93 (32.9)	70 (154) **
EMERG. EQUIP. STOWAGE UNIT	5.38 (211.81)	0.11 (3.9)	2.3 (5.1) **
FWD GALLEY	5.53 (217.72)	*	51 (113) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 1.49 m^3 (52.7 cu.ft) / 4 half trolleys.
** Reference values. Check aircraft placards for actual values.

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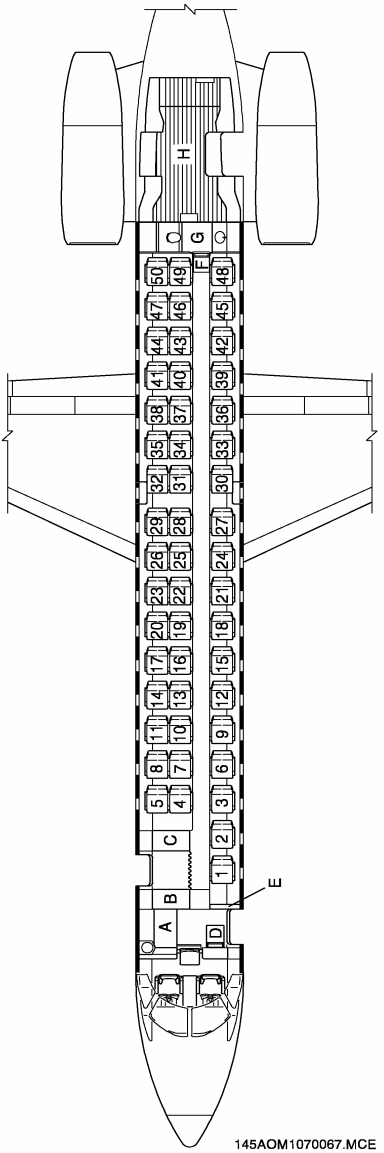
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 1B



A: Wardrobe
B: Forward Galley
C: Aft Galley
D: Forward Flight Attendant
E: Stowage Compartment
F: Aft Flight Attendant
G: Lavatory
H: Baggage Compartment

50 seats

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EMB-145 CONFIGURATION OPTION 1B

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	BALANCE ARM (in)
1	1	6.324	248.98
2	2	7.111	279.96
3	3,4,5	7.899	310.98
4	6,7,8	8.686	341.97
5	9,10,11	9.474	372.99
6	12,13,14	10.261	403.98
7	15,16,17	11.048	434.96
8	18,19,20	11.836	465.98
9	21,22,23	12.623	496.97
10	24,25,26	13.411	527.99
11	27,28,29	14.198	558.98
12	30,31,32	15.163	596.97
13	33,34,35	15.951	627.99
14	36,37,38	16.738	658.98
15	39,40,41	17.525	689.96
16	42,43,44	18.313	720.98
17	45,46,47	19.100	751.97
18	48,49,50	19.888	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
WARDROBE	4.90 (192.91)	0.93 (32.9)	70 (154) **
LH STOWAGE COMPARTMENT	5.38 (211.81)	0.11 (3.9)	2.3 (5.1) **
FWD GALLEY	5.53 (217.72)	*	113 (249) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 1.49 m^3 (52.7 cu.ft)/3 half trolleys.

** Reference values. Check airplane placards for actual values.

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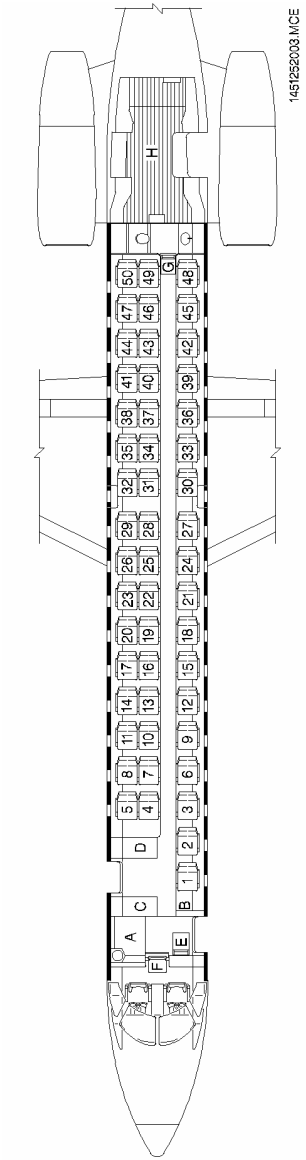
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION XZ



A: Outboard Galley

B: Stowage Compartment

C: Forward Galley

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

50 seats

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EMB-145 CONFIGURATION OPTION XZ

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1	6.324	248.98
2	2	7.111	279.96
3	3, 4, 5	7.899	310.98
4	6, 7, 8	8.686	341.97
5	9, 10, 11	9.474	372.99
6	12, 13, 14	10.261	403.98
7	15, 16, 17	11.048	434.96
8	18, 19, 20	11.836	465.98
9	21, 22, 23	12.623	496.97
10	24, 25, 26	13.411	527.99
11	27, 28, 29	14.198	558.98
12	30, 31, 32	15.163	596.97
13	33, 34, 35	15.951	627.99
14	36, 37, 38	16.738	658.98
15	39, 40, 41	17.525	689.96
16	42, 43, 44	18.313	720.98
17	45, 46, 47	19.100	751.97
18	48, 49, 50	19.888	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
LH STOWAGE COMPARTMENT	5.38 (211.81)	0.11 (3.9)	2.3 (5.1) **
OUTBOARD GALLEY	4.90 (192.91)	*	82 (181) **
FORWARD GALLEY	5.53 (217.72)	*	113 (249) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 2.42 m^3 (85.4 cu.ft)/6 half trolleys.

** Reference values. Check airplane placards for actual values.

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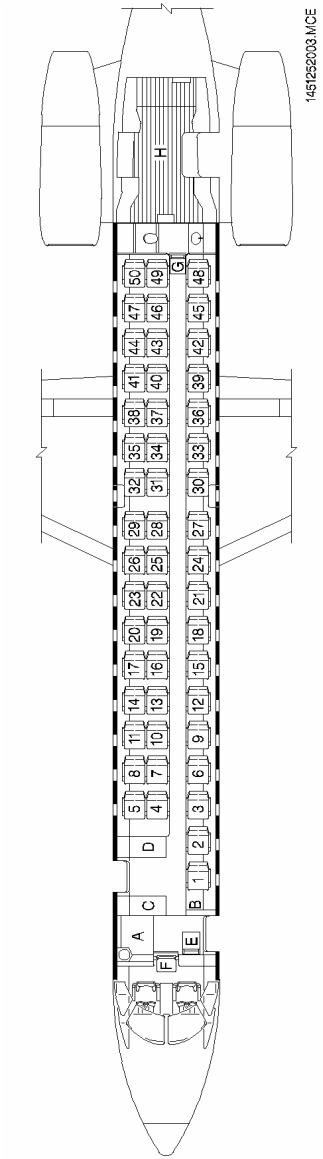
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION CZ



A: Outboard Galley

B: Stowage Compartment

C: Forward Galley

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

50 seats

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EMB-145 CONFIGURATION OPTION CZ

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	BALANCE ARM (in)
1	1	6.324	248.98
2	2	7.111	279.96
3	3, 4, 5	7.899	310.98
4	6, 7, 8	8.686	341.97
5	9, 10, 11	9.474	372.99
6	12, 13, 14	10.261	403.98
7	15, 16, 17	11.048	434.96
8	18, 19, 20	11.836	465.98
9	21, 22, 23	12.623	496.97
10	24, 25, 26	13.411	527.99
11	27, 28, 29	14.198	558.98
12	30, 31, 32	15.163	596.97
13	33, 34, 35	15.951	627.99
14	36, 37, 38	16.738	658.98
15	39, 40, 41	17.525	689.96
16	42, 43, 44	18.313	720.98
17	45, 46, 47	19.100	751.97
18	48, 49, 50	19.888	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
STOWAGE COMPARTMENT	5.38 (211.81)	0.11 (3.9)	2.3 (5.1) **
OUTBOARD GALLEY	4.90 (192.91)	*	82 (181) **
FORWARD GALLEY	5.53 (217.72)	*	113 (249) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 2.42 m^3 (85.4 cu.ft)/6 half trolleys.

** Reference values. Check airplane placards for actual values.

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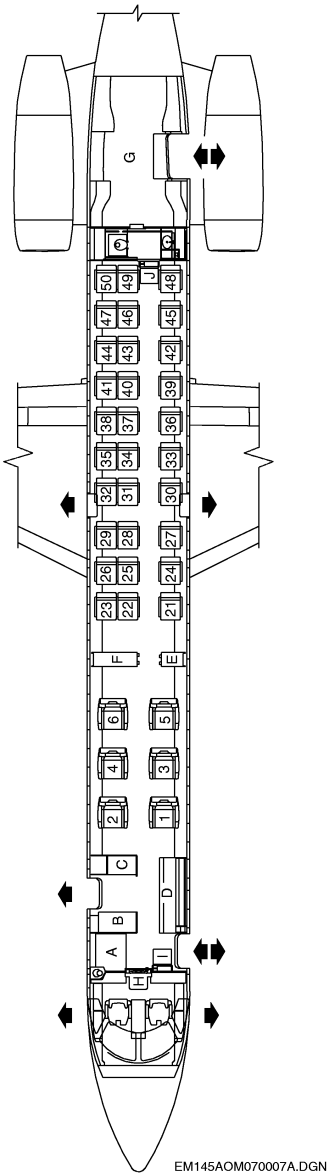
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION FAB VIP



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A: RH Wardrobe

B: Fwd Galley Catering

C: Aft Galley Catering

D: LH Double Wardrobe

E: LH Stowage

F: RH Stowage

G: Baggage Compartment

H: Cockpit Observer

I: First Flight Attendant

J: Second Flight Attendant

36 seats

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EMB-145 CONFIGURATION FAB VIP

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1, 2	7.998	314.88
2	3, 4	9.090	357.87
3	5, 6	10.182	400.87
4	7, 8, 9	12.623	496.97
5	10, 11, 12	13.411	527.99
6	13, 14, 15	14.198	558.98
7	16, 17, 18	15.163	596.97
8	19, 20, 21	15.951	627.99
9	22, 23, 24	16.738	658.98
10	25, 26, 27	17.525	689.96
11	28, 29, 30	18.313	720.98
12	31, 32, 33	19.100	751.97
13	34, 35, 36	19.888	782.99

PASSENGER AVERAGE CG: 15.030 m / 591.73 in.

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
RH WARDROBE	4.88 (192.09)	0.93 (32.8)	70 (154) **
FWD GALLEY CATERING	5.53 (217.83)	*	113 (249) **
AFT GALLEY CATERING	6.80 (267.56)	*	149 (328) **
LH DOUBLE WARDROBE	6.14 (241.77)	1.07 (37.6)	80 (176) **
LH STOWAGE	11.35 (446.81)	0.09 (3.3)	23 (50) **
RH STOWAGE	11.35 (446.81)	0.25 (8.8)	36 (80) **

* Total Galley Volume: 1.49 m^3 (52.7 cu.ft) / 4 half trolleys.
** Reference values. Check aircraft placards for actual values.

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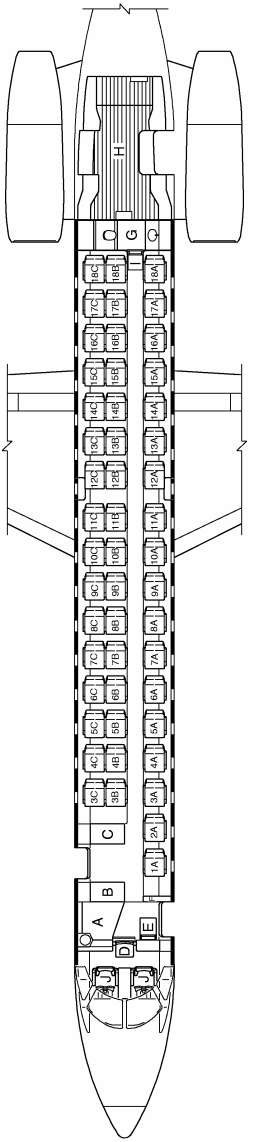
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 6A



A: RH Wardrobe

B: Forward Galley Catering

C: Aft Galley Catering

D: Observer Seat

E: 1st Attendant

F: Emergency Equipment Unit

G: Lavatory

H: Baggage Compartment

I: 2nd Attendant

J: Pilot Seats

50 seats

EM145AOM070026A.DGN

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EMB-145 CONFIGURATION OPTION 6A

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1A	6.324	248.98
2	2A	7.111	279.96
3	3A, 3B, 3C	7.899	310.98
4	4A, 4B, 4C	8.686	341.97
5	5A, 5B, 5C	9.474	372.99
6	6A, 6B, 6C	10.261	403.98
7	7A, 7B, 7C	11.048	434.96
8	8A, 8B, 8C	11.836	465.98
9	9A, 9B, 9C	12.623	496.97
10	10A, 10B, 10C	13.411	527.99
11	11A, 11B, 11C	14.198	558.98
12	12A, 12B, 12C	15.163	596.97
13	13A, 13B, 13C	15.951	627.99
14	14A, 14B, 14C	16.738	658.98
15	15A, 15B, 15C	17.525	689.96
16	16A, 16B, 16C	18.313	720.98
17	17A, 17B, 17C	19.100	751.97
18	18A, 18B, 18C	19.888	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
EMERGENCY EQUIPMENT UNIT	5.38 (211.81)	0.11 (3.9)	2.3 (5.1) **
RH WARDROBE	5.014 (197.40)	1.12 (39.6)	82 (181) **
FORWARD GALLEY	5.53 (217.72)	*	113 (249) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 3.26 m^3 (115.07 cu.ft)/2 half trolleys.

** Reference values. Check airplane placards for actual values.

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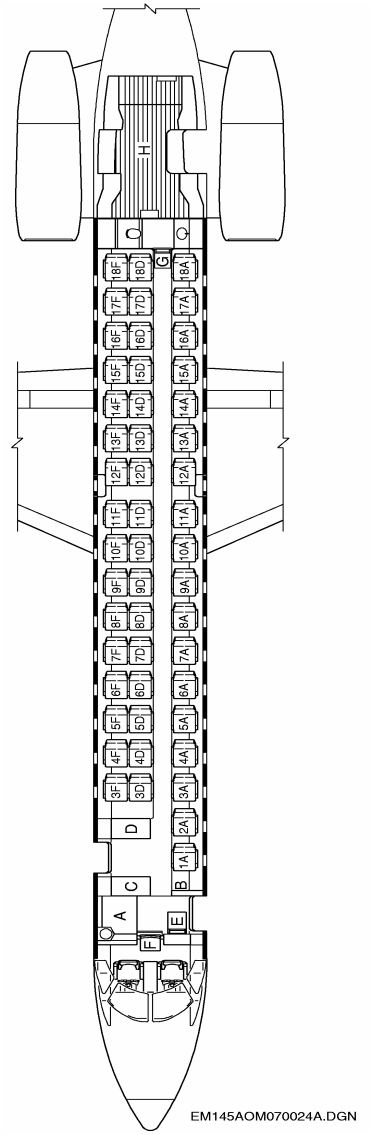
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 7



A: Wardrobe

B: Stowage Compartment

C: Forward Galley

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

50 seats

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EMB-145 CONFIGURATION OPTION 7

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	BALANCE ARM (in)
1	1A	6.324	248.98
2	2A	7.111	279.96
3	3A, 3D, 3F	7.899	310.98
4	4A, 4D, 4F	8.686	341.97
5	5A, 5D, 5F	9.474	372.99
6	6A, 6D, 6F	10.261	403.98
7	7A, 7D, 7F	11.048	434.96
8	8A, 8D, 8F	11.836	465.98
9	9A, 9D, 9F	12.623	496.97
10	10A, 10D, 10F	13.411	527.99
11	11A, 11D, 11F	14.198	558.98
12	12A, 12D, 12F	15.163	596.97
13	13A, 13D, 13F	15.951	627.99
14	14A, 14D, 14F	16.738	658.98
15	15A, 15D, 15F	17.525	689.96
16	16A, 16D, 16F	18.313	720.98
17	17A, 17D, 17F	19.100	751.97
18	18A, 18D, 18F	19.888	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
WARDROBE	4.90 (192.91)	0.93 (32.9)	70 (154) **
LH STOWAGE COMPARTMENT	5.38 (211.81)	0.11 (3.9)	10.2 (22.6) **
FWD GALLEY	5.53 (217.72)	*	83 (183) **
AFT GALLEY	6.79 (267.32)	*	89 (195.5) **

* Total Galley Volume: 1.49 m^3 (52.7 cu.ft)/4 half trolleys.

** Reference values. Check airplane placards for actual values.

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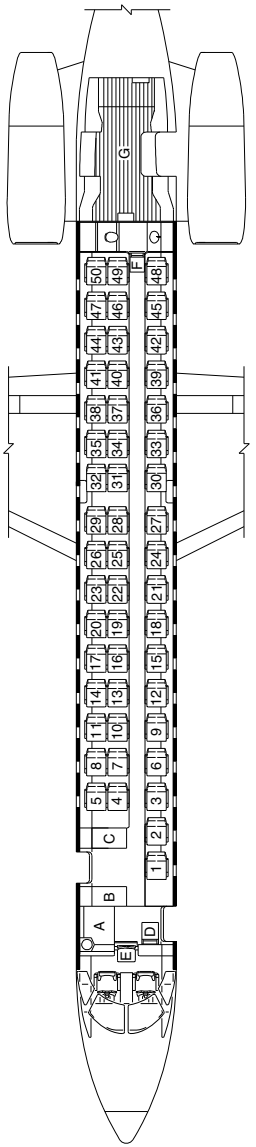
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 8



A: Outboard Galley

B: Forward Galley

C: Aft Galley

D: Forward Flight Attendant

E: Cockpit Observer

F: Aft Flight Attendant

G: Baggage Compartment

50 seats

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EMB-145 CONFIGURATION OPTION 8

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	1	6.193	243.82
2	2	6.980	274.80
3	3, 4, 5	7.768	305.83
4	6, 7, 8	8.555	336.81
5	9, 10, 11	9.343	367.83
6	12, 13, 14	10.130	398.82
7	15, 16, 17	10.917	429.80
8	18, 19, 20	11.705	460.83
9	21, 22, 23	12.492	491.81
10	24, 25, 26	13.280	522.83
11	27, 28, 29	14.067	553.82
12	30, 31, 32	15.134	593.82
13	33, 34, 35	15.895	624.80
14	36, 37, 38	16.658	655.83
15	39, 40, 41	17.445	686.81
16	42, 43, 44	18.223	717.84
17	45, 46, 47	19.020	748.82
18	48, 49, 50	19.807	779.80

PASSENGER AVERAGE CG: 13.490 m / 531.10 in.

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
FWD GALLEY	5.00 (196.85)	*	82 (181) **
MID GALLEY	5.55 (218.50)	*	113 (249) **
AFT GALLEY	6.8 (267.72)	*	149 (328) **

* Total Galley Volume: 2.42 m^3 (85.4 cu.ft) / 6 half trolleys.
** Reference values. Check aircraft placards for actual values.

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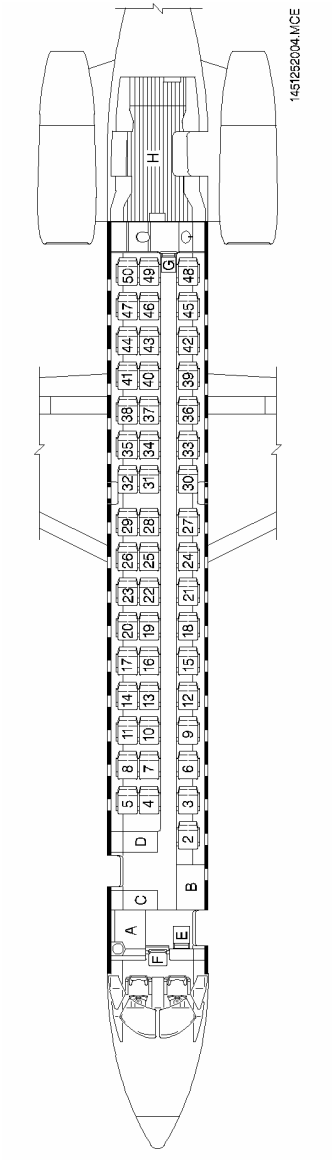
INTERIOR ARRANGEMENT

EMB-145 CONFIGURATION OPTION 4B



A: Wardrobe

B: Stowage Compartment

C: Forward Galley

D: Aft Galley

E: Forward Flight Attendant

F: Cockpit Observer

G: Aft Flight Attendant

H: Baggage Compartment

49 seats

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EMB-145 CONFIGURATION OPTION 4B

SEATS ROW	PASSENGER SEATS	BALANCE ARM (m)	(in)
1	-	-	-
2	2	7.111	279.96
3	3,4,5	7.898	310.98
4	6,7,8	8.686	341.97
5	9,10,11	9.473	372.99
6	12,13,14	10.261	403.98
7	15,16,17	11.048	434.96
8	18,19,20	11.835	465.98
9	21,22,23	12.623	496.97
10	24,25,26	13.410	527.99
11	27,28,29	14.198	558.98
12	30,31,32	15.163	596.97
13	33,34,35	15.950	627.99
14	36,37,38	16.738	658.98
15	39,40,41	17.525	689.96
16	42,43,44	18.312	720.98
17	45,46,47	19.100	751.97
18	48,49,50	19.887	782.99

	Balance Arm m (in)	Volume m^3 (cu.ft)	Capacity kg (lb)
WARDROBE	4.90 (192.91)	0.57 (20.2)	57 (126) **
FWD GALLEY	5.53 (217.72)	*	82 (181) **
AFT GALLEY	6.79 (267.32)	*	149 (328) **

* Total Galley Volume: 2.42 m^3 (85.4 cu.ft) / 6 half trolleys.
** Reference values. Check aircraft placards for actual values.

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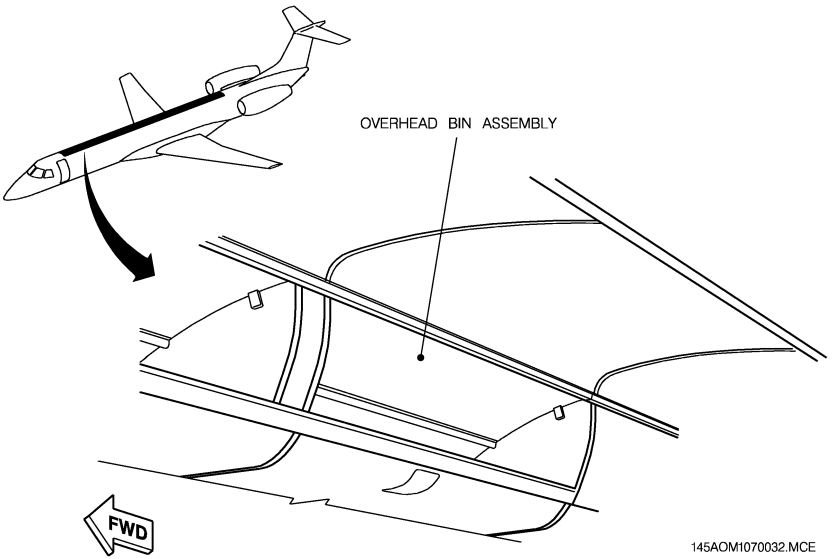
CARRY-ON BAGGAGE

Carry-on volumes may be stowed in the overhead bins and in the wardrobe.

There is no specific requirement for underseat carry-on volumes; however a maximum of 9.0 kg (20.0 lb) is allowable, provided the volume is properly restrained to avoid sliding.

OVERHEAD BINS

The overhead bins comprise 10 standard overhead bin assemblies and 1 short overhead bin assembly for EMB-145 models, 9 standard overhead assemblies and 1 short for ERJ-140 models and 8 standard overhead bin assemblies, 1 short overhead bin assembly and 1 very-short overhead bin assembly for EMB-135 models.
The bins present a total volume of 1.9 m^3 (67.1 cu.ft) on the EMB-145 models, 1.44 m^3 (49.3 cu.ft) on the ERJ-140 models and 1.2 m^3 (42.3 cu.ft) on the EMB-135 models.
The overhead bins are installed on the right side of the passenger cabin.



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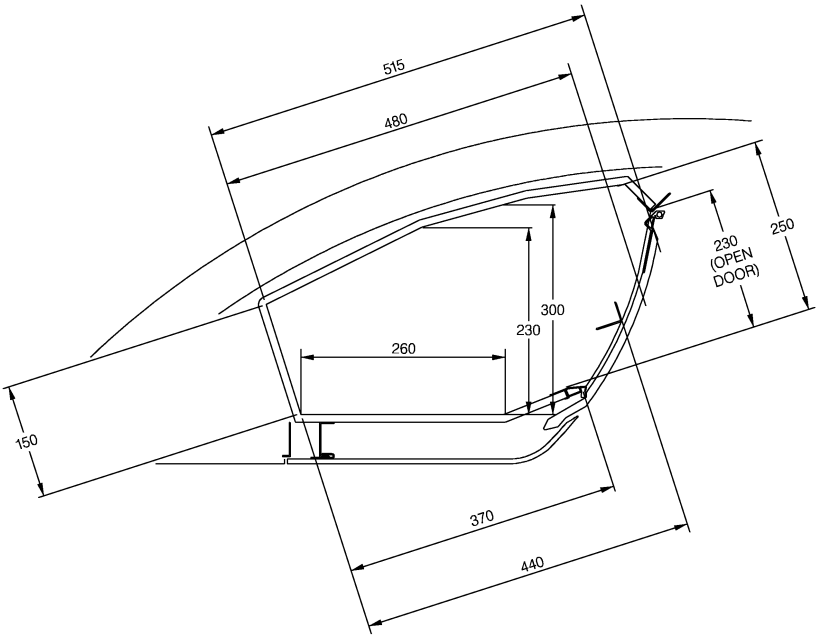
OVERHEAD BIN CAPACITY AND LENGTH

	Length m (in)	Capacity kg (lb)
Standard Assembly	1.16 (45.67)	27 (60)
Short Assembly	0.83 (32.68)	20 (45)
Very-Short Assembly	0.49 (19.29)	14 (31)

OVERHEAD BIN CROSS SECTION



- DIMENSIONS IN mm

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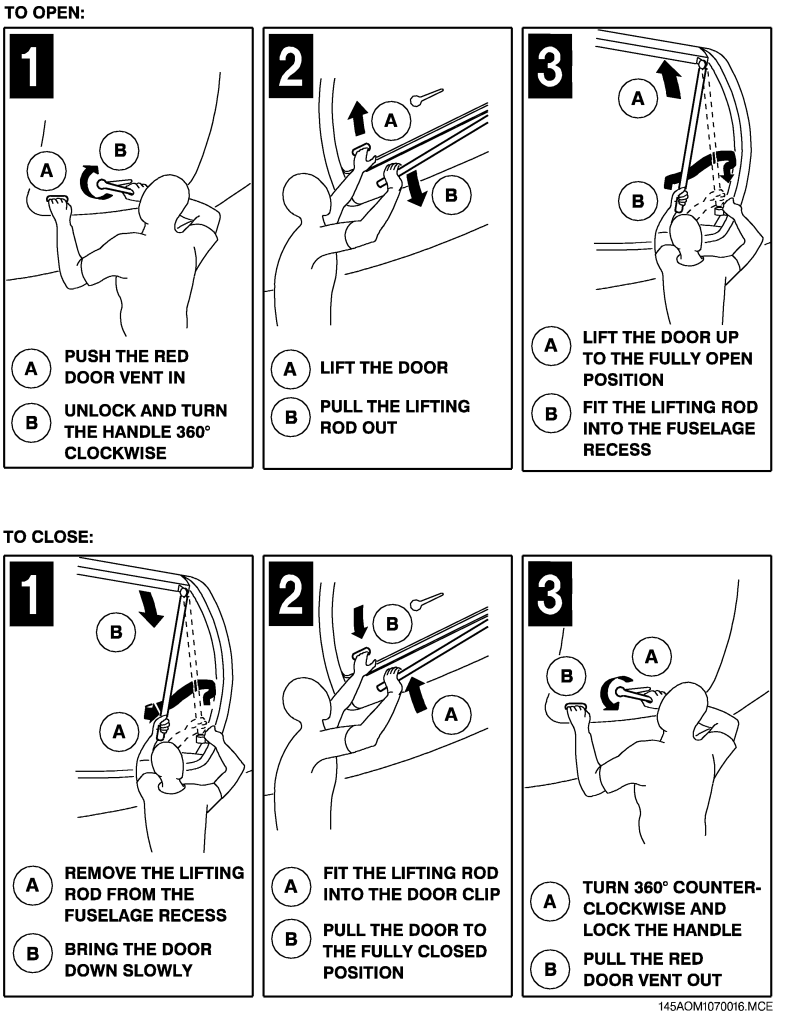
BAGGAGE DOOR

The baggage door, located on the rear left side of the fuselage, is 1.00 meter (39 in) wide and 1.11 meters (44 in) high.
The baggage door is manually operated from the outside. The initial opening movement (displacement of the door inward) and final closing and latching movement (displacement of the door outward) are achieved by means of a door locking mechanism controlled by an external handle which is stowed in the lower half of the door.



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BAGGAGE COMPARTMENT

DESCRIPTION

The baggage compartment is located in the rear part of the fuselage.

All EMB-135, ERJ-140 and some EMB-145 are fitted with a “class-C” baggage compartment. Airplanes with the “class-C” baggage compartment have the following systems installed:

- Baggage Compartment Smoke Detection System.
- Baggage Compartment Fire Extinguishing System.
- Baggage Compartment Ventilation System.

Although no dedicated temperature control is available (the “class-C” baggage compartment is heated by passenger cabin air flowing into it), the baggage ventilation system provides an adequate environment for carrying live animals in the compartment.

EMB-145 airplanes with a “class-D” baggage compartment (i.e., a fire occurring in it will be completely confined without endangering the safety of the airplane or the occupants) have the following systems installed:

- Baggage Compartment Smoke Detection System.

Since ventilation and temperature control are not available on “class-D” compartments, the transportation of live animals is not recommended.

Both “class-C” and “class-D” compartments are pressurized.

The following cargo nets may be installed in the baggage compartment:

- Cargo Restraint Nets (horizontal net).
- Baggage Compartment Door Safety Net.
- Cargo Barrier Net (vertical net).

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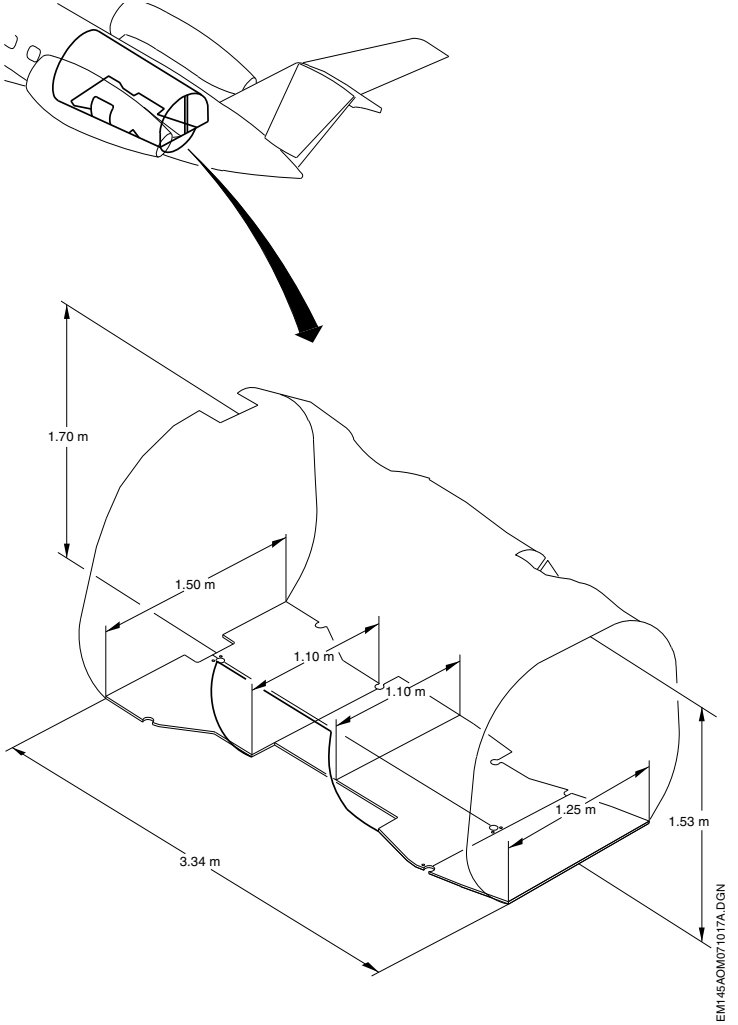
DIMENSIONS AND LIMITS



	Baggage Compartment Balance Arm m (in)
EMB-145	22.601 (889.80)
ERJ-140	21.186 (834.09)
EMB-135	19.061 (750.43)

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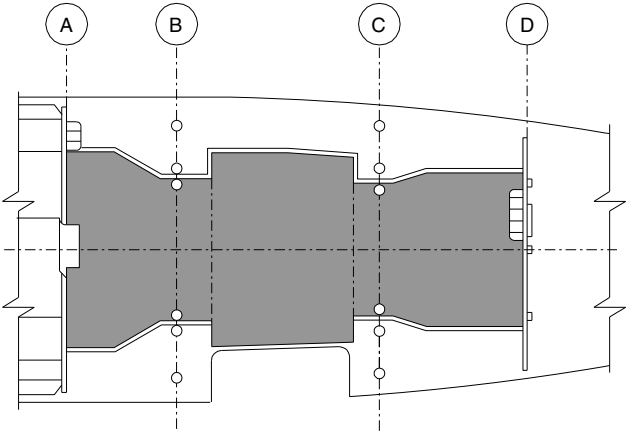

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Compartment and Vertical Net Position - m (in)

		EMB-145	ERJ-140	EMB-135
A	Forward Division Position	20.97 (825.59)	19.55 (769.88)	17.42 (685.83)
B	Forward Vertical Net (*)	21.78 (857.48)	20.36 (801.77)	18.23 (717.72)
C	Aft Vertical Net (*)	23.25 (915.35)	21.83 (859.64)	19.70 (775.59)
D	Aft Division Position	24.31 (957.09)	22.89 (901.38)	20.76 (817.32)

* - For airplanes with the optional Cargo Barrier Nets (vertical nets) installed.

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Balance Arm for each Section (*) - m (in)

	EMB-145	ERJ-140	EMB-135
Forward Section	21.38 (841.54)	19.96 (785.82)	17.82 (701.57)
Central Section	22.515 (886.42)	21.095 (830.51)	18.965 (746.65)
Aft Section	23.78 (936.22)	22.36 (880.31)	20.23 (796.46)

EMB-145 Compartment Limits:

Baggage Compartment Available Volume..... 9.2 m^3 (325 cu.ft)

Maximum Floor Distributed Load.....390 kg/m^2 (80 lb/ft^2)

Maximum Floor Concentrated Load (**) .....0.70 kg/m^2 (10 lb/in^2)

Total Maximum Capacity .....1200 kg (2646 lb)

Maximum Capacity per Section (*) .....400 kg (882 lb)

ERJ-140 Compartment Limits:

Baggage Compartment Available Volume..... 9.2 m^3 (325 cu.ft)

Maximum Floor Distributed Load.....390 kg/m^2 (80 lb/ft^2)

Total Maximum Capacity .....1200 kg (2646 lb)

Maximum Capacity per Section (*) .....400 kg (882 lb)

EMB-135 Compartment Limits:

Baggage Compartment Available Volume..... 9.2 m^3 (325 cu.ft)

Maximum Floor Distributed Load.....390 kg/m^2 (80 lb/ft^2)

Total Maximum Capacity .....1000 kg (2205 lb)

Maximum Capacity per Section (*) .....333 kg (735 lb)

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* - For airplanes with the optional Cargo Barrier Nets (vertical nets) installed.

** - Loading application in this condition is limited to an area not greater than 4.66 in^2 per panel

PACKAGE SIZE TABLE

The table below shows the approximate rectangular package maximum dimensions which will pass through the baggage door without interference with the baggage door, airplane fuselage or compartment interior.
Enter the table with the package width and height and read the maximum length of the package that can be stowed in the baggage compartment.

WIDTH – in cm							
5	10	15	20	25	30	35	40
12.7	25.4	38.1	50.8	63.5	76.2	88.9	101.6

Height in cm	MAXIMUM PACKAGE LENGTH – in cm							
5 12.7	104 264.16	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
8 20.32	104 264.16	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
10 25.4	104 264.16	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
13 33.02	104 264.16	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
16 40.64	104 264.16	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
19 48.26	100 254	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
22 55.88	100 254	97 246.38	95 241.3	90 228.6	80 203.2	70 177.8	60 152.4	45 114.3
25 63.5	100 254	97 246.38	95 241.3	90 228.6	80 203.2	70 177.8	60 152.4	45 114.3
28 71.12	100 254	97 246.38	95 241.3	90 228.6	80 203.2	70 177.8	60 152.4	45 114.3
31 78.74	100 254	97 246.38	95 241.3	90 228.6	80 203.2	70 177.8	60 152.4	45 114.3
34 86.36	100 254	97 246.38	95 241.3	90 228.6	80 203.2	70 177.8	60 152.4	45 114.3

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BAGGAGE AND CARGO LOADING

Baggage and cargo should be evenly distributed over the baggage compartment to avoid load concentration.

Cargo and baggage loading up to 990 kg (2182 lb) are not required to be tied down. If the baggage compartment is loaded with more than 990 kg (2182 lb), only the exceeding load must be tied down with the horizontal net.

For airplanes Post-Mod. SB 145-25-0261 (reinforced liners) or equipped with an equivalent modification factory incorporated, the use of the horizontal net is not required.

Cargo must not become a hazard to the airplane structure or systems as a result of shifting under operational loads. Sharp edges (like wooden or metal containers) or dense cargo (objects significantly more dense than typical passenger baggage) must be placed under the cargo restraint net to prevent shifting.

If the baggage compartment is to be loaded with higher values than those listed below, the following simultaneous conditions must be observed:

- Airplane shall be with a minimum required fuel of 907 kg (2000 lb).
- No more than one person can be at the airplane cone either inside the baggage compartment or inside the rear electronic compartment.

  EMB-145 models without Thrust Reverser: 1000 kg (2205 lb).

  EMB-145 models with Thrust Reverser: 800 kg (1764 lb).

  ERJ-140 models with Thrust Reverser: 1000 kg (2205 lb)

  EMB-135 models: 800 kg (1764 lb).

CAUTION: IF THE CONDITIONS ABOVE ARE NOT OBSERVED, AIRPLANE TILTING (TAIL DOWN) MAY OCCUR.

Before loading or unloading the baggage compartment, the Cargo Loading/Unloading Ramp (also known as Door Jamb Barrier) must be lowered in order to protect the baggage door latching mechanism.

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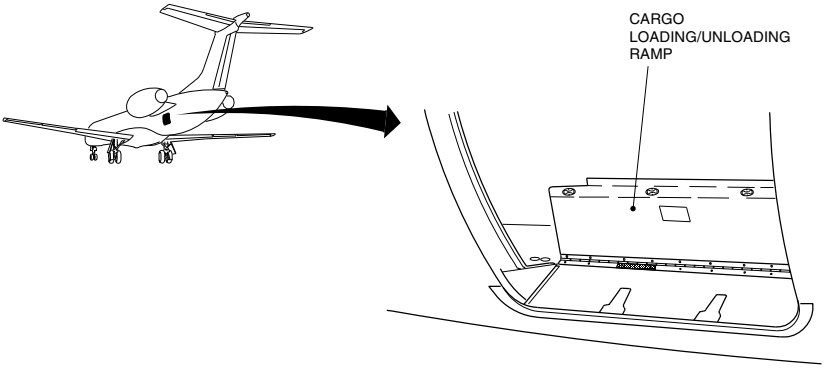

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BAGGAGE COMPARTMENT

DESCRIPTION

The baggage compartment is located in the rear part of the fuselage.

The EMB-145 is fitted with a “class-C” baggage compartment. Airplanes with the “class-C” baggage compartment have the following systems installed:

- Baggage Compartment Smoke Detection System.
- Baggage Compartment Fire Extinguishing System.
- Baggage Compartment Ventilation System.

Although no dedicated temperature control is available (the “class-C” baggage compartment is heated by passenger cabin air flowing into it), the baggage ventilation system provides an adequate environment for carrying live animals in the compartment. The “class-C” compartment is pressurized.

The following cargo nets are installed in the baggage compartment:

- Baggage Compartment Door Safety Net.
- Cargo Arresting Net (horizontal net).

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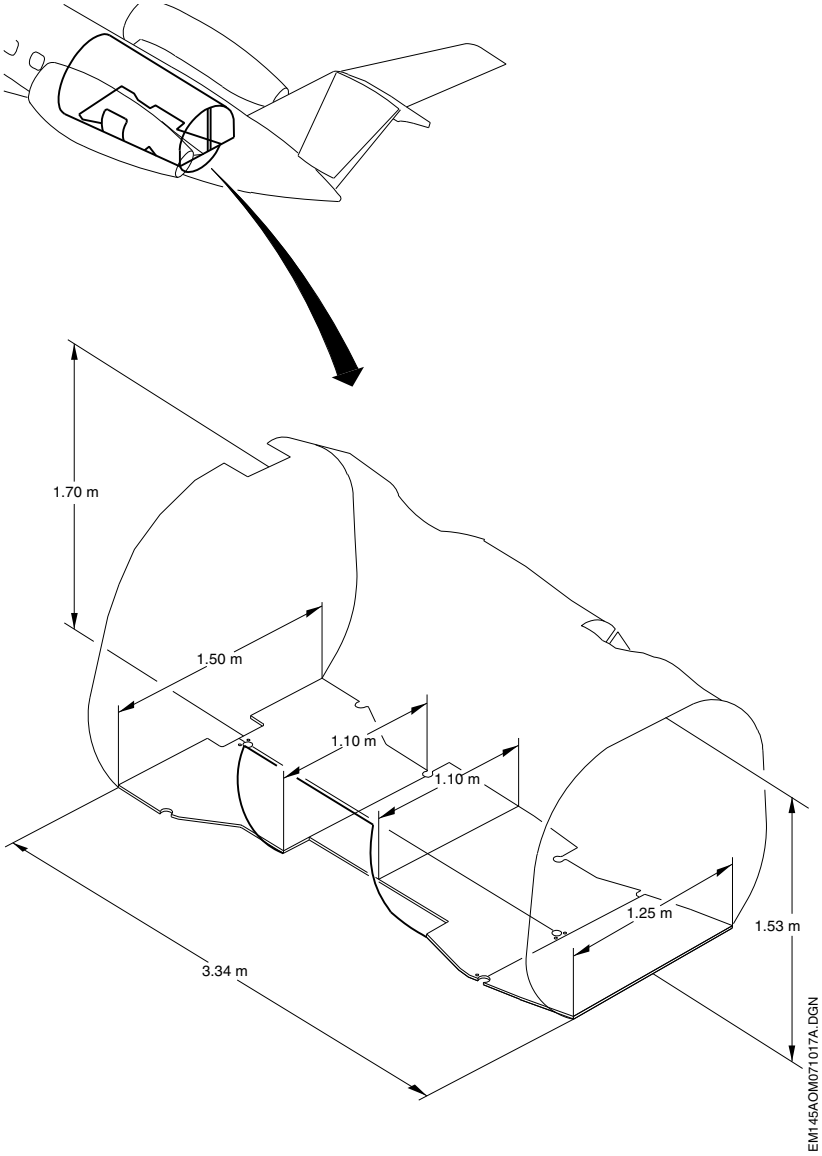
DIMENSIONS AND LIMITS



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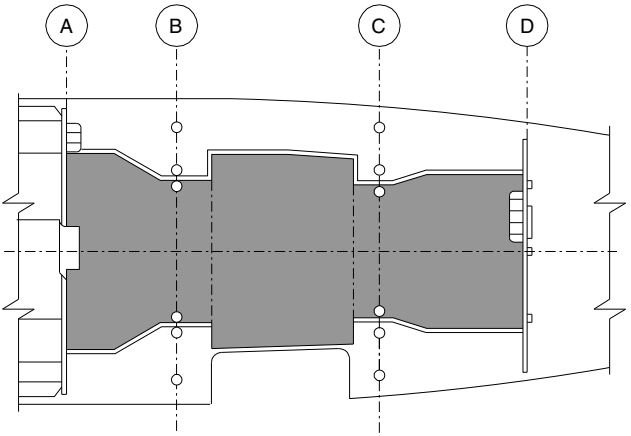

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Forward and Aft Division Position – m (in)

A	Forward Division Position	20.97 (825.59)
B	Aft Division Position	24.31 (957.09)

Compartment Limits for airplanes equipped with Cart Stowage Unit:

Baggage Compartment Available Volume ..... 8.6 m^3 (304 cu.ft)

Maximum Floor Distributed Load..... 390 kg/m^2 (80 lb/ft^2)

Maximum Floor Concentrated Load (*) ..... 0.70 kg/m^2 (10 lb/in^2)

Baggage Compartment Capacity ..... 1000 kg (2205 lb)

Baggage Compartment Balance Arm..... 22.85 m (900 in)

Cart Stowage Unit Capacity ..... 120 kg (265 lb)

Cart Stowage Unit Balance Arm..... 21.40 m (843 in)

Maximum Load on the Top of Cart Stowage Unit ..... 14 kg (30 lb)

* - Loading application in this condition is limited to an area not greater than 4.66 in^2 per panel.

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CAUTION:

- THE CART STOWAGE UNIT MUST BE LOADED WHEN OPERATING THE AIRPLANE WITH BAGGAGE OR CARGO ON THE BAGGAGE COMPARTMENT.
- BAGGAGE COMPARTMENT PARTITION DOOR MUST BE CLOSED FOR FLIGHT. ANY DAMAGE TO THE DOOR OR DOOR FRAME SHALL BE COMMUNICATED TO THE FLIGHT CREW BEFORE DISPATCH.

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PACKAGE SIZE TABLE

The table below shows the approximate rectangular package maximum dimensions which will pass through the baggage door without interference with the baggage door, airplane fuselage or compartment interior.

Enter the table with the package width and height and read the maximum length of the package that can be stowed in the baggage compartment.

NOTE: This table was calculated not considering the cart stowage unit on the baggage compartment.

WIDTH – in cm							
5	10	15	20	25	30	35	40
12.7	25.4	38.1	50.8	63.5	76.2	88.9	101.6

Height in cm	MAXIMUM PACKAGE LENGTH – in cm							
5 12.7	104 264.16	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
8 20.32	104 264.16	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
10 25.4	104 264.16	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
13 33.02	104 264.16	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
16 40.64	104 264.16	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
19 48.26	100 254	97 246.38	95 241.3	90 228.6	85 215.9	75 190.5	60 152.4	45 114.3
22 55.88	100 254	97 246.38	95 241.3	90 228.6	80 203.2	70 177.8	60 152.4	45 114.3
25 63.5	100 254	97 246.38	95 241.3	90 228.6	80 203.2	70 177.8	60 152.4	45 114.3
28 71.12	100 254	97 246.38	95 241.3	90 228.6	80 203.2	70 177.8	60 152.4	45 114.3
31 78.74	100 254	97 246.38	95 241.3	90 228.6	80 203.2	70 177.8	60 152.4	45 114.3
34 86.36	100 254	97 246.38	95 241.3	90 228.6	80 203.2	70 177.8	60 152.4	45 114.3

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BAGGAGE AND CARGO LOADING

Baggage and cargo should be evenly distributed over the baggage compartment to avoid load concentration.

Cargo and baggage loading up to 990 kg (2182 lb) are not required to be tied down. If the baggage compartment is loaded with more than 990 kg (2182 lb), only the exceeding load must be tied down with the horizontal net.

For airplanes Post-Mod. SB 145-25-0261 (reinforced liners) or equipped with an equivalent modification factory incorporated, the use of the horizontal net is not required.

Cargo must not become a hazard to the airplane structure or systems as a result of shifting under operational loads. Sharp edges (like wooden or metal containers) or dense cargo (objects significantly more dense than typical passenger baggage) must be placed under the cargo restraint net to prevent shifting.

If the baggage compartment is to be loaded with higher values than those listed in the table 1 below, the following simultaneous conditions must be observed:

- Airplane shall be with a minimum required fuel of 907 kg (2000 lb).
- No more than one person can be at the airplane cone either inside the baggage compartment or inside the rear electronic compartment.

CAUTION: IF THE CONDITIONS ABOVE ARE NOT OBSERVED, AIRPLANE TILTING (TAIL DOWN) MAY OCCUR.

Table 1	
Without Thrust Reverser	1000 kg (2205 lb)
With Thrust Reverser	800 kg (1764 lb)

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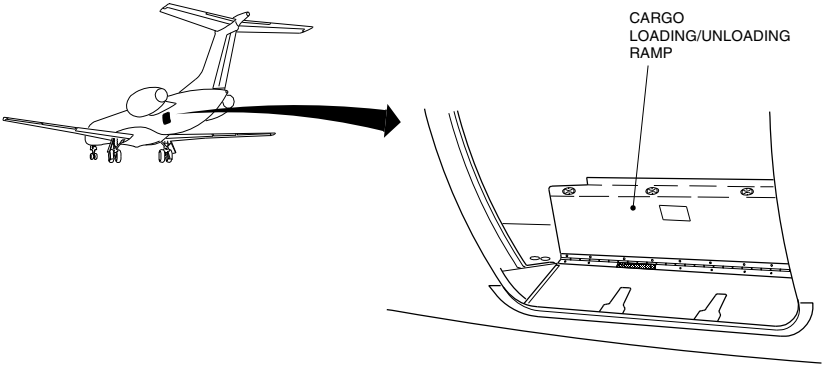
Before loading or unloading the baggage compartment, the Cargo Loading/Unloading Ramp (also known as Door Jamb Barrier) must be lowered in order to protect the baggage door latching mechanism.



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CARGO NETS

BAGGAGE COMPARTMENT DOOR SAFETY NET

The safety barrier net secures the baggage and prevents the cargo door from jamming (the door slides inboard before opening upward).
The net attaches to two pulley assemblies which attach to the net beam assembly. The net beam assembly is attached to an upper attach bracket. A cargo net adapter attaches the cargo door safety net to the upper attach bracket. Decals on the net assembly indicate orientation (FWD, AFT, UPSIDE, or R/L). Straps on the net attach to anchor plates on the cargo loading/unloading ramp (door jamb barrier). The cargo door safety net is held to the cargo compartment floor by six anchor plates. Two shock lanyard assemblies extend the door jamb barrier assembly when the baggage door is opened.

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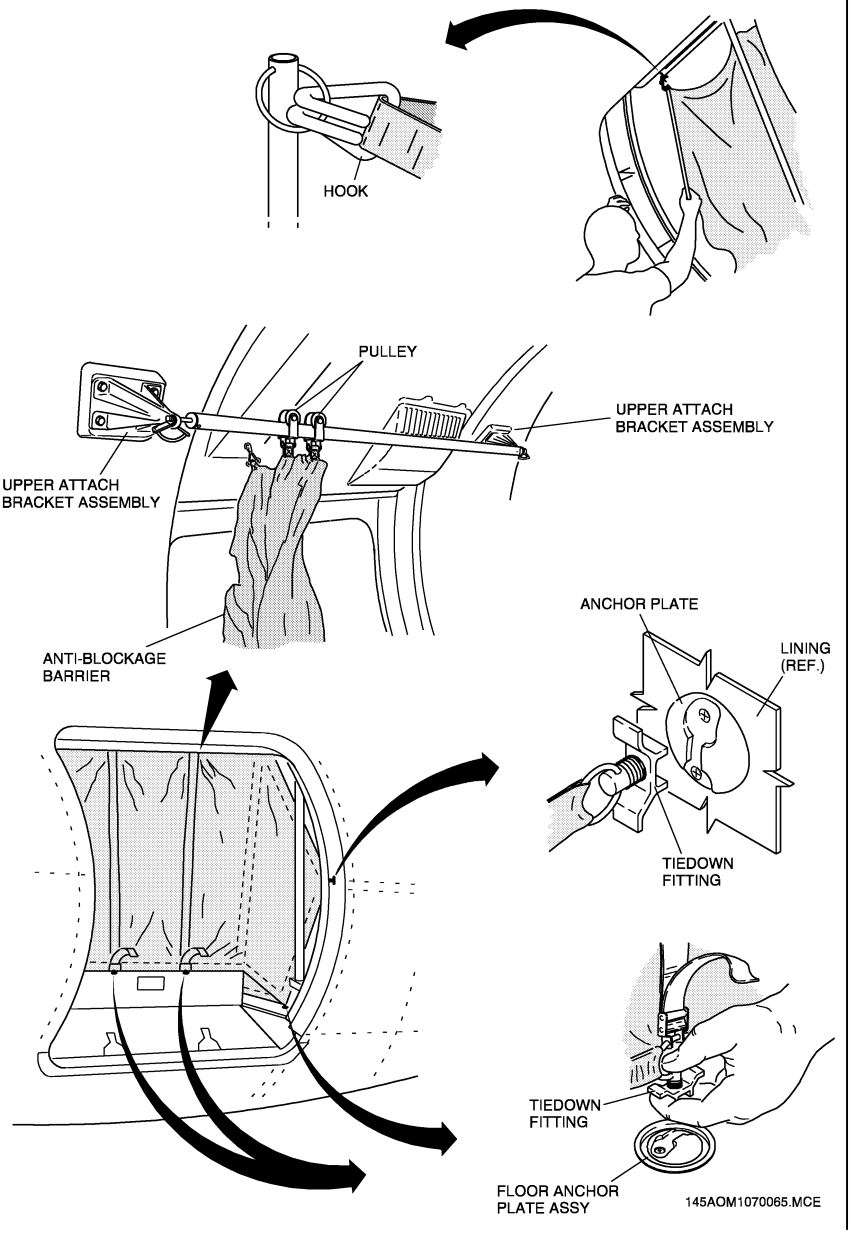

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CARGO RESTRAINT NET (HORIZONTAL NET)

The cargo restraint net (tie-down) provides vertical restraint for the baggage and cargo. It is attached to the cargo compartment floor with anchor plates. Adjustable straps allow the arresting net to extend and retract. Some airplanes are equipped with retaining strips located at the upside of the baggage compartment which are used to hold the net while the baggage is placed under it. Decals on the cargo net assembly indicate orientation (FWD, AFT, UPSIDE, or R/L) of the net in the cargo compartment. The net may be a two-piece assembly.

For the cargo restraint net P/Ns 7162041-501 or -503 the maximum load that can be placed under it is 450 kg (992 lb) and, for the cargo restraint net P/N 7162041-505, it is limited to the maximum capacity of the baggage compartment.

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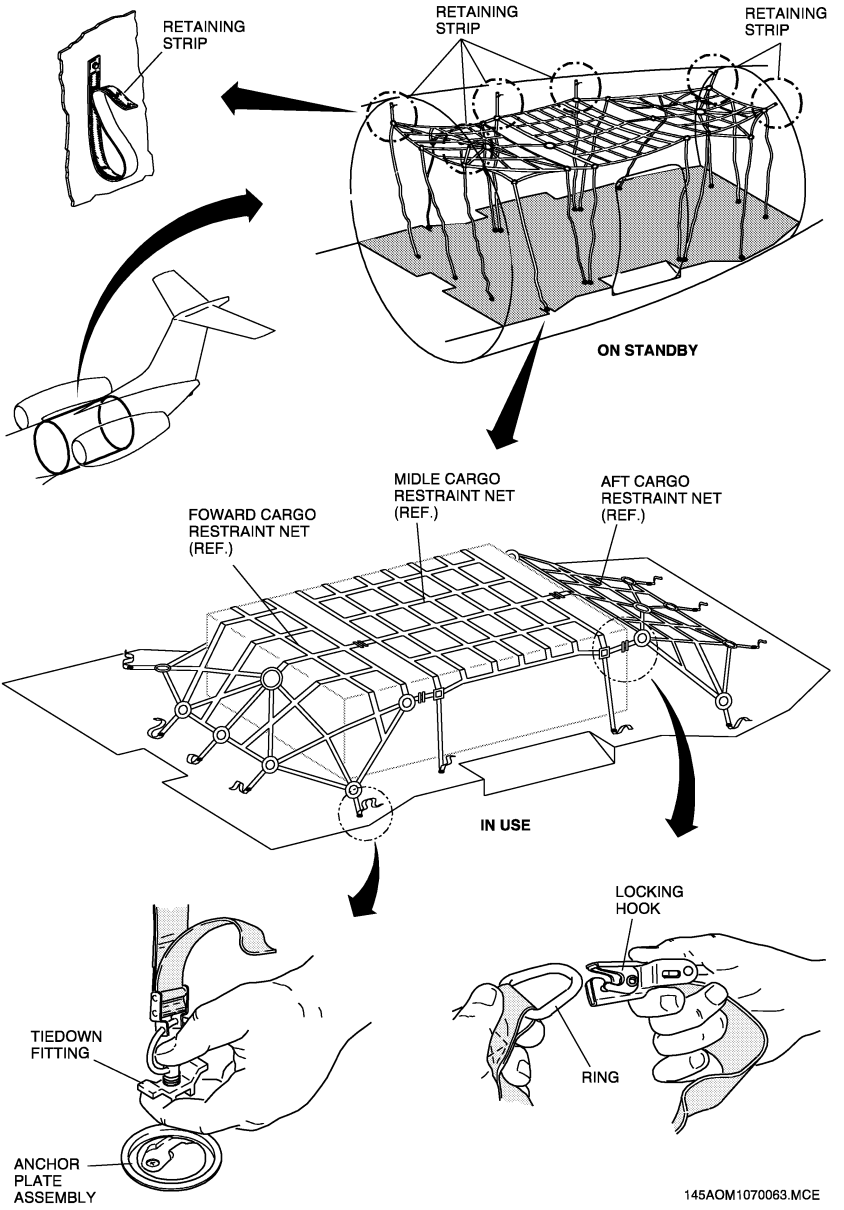

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CARGO BARRIER NET (VERTICAL NET)

The optional cargo barrier net is a two-piece assembly that divides the cargo compartment into three areas and provides horizontal restraint. The vertical net is solely intended to optimize the cargo compartment loading. The cargo barrier net attaches to the cargo compartment floor with six anchor plates each. Adjustable straps and pigtails allow the restraint net to extend and retract. Decals on the cargo net assembly indicate orientation (FWD, AFT, UPSIDE, or R/L) of the net in the cargo compartment.

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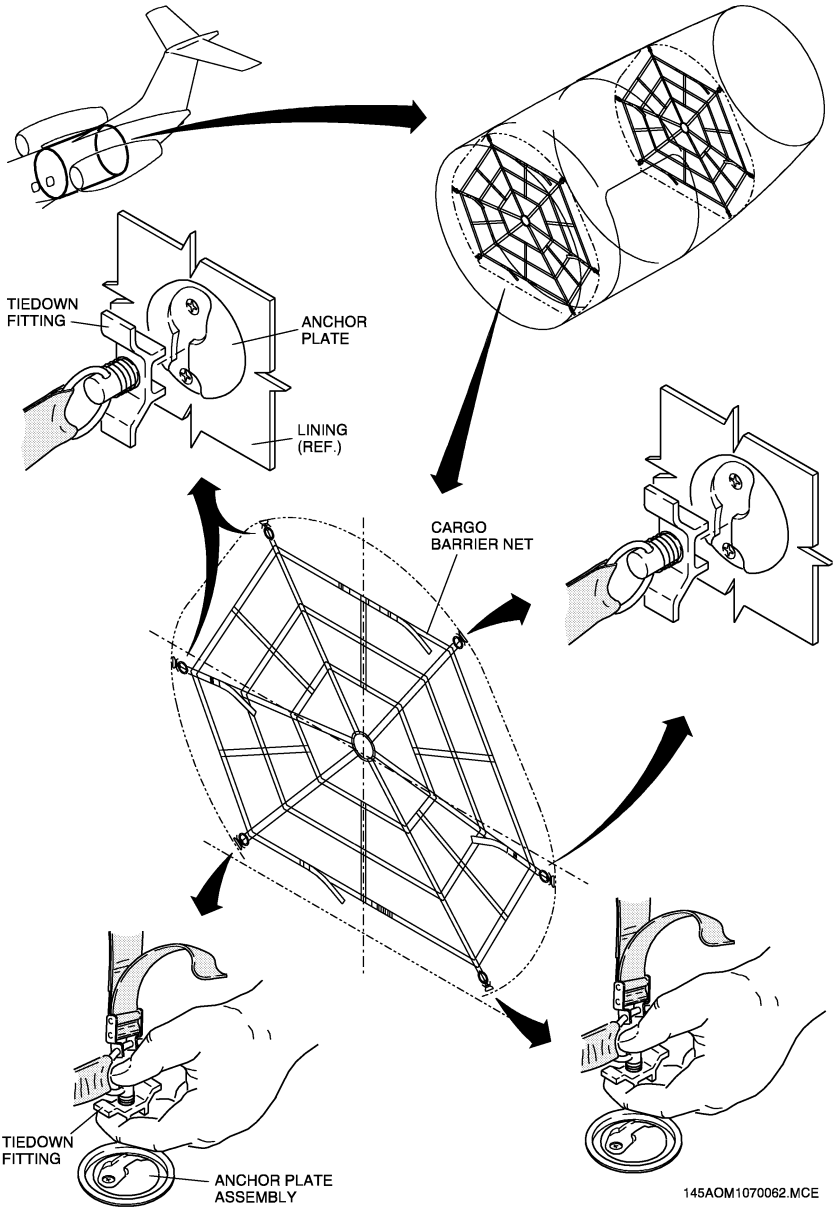

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LIVE ANIMALS TRANSPORTATION

This section presents the general conditions for live animal transportation in the EMB-145 and EMB-135 Class C Baggage Compartment. Live animals transportation on aircraft equipped with Class D Baggage Compartments is not recommended.

The main references that regulate and state methods and procedures to handling, appropriate packaging, legal aspects for animal transportation, etc. are the IATA Live Animal Regulations and SAE AIR1600.

GENERAL RECOMMENDATIONS

Generically, animals should be protected from stressing situations, like excessive noise, solar radiation, draft, high or low temperatures.

The containers should be appropriate for the type of animal to be transported, as recommended by IATA Live Animal Regulations.

Animals shall be handled with great care, to minimize the stress associated to handling. While waiting for the shipment, animals should be maintained in a waiting room with temperature control and protected from noise and draught. The adverse climatic conditions could cause additional stress to the animals. The ambient should be dark to make the animals more calm and comfortable while waiting for shipment. Animals of different species, specially which are natural enemies, such as cats and dogs, must be kept apart one from another. On the other hand, animals of the same species would be more calm if kept together.

Animals shall be loaded just before departure and unloaded just after arrival, in order to minimize the exposition to high or low temperatures on ground, where the baggage compartment ventilation is not completely effective. Specially in the hot season, it should be preferable to schedule the animal shipment for the night period, when the temperatures are lower than during the day. For the more sensitive animals, such as little birds, that would not resist to high temperatures, this is an important requirement. In addition, these animals would be too susceptible to low temperatures achieved during long cruise flights, so it could be necessary to limit the flight cruise altitude to reduce the temperature drop in the baggage compartment and protect them.

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The containers should not be placed near the compartment floor, in order to isolate the animals from low temperatures in that region. The recommendations for animal load limitations should be observed, in order to prevent animals being exposed to adverse environmental conditions.

LOAD LIMITATIONS

The limitations for the load in the compartment are defined mainly by Temperature, Carbon Dioxide concentration and Humidity, that are a result of animal metabolism. These items have to be compensated with the baggage compartment ventilation system, that draws air from passenger cabin to the cargo compartment, as air exchange reduces CO_2 concentration and humidity and controls the compartment temperature.

The calculations to determine the maximum animal load for EMB-145/135 Class C Baggage Compartment were developed using the methodology stated in the reference SAE AIR1600. The estimate was developed for the animals that are most likely to be transported, and taking the baggage compartment characteristics into consideration.

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1 - DOGS AND CATS

The temperature limits for these animals are within 10°C to 30°C range. Considering this and the humidity and CO2 generation by animals metabolism, the number of animals as function of animal mass are stated in the table 1, as follows.

Table 1: Dog and Cat Load	
Dog/Cat mass(kg)	Load Limitation
1.0	50
5.0	24
10.0	12
25.0	8
50.0	4

2 - SMALL BIRDS

These are very sensitive animals. This kind of animal is very susceptible to high and low temperatures. It may be necessary to avoid flights at high temperatures during the day and schedule the shipment to night flights. In case of low temperatures during cruise flight, depending on the flight extension, it might be necessary to limit the maximum flight altitude in order to reduce the temperature drop in the baggage compartment. The containers should be placed at some distance from the compartment floor, avoiding the contact with low temperatures coming from the area below the floor.

The limitations for the maximum load of these animals are stated in the table 2, as follows.

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Table 2: Small Birds Load	
Mass (kg)	Load
0.03	3000
0.10	1000
0.25	400
0.50	200
1.00	100
2.50	80

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3 - OTHERS

For the other animals not mentioned in this section, estimations could be developed considering the data presented here. In case of special animal shipment, Embraer Customer Support may be consulted.

DRY ICE TRANSPORTATION

This section presents the general conditions for dry ice (carbon solid dioxide) transportation in the EMB-145, ERJ-140 and EMB-135 cargo compartment.

The main reference that regulates and state methods and procedures to handling, appropriate packaging, legal aspects for dry ice transportation, etc. is the IATA Dangerous Goods Regulations.

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GENERAL RECOMMENDATIONS

It is not recommended to transport dry ice in the cabin and in the galleys. If small quantities are present in the galley, it is required to compute this dry ice mass in the calculation of the total dry ice.

Prior to enter into the cargo compartment in which a large amount of dry ice has been loaded, ensure that adequate ventilation is provided checking that the cargo ventilation system is running properly. If this condition is not met, avoid storing dry ice on airplanes for extended periods of time.

Similar precautions must be followed when entering any area, adjacent to a cargo compartment, loaded with dry ice. If adequate ventilation is not provided, it is recommended to wear oxygen mask and portable oxygen cylinder inside these areas. In addition, animals should not be transported on a cargo compartment loaded with dry ice.

Both air conditioning packs (or equivalent ground cart ventilation) shall be operating while persons are on board of an airplane transporting dry ice.

In case of failure of the cargo ventilation system during flight, the CO_2 sublimated in the cargo compartment may spread in the airplane, but the fresh air flow that comes from the packs dilutes the CO_2 concentration below 0.5% CO_2 in volume. The airplane can continue the flight normally, but after landing it is required to follow special procedures to ventilate the place in which CO_2 buildup is suspected.

Notify the flight crew whenever the amount of dry ice stowed in the cargo compartment exceeds 440 lb (200 kg), as recommended by the IATA Dangerous Goods Regulations.

In case of suspect of CO_2 leakage from cargo compartment, the crew may start Emergency Procedures. If large quantities of dry ice appear in the cabin, it is recommended to start an emergency descent to FL 100 to allow activate the emergency ram air ventilation. It is also necessary to alert personnel for symptoms of excessive CO_2 gas concentrations when around dry ice.

LOAD LIMITATIONS

Significant concentration of gaseous CO_2 by sublimation of dry ice in airplanes may affect the breathing of passengers and crew. For this reason, it is necessary to establish dry ice carriage limits. The table below provides the maximum load for dry ice transportation in EMB-145, ERJ-140 and EMB-135 cargo compartment.

Dry Ice Load Limitation		
EMB-135	322.50 kg	711.00 lb
ERJ-140	322.50 kg	711.00 lb
EMB-145	347.00 kg	765.00 lb

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SECTION 1-08

CONFIGURATION DEVIATION LIST

TABLE OF CONTENTS

Page Block

Introduction 1-08-00
ATA Chapter 06 Dimensions and Areas 1-08-06
ATA Chapter 23 Communications 1-08-23
ATA Chapter 28 Fuel 1-08-28
ATA Chapter 32 Landing Gear 1-08-32
ATA Chapter 33 Lights 1-08-33
ATA Chapter 49 Auxiliary Power Unit 1-08-49
ATA Chapter 52 Doors 1-08-52
ATA Chapter 54 Nacelle/Pylons 1-08-54
ATA Chapter 55 Stabilizers 1-08-55
ATA Chapter 57 Wings 1-08-57
ATA Chapter 78 Engine Exhaust 1-08-78

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INTRODUCTION

This Configuration Deviation List contains additional certificate limitations for operation of all models of the EMB-145 airplanes without certain secondary airframe and engine parts as listed herein. When the airplane is operated using the CDL, it must be operated in accordance with the limitations specified in the AFM, as amended in the CDL. All the items which are related to the airworthiness of the airplane and not included on the list are automatically required.

The associated limitations must be listed on a placard affixed in the cockpit in clear view of the pilots and other appropriate crewmember(s). The pilot in command should be notified of each operation with a missing part(s) by listing the missing part(s) in the flight or dispatch release. The operator should list in the airplane logbook an appropriate notation covering the missing part(s) on each flight.

If an additional part is lost, the airplane may not depart the airport at which it landed following this event, until it complies with the limitation of the CDL. This, of course, does not preclude the issuance of a ferry permit to allow the airplane to be flown to a point where the necessary repairs or replacement can be made.

No more than one part for any one system may be missing, unless specific combinations of parts are included in the CDL. Unless otherwise specified, parts from different systems may be missing. The performance penalties are cumulative, unless specifically designated penalties are indicated for the combination of missing parts.

No more than three parts that have each been determined to cause negligible performance degradation may be missing for takeoff without applying a performance penalty. When more than three of such parts are missing, a performance penalty of 45 kilograms (100 pounds) must be applied for takeoff, en route, and landing for each missing part.

No more than ten parts that have each been determined to cause no performance penalty may be missing.

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Takeoff performance penalties should be applied to the takeoff weights that are limited by performance considerations (i.e., takeoff field length, first, second, or final segment climb, or takeoff flight path).

If the performance-limited takeoff weight is greater than the maximum certified takeoff weight, the takeoff performance penalties should be applied to the maximum certified takeoff weight to ensure compliance with the noise requirements.

Landing performance penalties should be applied to the landing weights that are limited by performance considerations (i.e., landing field length, landing climb, or approach climb). If the performance-limited landing weight is greater than the maximum certified landing weight, the landing performance penalties should be applied to the maximum certified landing weight to ensure compliance with the noise requirements.

En route performance penalties apply only to operations that are limited by the one-engine inoperative en route climb performance.

If the CDL item refers to a MMEL item, the MMEL repair interval must be applied.

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COMPONENT LOCATION

The numbering and designation of systems in this section are based on ATA Spec. 100. The parts within each system are identified by their functional description and, when necessary, by door or panel identification, followed by the appropriate figure.

The access doors and panels in a zone are identified by an alphanumeric system which has three digits. They identify the zone where the access door or panel is located, followed by a two-letter or three-letter suffix.

- The first digit indicates a major zone of the airplane, which gives the necessary reference for the identification of the service areas or components:

MAJOR ZONE	AREA
100	Lower fuselage (below the floor line)
200	Upper fuselage (above the floor line)
300	Tail cone and empennage group
400	Powerplant and nacelles
500	Left half-wing
600	Right half-wing
700	Landing gear wheel well doors
800	Doors (main, service, cargo, emergency)

- The following two digits indicates sub-zones. For example: 111 - Radome; 510 - Wing Leading Edge.
- The first letter identifies a sequence which starts with the letter A.
- The second letter shows the location of each access door or panel in relation to the aircraft as follows:

  B: Bottom
  L: Left
  T: Top
  R: Right

- Each panel gets a fastener identification code, boxed, which identifies the type and quantity of the fasteners for each panel.
  L: Latch
  S: Screw
  C: Camloc

For further details on this system, please see Airplane Maintenance Manual, Chapter 6, for the part identification.

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ATA CHAPTER 06 DIMENSIONS AND AREAS

System & Sequence Number	1. ITEM	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
6 DIMENSIONS AND AREAS				
41-1	Exterior Main Door Control Panel Access Door (123AL - Figure 1)	1	0	May be missing with no penalty.
41-2	External Power Connection Access Door (113EL - Figure 1)	1	0	May be missing with no penalty.
41-3	Ground Air Conditioning Connection Access Door (191AR - Figures 3, 5)	1	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.
41-4	Air Conditioning Heat Exchanger Grills (191ML - Figures 2, 4) (191NR - Figures 3, 5)	2	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.
41-5	Pack Valve/Wing Anti-ice Valve Access Door (191KL - Figure 2) (191LR - Figure 3)	2	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.
41-6	Bleed Flexible Joint Access Door (195AL/CL - Figure 2) (194AR/CR - Figure 3)	4	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.

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System & Sequence Number ITEM (1.)	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
6 DIMENSIONS AND AREAS			
41-7 Red Beacon Fairing (192EL - Figure 2)	1	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.
41-8 Hydraulic Servicing Access Door (193DL/EL/FL - Figure 2) (193GR/HR/JR - Figure 3)	6	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower
41-9 Fuel Tank Drain Valve Access Door (192CL - Figure 2, 4) (192DR - Figure 3, 5)	2	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.
41-10 Fuel Wing Stub Drain Valve Access Door (192HL - Figure 4) (192JR - Figure 5) (EMB-145 LR and XR)	2	1	One may be missing with no penalty.
41-11 Drip Stick Door (192FL - Figure 4) (192GR - Figure 5) (EMB-145 LR and XR)	2	1	One may be missing with no penalty.
41-12 Pneumatic Duct Joints Access Panel (193SL/XL - Figure 4) (193YR/TR - Figure 5)	4	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.
41-13 Hydraulic System Service Access Door (193WL - Figure 4) (193ZR - Figure 5)	2	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.

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System & Sequence Number	1. ITEM	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
6 DIMENSIONS AND AREAS				
41-14	Hydraulic Oil Level Sight Glass Access Door (193UL - Figure 4) (193VR - Figure 5)	2	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.
41-15	Pneumatic Duct Junction Access Panel (198DL - Figure 4) (198ER - Figure 5)	2	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.
42-1	Pressure Fueling Panel Access Door (191BR - Figures 3, 5)	1	0	May be missing provided: a) Door microswitch is locked actuated (simulating door closed); b) Refueling, defueling and power switches are verified in the CLOSED/NORMAL position (Refer to RAMP Manual 52-78-01-DP); c) Refueling cap is locked and latched; and d) Maximum airspeed is limited to 250 KIAS/ 0.65 M, whichever is lower.
42-2	Potable Water Service Door (193MR - Figure 3)	1	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.
42-3	Potable Water Service Access Panel (198BR - Figure 5)	1	0	May be missing provided maximum airspeed is limited to 250 KIAS/0.65 M, whichever is lower.
42-4	Waste Service Door (272AR - Figure 6)	1	0	May be missing with no penalty.

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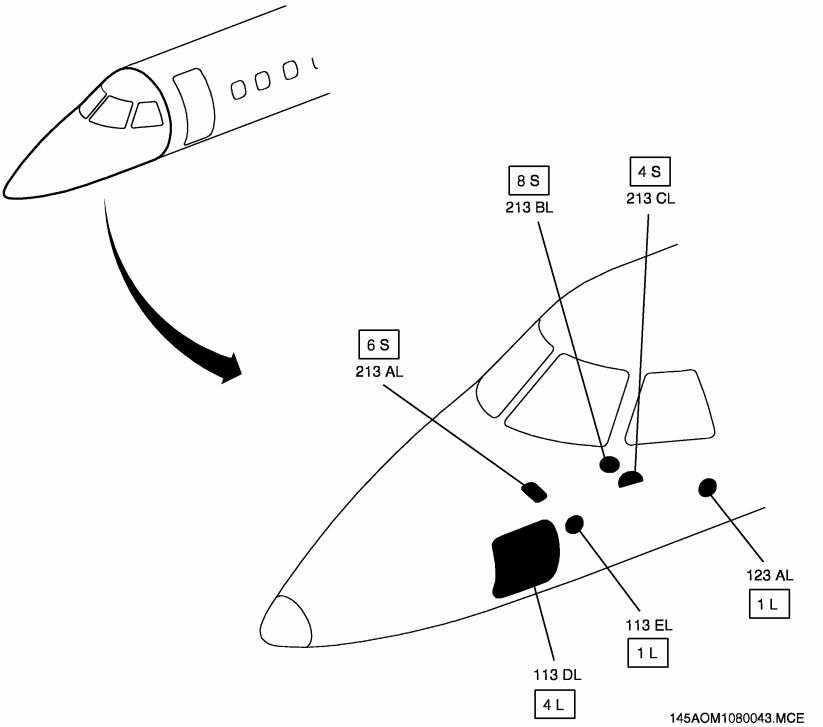

FIGURE 1

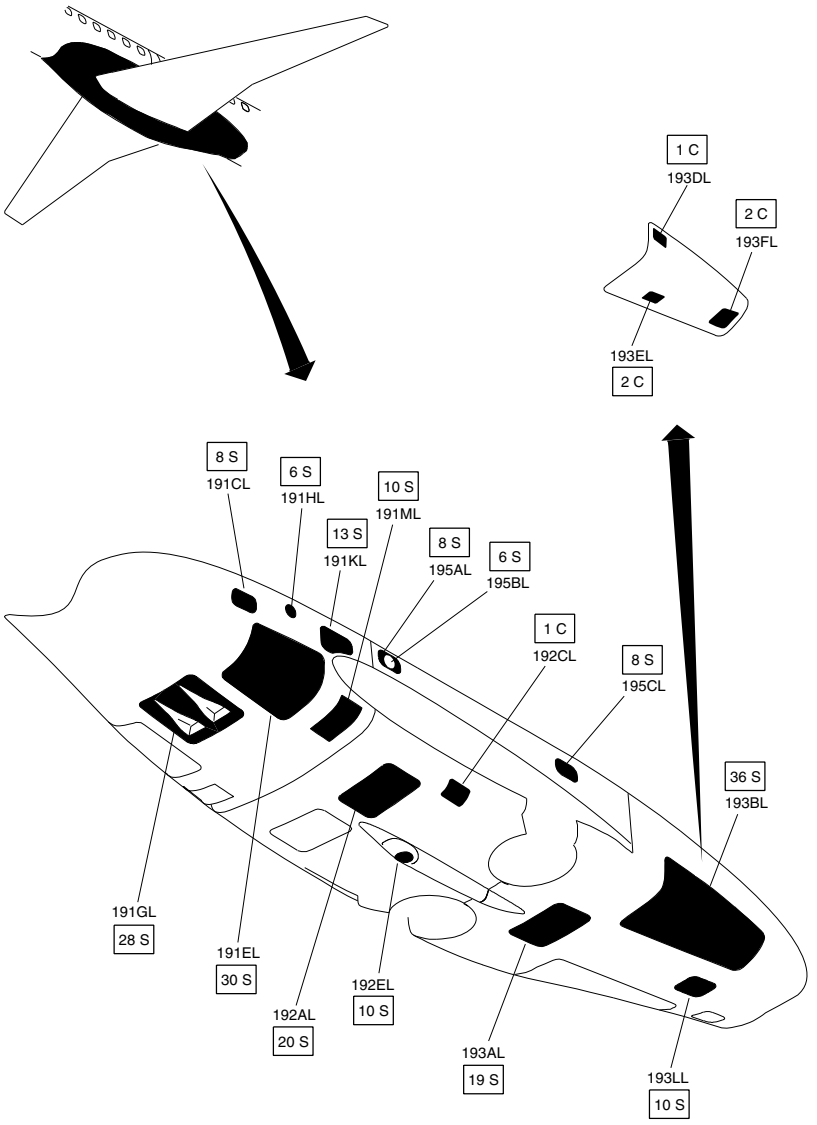

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FIGURE 2 - ALL EXCEPT EMB-145XR

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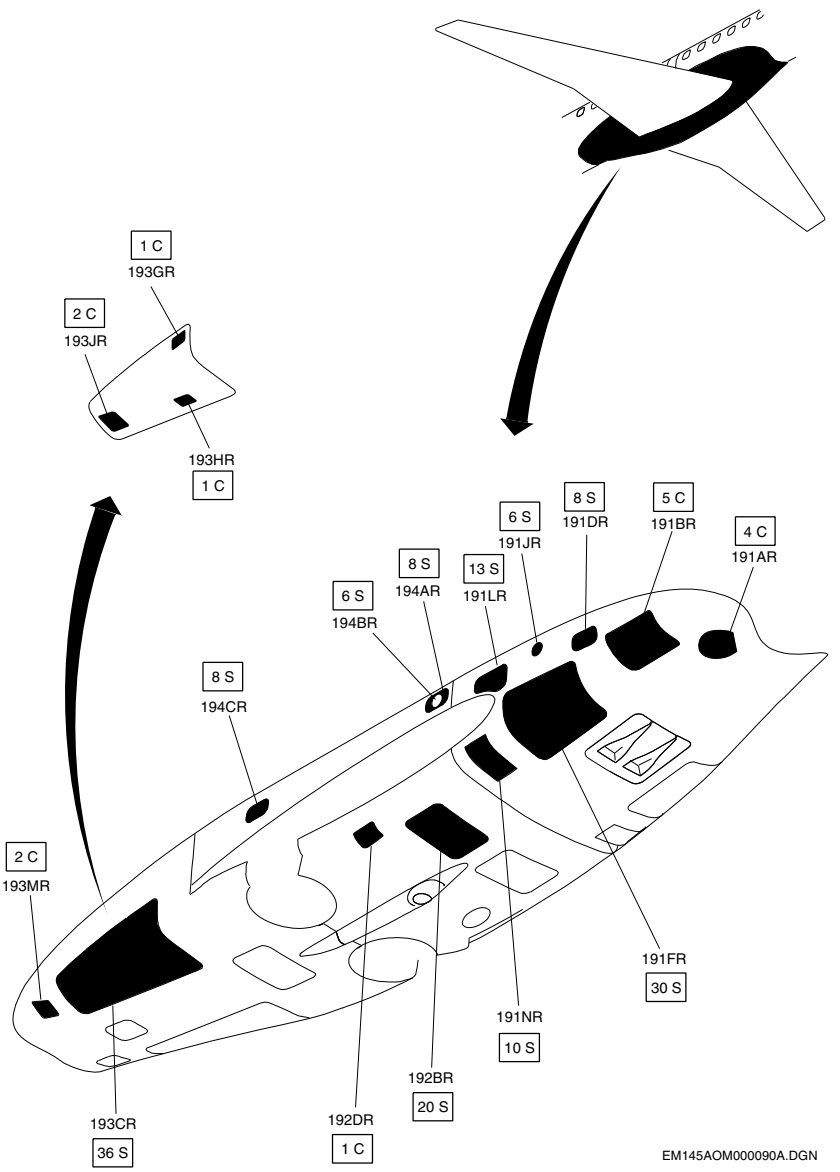

FIGURE 3 - ALL EXCEPT EMB-145XR

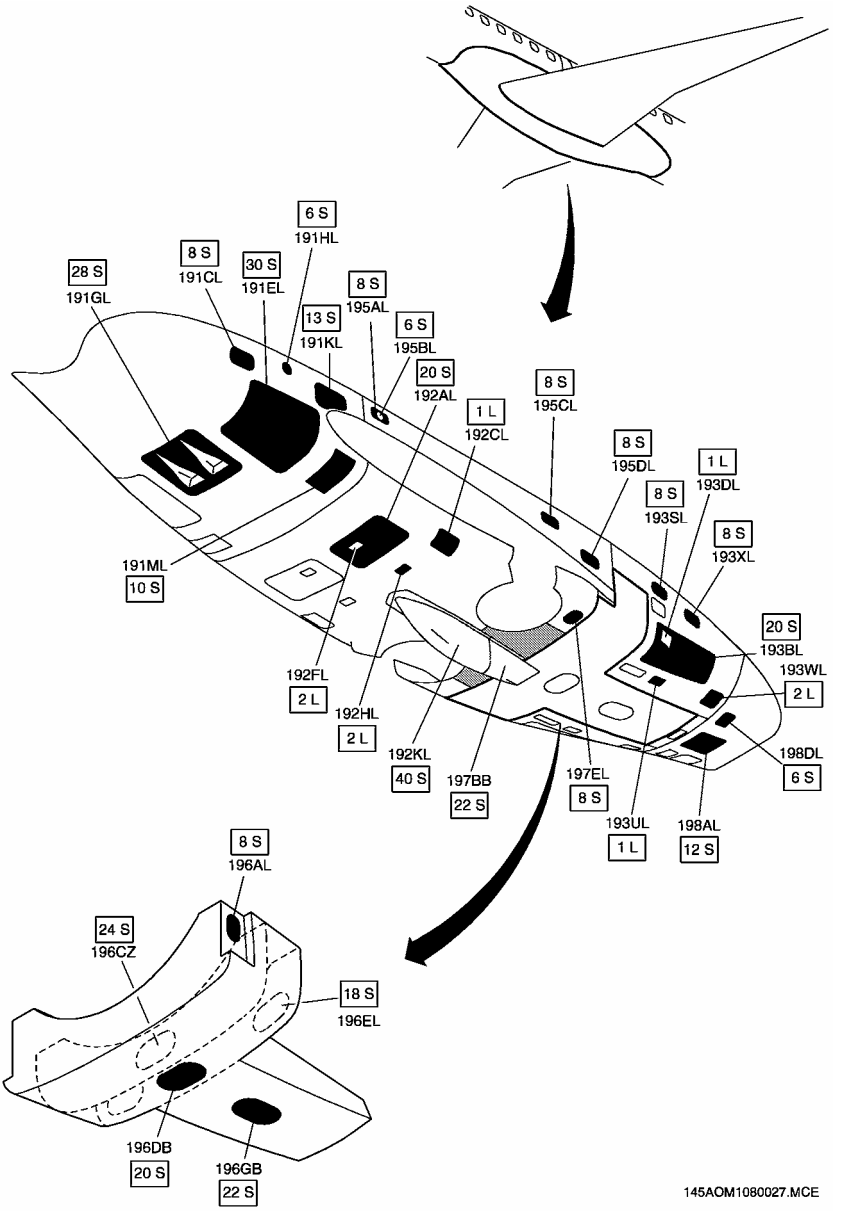

FIGURE 4 - EMB-145XR

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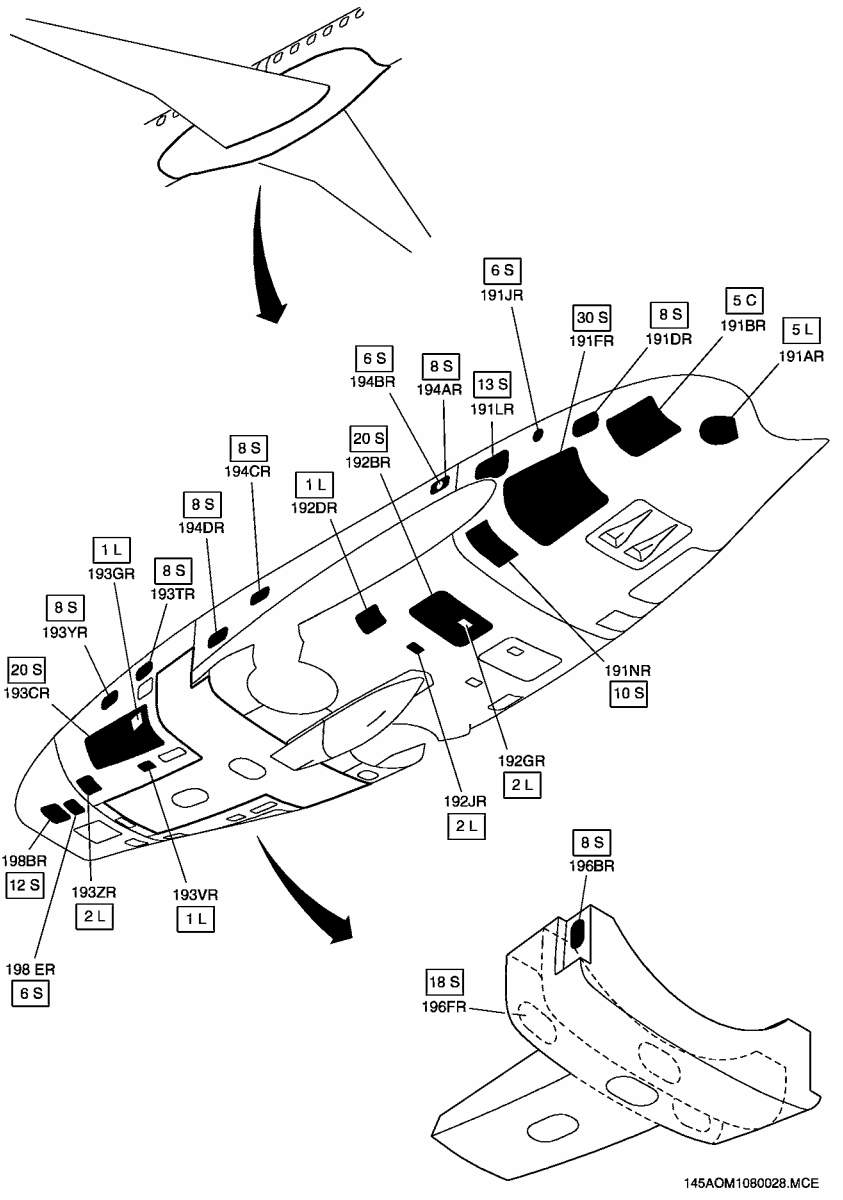

FIGURE 5 - EMB-145XR

System & Sequence Number	1. ITEM	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
6 DIMENSIONS AND AREAS				
42-5	Engine Starting Pneumatic Connection Door (272CR - Figure 6)	1	0	May be missing with no penalty.
42-6	Maintenance Interphone Connection Door (272BR - Figure 6)	1	0	May be missing with no penalty.
42-7	APU Tail Cone Attaching Bolt Access Door (313GR/DR/AL/BL - Figure 6)	4	0	May be missing with no penalty.
42-8	APU Servicing Access Door (313CL - Figure 6)	1	0	May be missing provided APU operates on the ground only. **NOTE:** If the APU oil temperature increases to over 135°C (275°F) during ground operation, the APU OIL HIGH TEMP message will be displayed on the EICAS and the APU will be automatically shut down.

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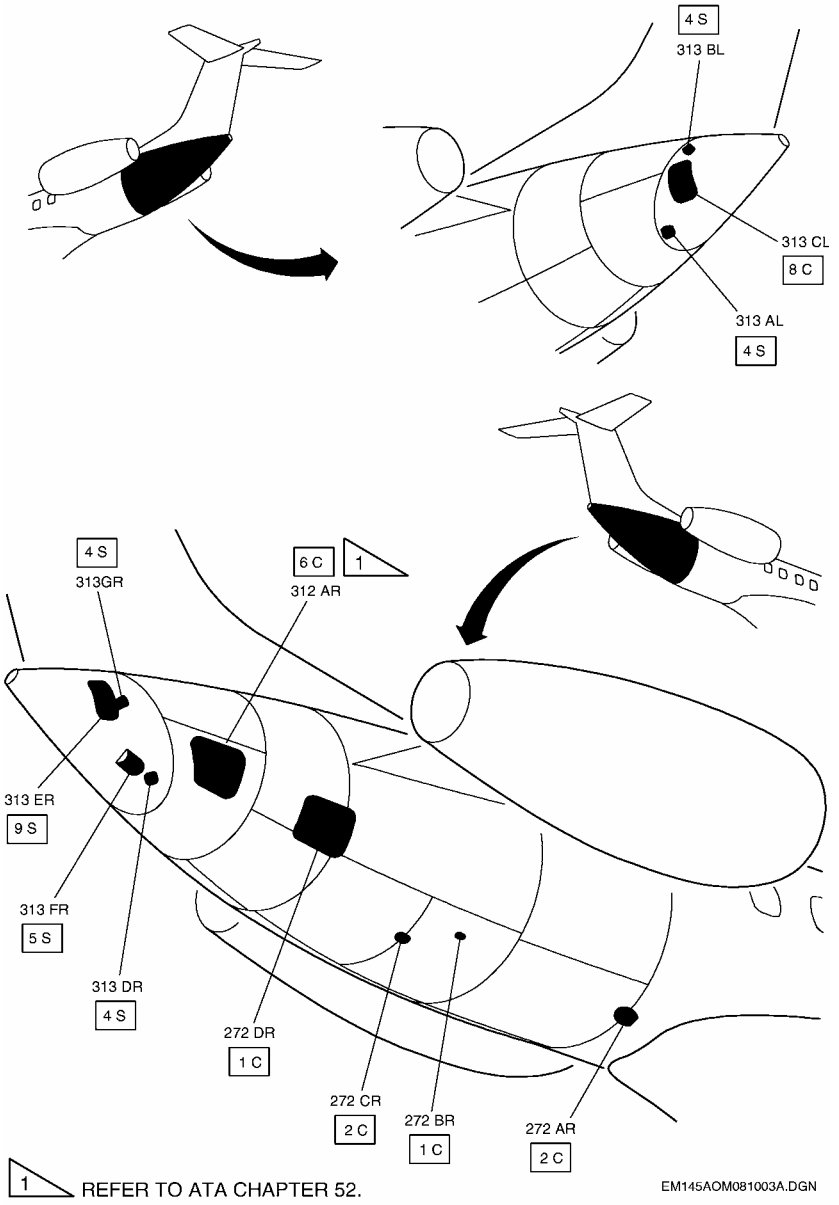

FIGURE 6

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ATA CHAPTER 23 COMMUNICATIONS

System & Sequence Number / ITEM 1.	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
23 COMMUNICATIONS			
60-1 Static Dischargers (Figure 7) (All except EMB-145XR)	22	13	A maximum of 9 (nine) static dischargers may be missing with no penalty. At least the following dischargers are required to be installed: a) 3 (three) are installed on each wing; b) 1 (one) is installed on the rudder; c) 3 (three) are installed on each elevator.
60-2 Static Dischargers (Figure 7) (EMB-145 XR)	26	17	A maximum of 9 (nine) static dischargers may be missing with no penalty. At least the following dischargers are required to be installed: a) 4 (four) are installed on each wing; b) 1 (one) is installed on the rudder: c) 3 (three) are installed on each elevator.

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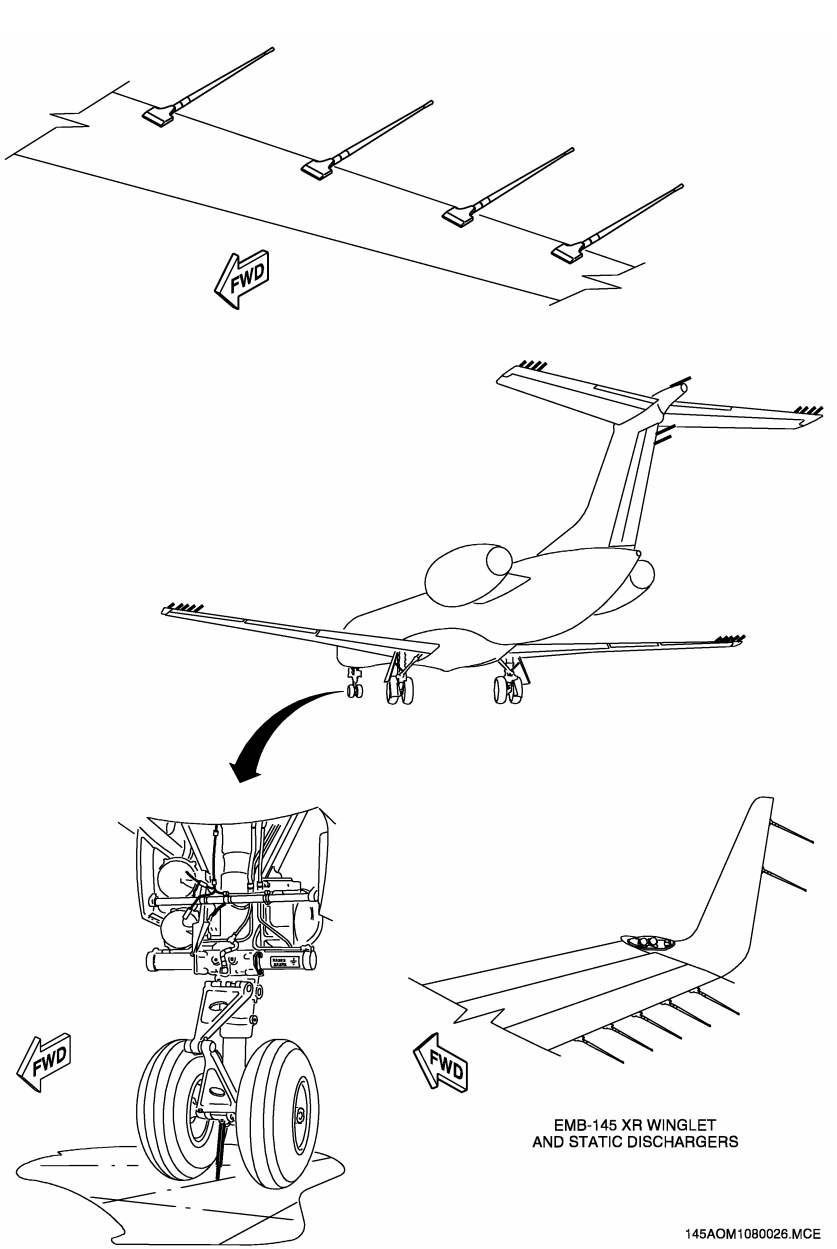

FIGURE 7

ATA CHAPTER 28 FUEL

System & Sequence ITEM Number 1.	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
28 FUEL			
11-1 Fuel Tank Drain Access Door (192CL - Figures 2, 4) (192DR - Figures 3, 5)	2	0	May be missing provided maximum airspeed is limited to 250 KIAS /0.65 M, whichever is lower.
12-1 Vent Valves Screen Assembly (Figure 8)	2	0	May be missing with no penalty.
42-1 Direct Quantity Measuring Sticks (Figure 9)	-	0	May be missing with no penalty. Refer to MMEL 28-42-01.

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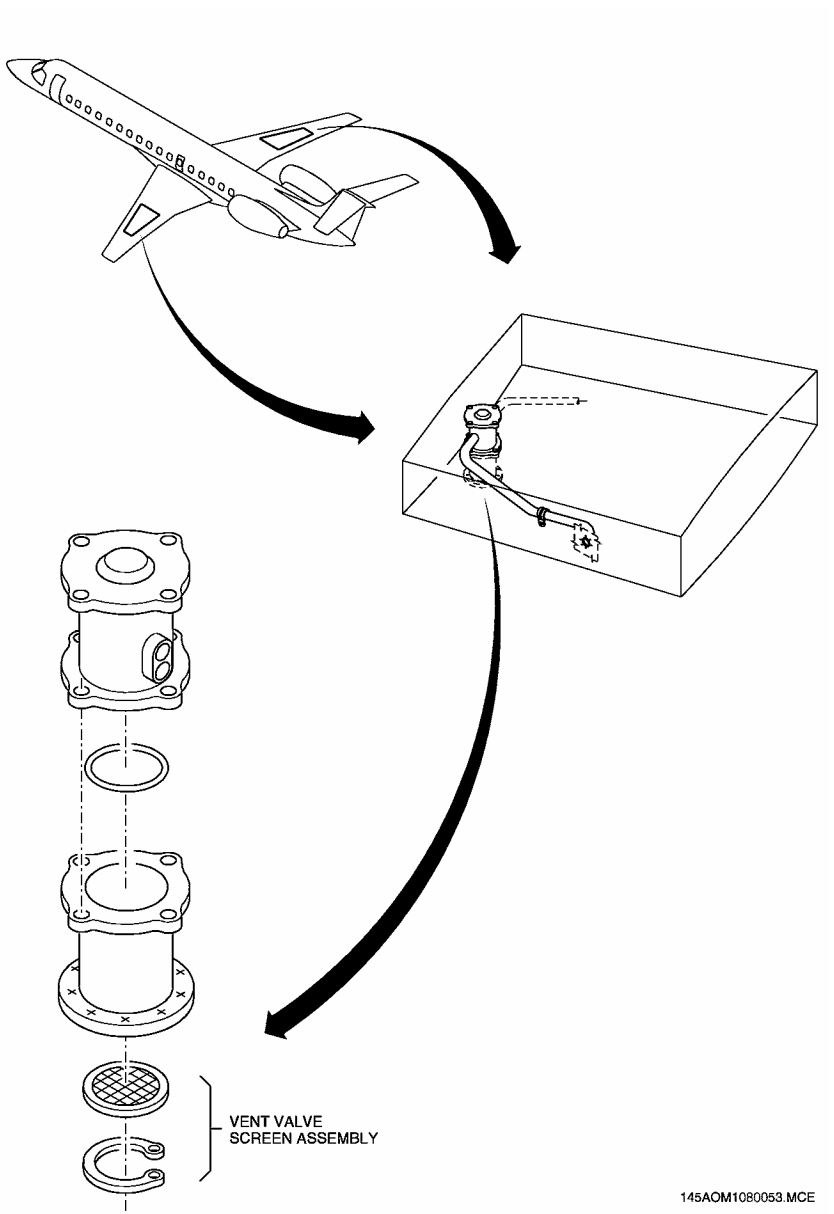

FIGURE 8

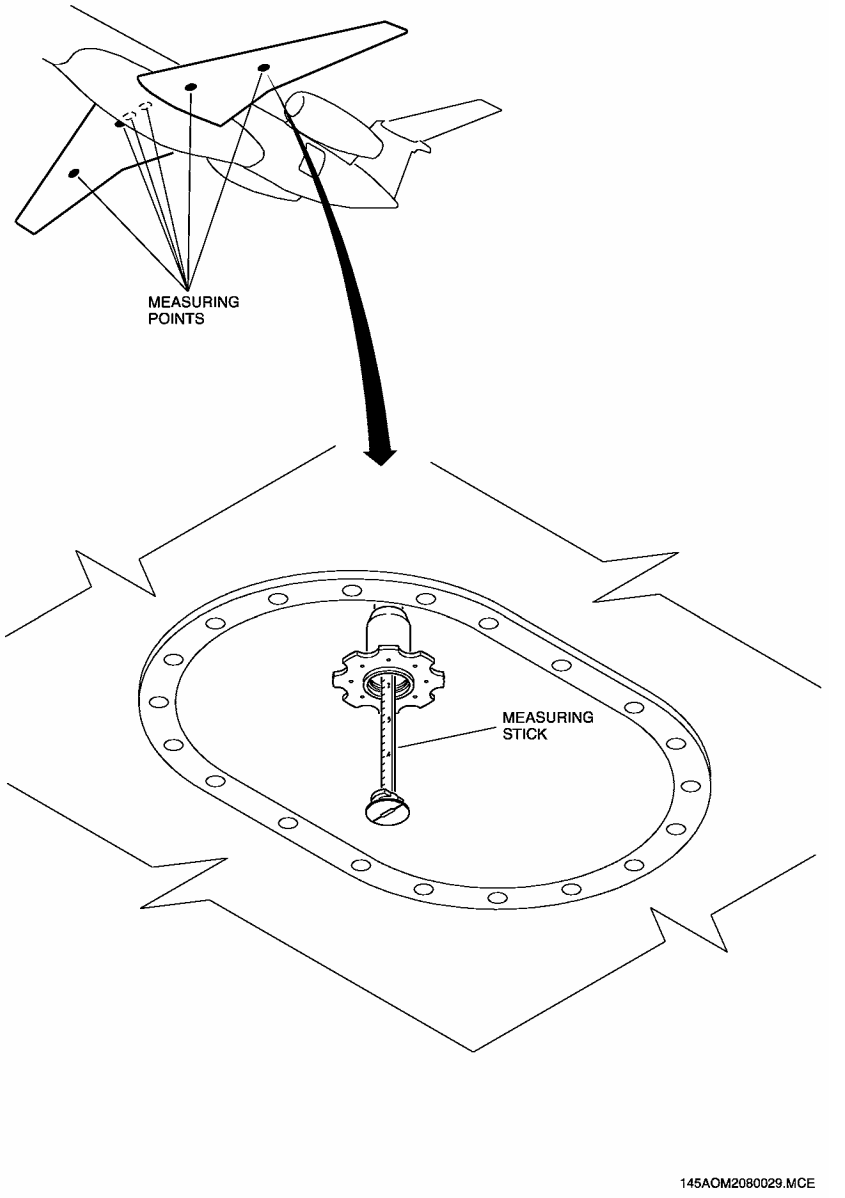

FIGURE 9

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ATA CHAPTER 32 LANDING GEAR

System & Sequence ITEM Number	1.	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
32 LANDING GEAR				
10-1 Main Landing Gear Doors (Figure 10)		2	0	May be missing provided maximum airspeed is limited to 250 KIAS / M 0.65, whichever is lower.
10-2 Main Landing Gear Wheels Fairing (Figure 10)		2	0	May be missing provided maximum airspeed is limited to 250 KIAS / M 0.65, whichever is lower.

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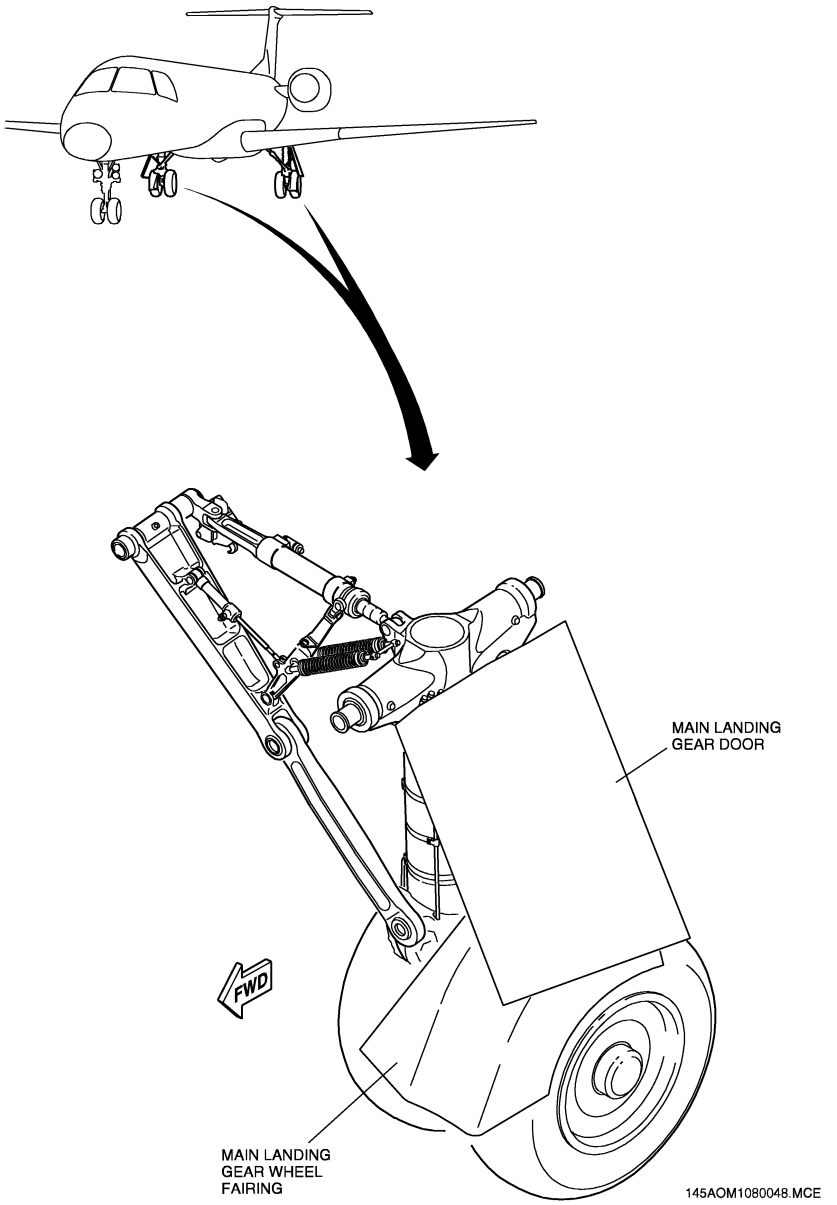

FIGURE 10

ATA CHAPTER 33 LIGHTS

System & Sequence ITEM Number	1.	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
33 LIGHTS				
41-1 Nose Landing Light (Figure 11)		1	0	May be missing with no penalty. Refer to MMEL 33-41-00.
42-1 Taxi Light (Figure 11)		2	0	May be missing with no penalty. Refer to MMEL 33-42-00.
43-1 Navigation Light Protective Lens (Figure 12) (All except EMB-145XR)		3	0	May be missing with no penalty. Refer to MMEL 33-43-00.
43-2 Navigation Light Protective Lens (Figure 13) (EMB-145 XR)		6	0	May be missing with no penalty. Refer to MMEL 33-43-00.
44-1 Inspection Light Protective Lens (Figure 14)		2	0	May be missing with no penalty. Refer to MMEL 33-44-00.
46-1 Logotype Light Protective Lens (Figure 15)		2	0	May be missing with no penalty. Refer to MMEL 33-46-00.
47-1 Red Beacon Light Protective Lens (Figure 16)		2	0	May be missing with no penalty. Refer to MMEL 33-47-05.
50-1 Exterior Emergency Light Protective Lens (Figure 17)		4	0	May be missing with no penalty. Refer to MMEL 33-50-00.

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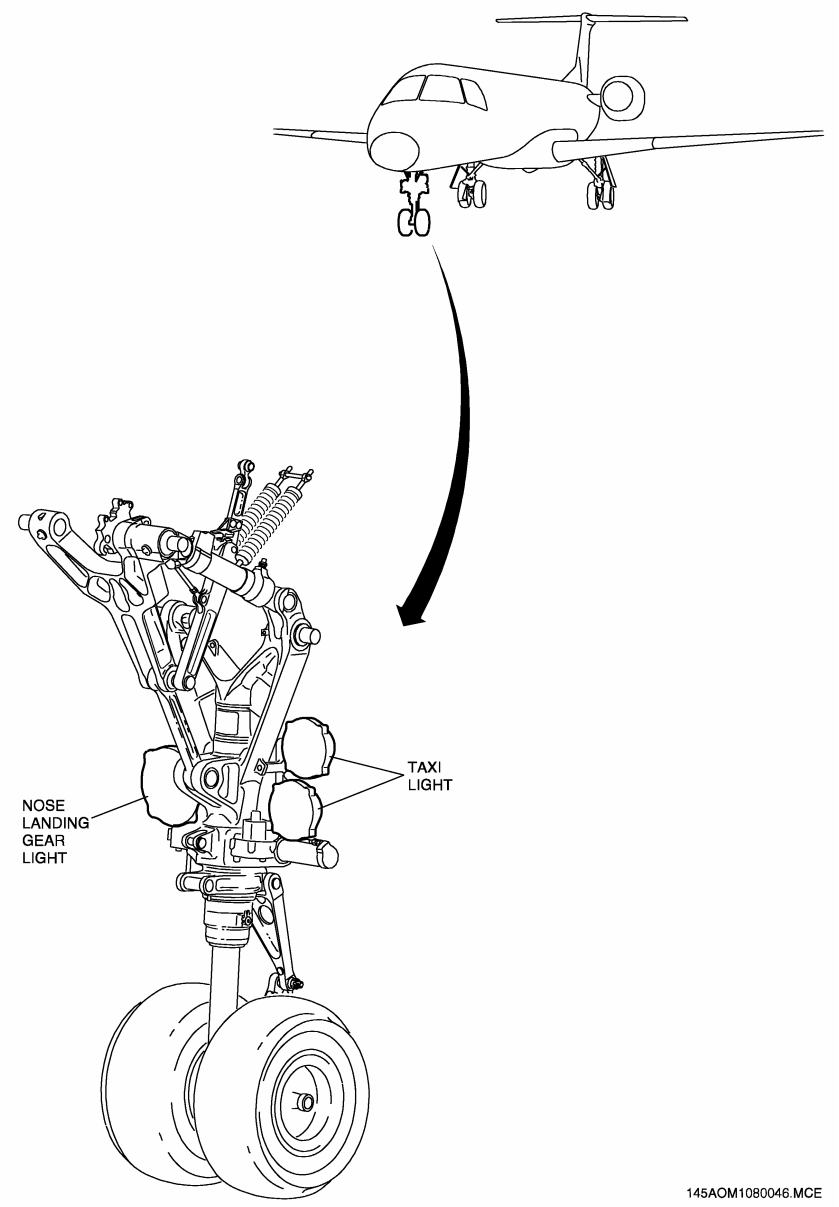

FIGURE 11

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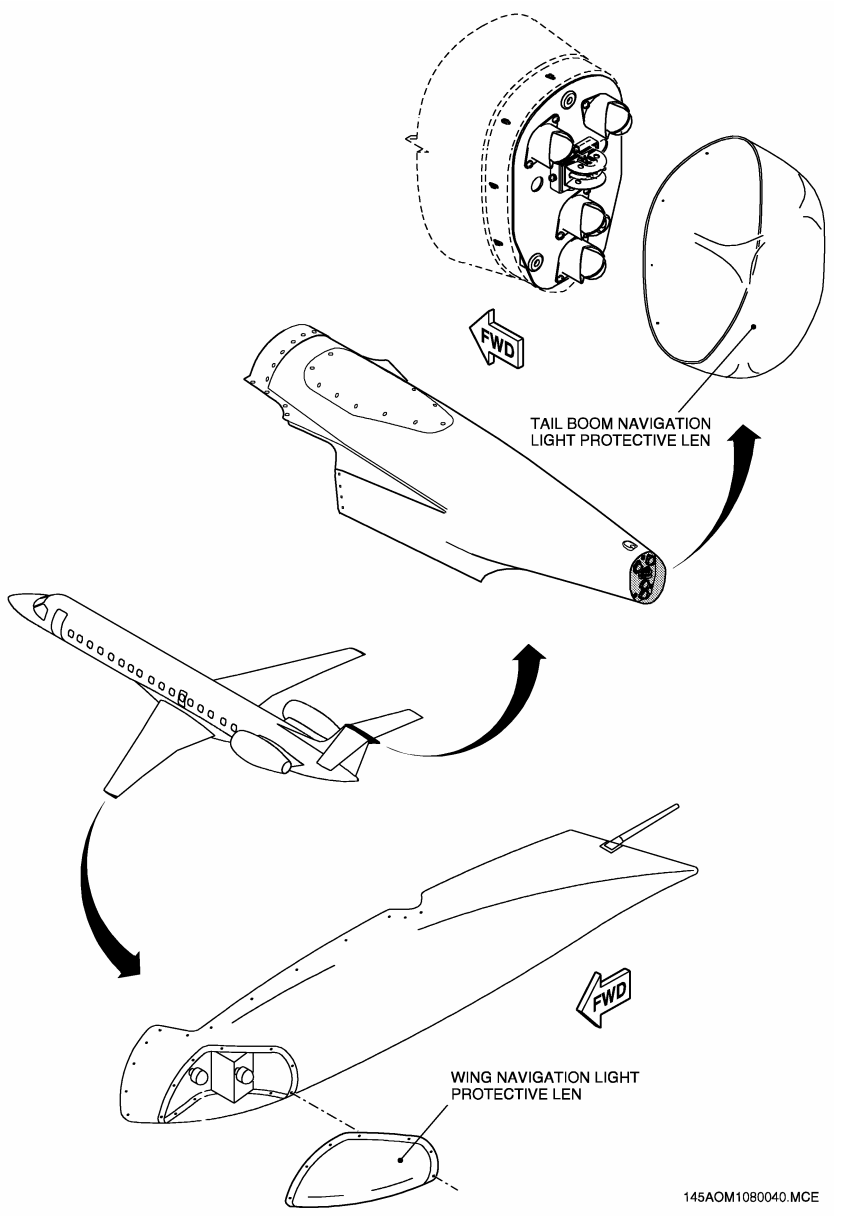

FIGURE 12

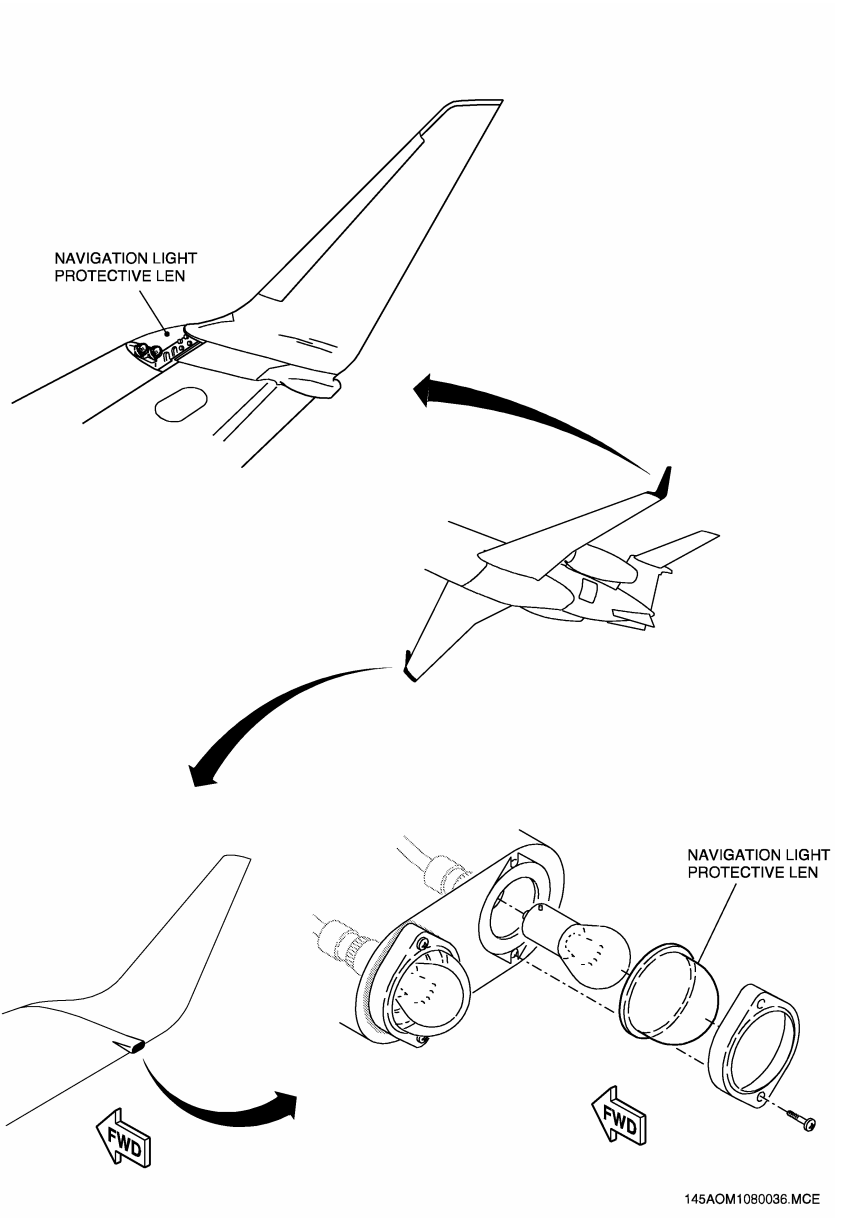

FIGURE 13

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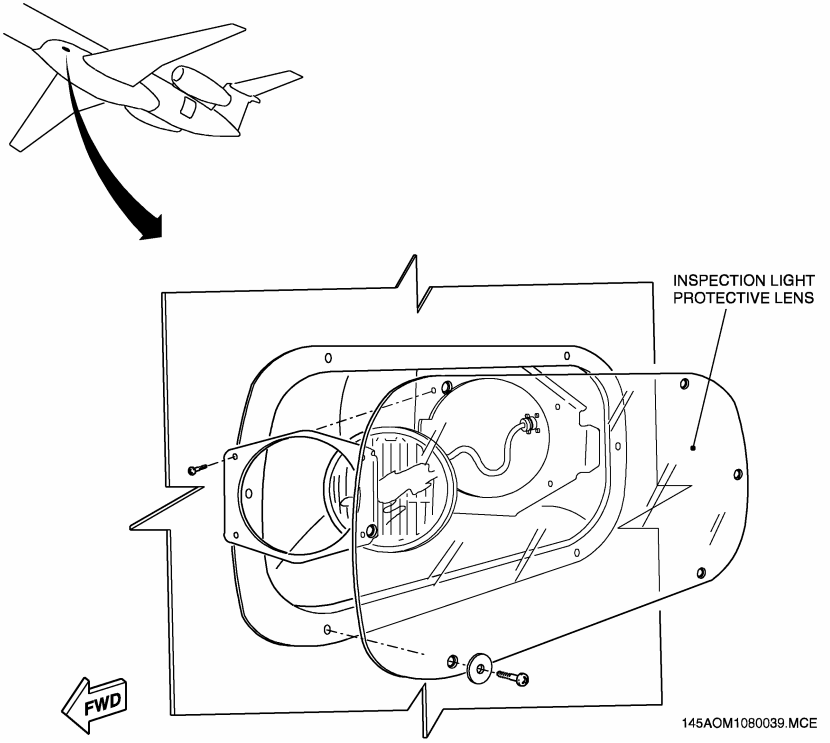

FIGURE 14

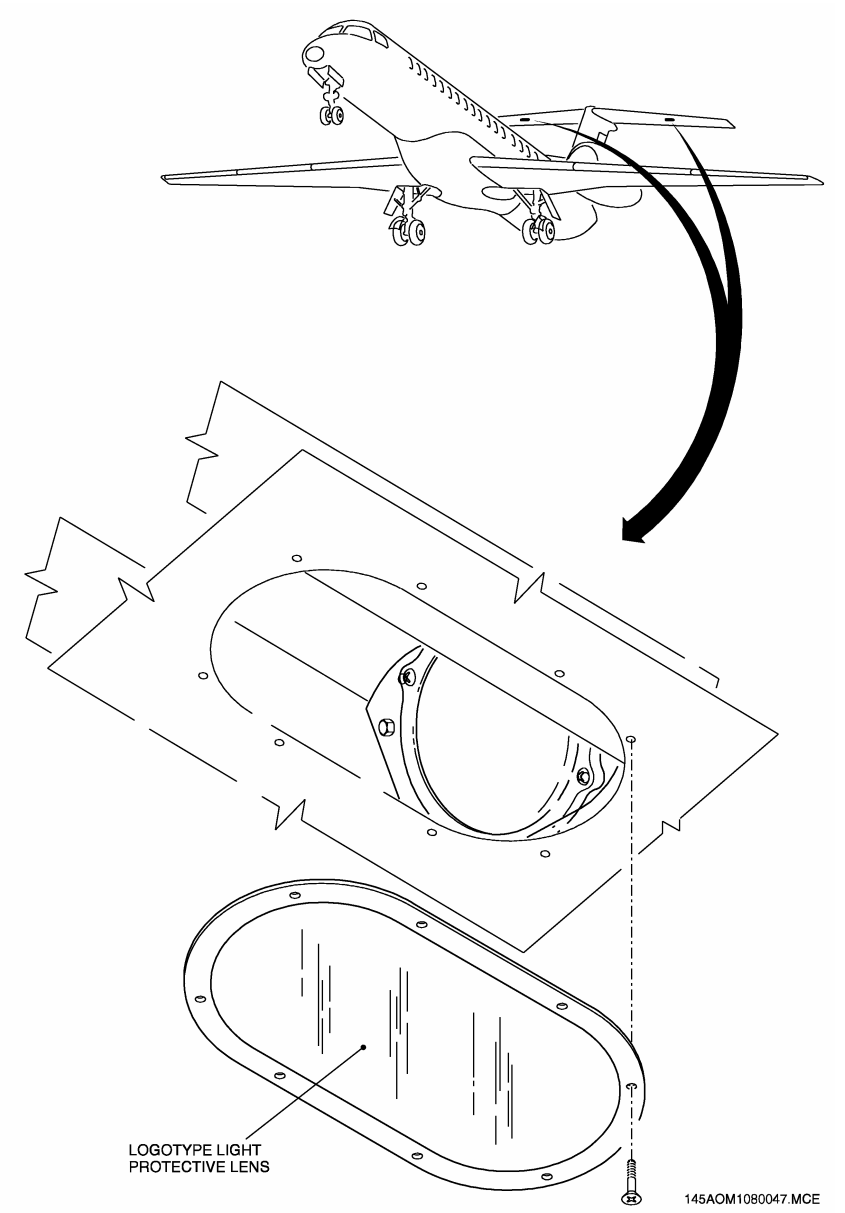

FIGURE 15

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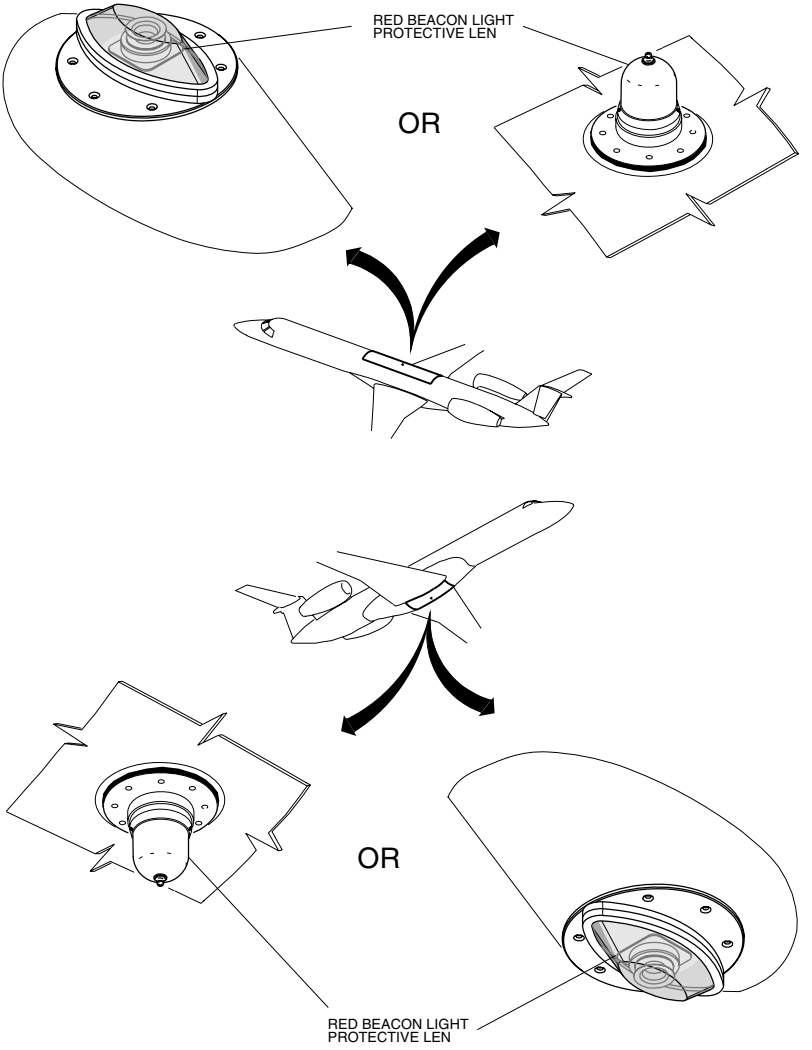

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FIGURE 16

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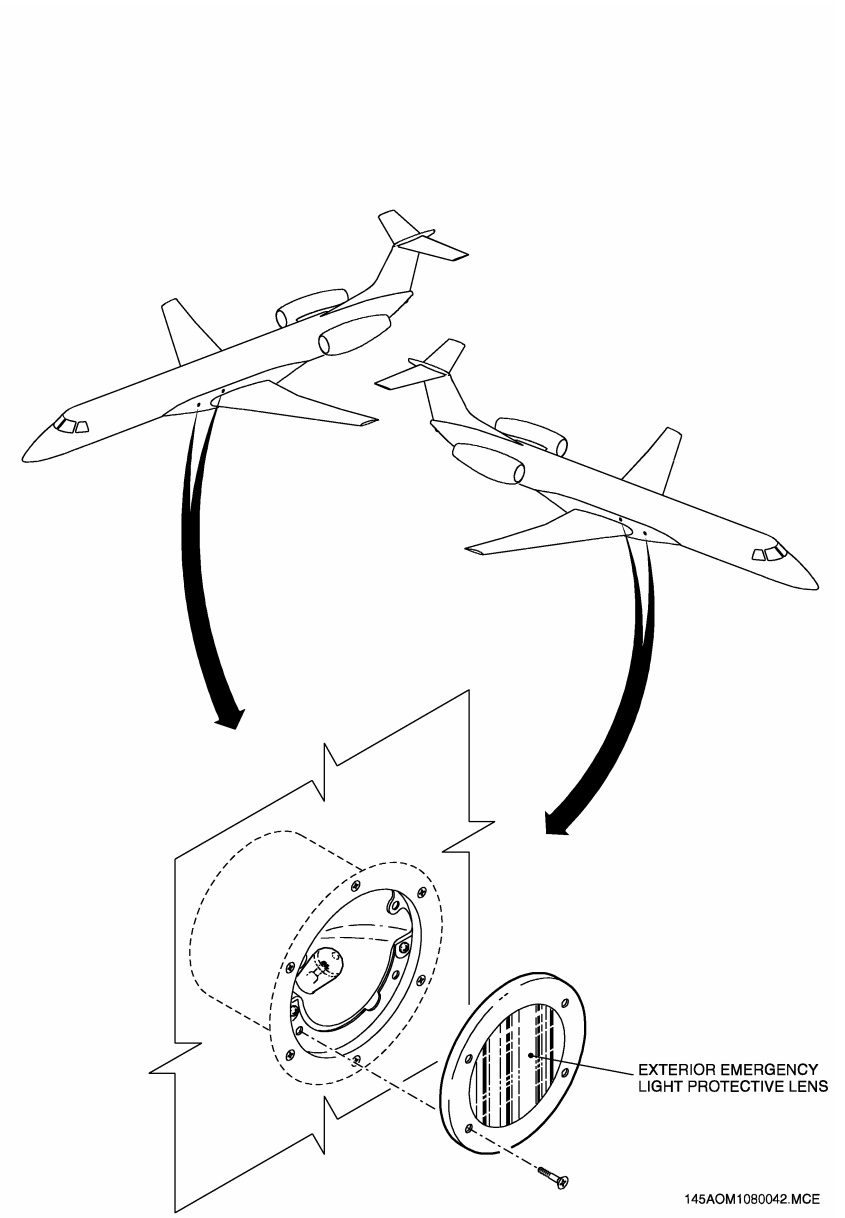

FIGURE 17

ATA CHAPTER 49 AUXILIARY POWER UNIT

System & Sequence ITEM Number	1.	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
49 AUXILIARY POWER UNIT				
42-1 APU Starter/Generator Air Intake Scoop (Figure 18)		1	0	May be missing provided APU operates on the ground only.
52-1 APU Compartment Cooling Air Intake Scoop (Figure 18)		1	0	May be missing provided APU operates on the ground only.

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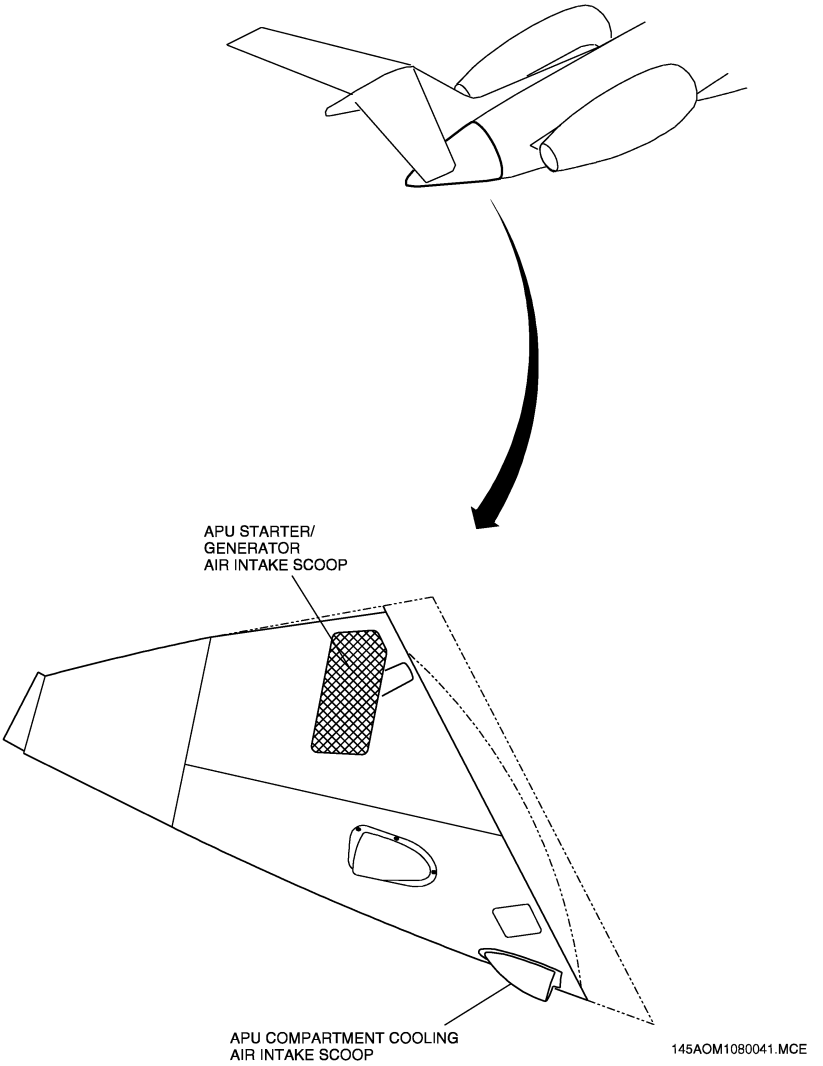

FIGURE 18

ATA CHAPTER 52 DOORS

System & Sequence ITEM Number	1.	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
52 DOORS				
10-1 Main Door Handgrip (Figure 19)		1	0	May be missing with no penalty.
42-1 Service Door Handgrip (Figure 19)		1	0	May be missing with no penalty.
43-1 Tail Cone Access Door (312AR - Figure 6)		1	0	May be missing with no penalty.

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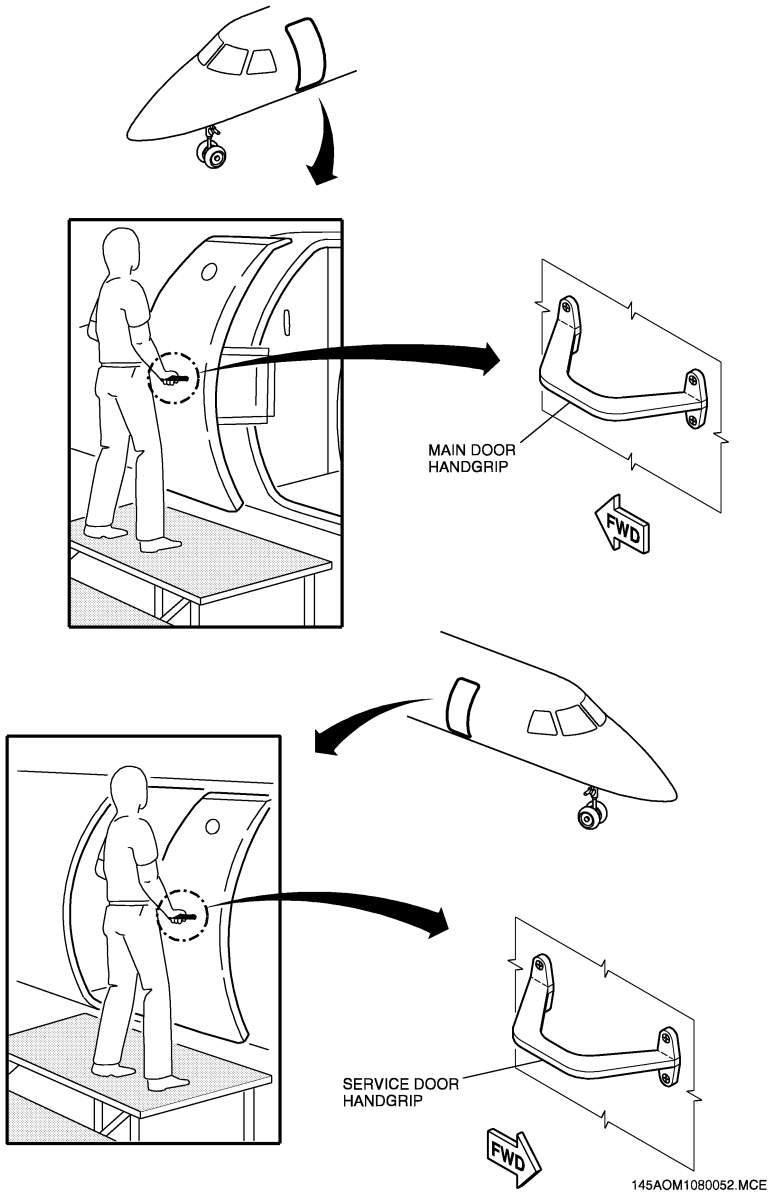

FIGURE 19

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ATA CHAPTER 54 NACELLE/PYLONS

System & Sequence ITEM Number 1.	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
54 NACELLE/PYLONS			
50-1 Systems Access Door (414AB/BB/EB - Figure 20) (424AB/BB/EB - Figure 21)	6	4	A maximum of 1 per pylon for a total of 2 may be missing provided maximum airspeed is limited to 250 KIAS / 0.65 M, whichever is lower.
50-2 Bleed Valve Access Door (414DB - Figure 20) (424DB - Figure 21)	2	0	May be missing with no penalty.
50-3 Pre-cooler Access Door (414CB - Figure 20) (424CB - Figure 21)	2	0	May be missing with no penalty.
50-4 Engine Pylon Fairing (414HL - Figure 20) (424HR - Figure 21)	2	0	May be missing with no penalty.

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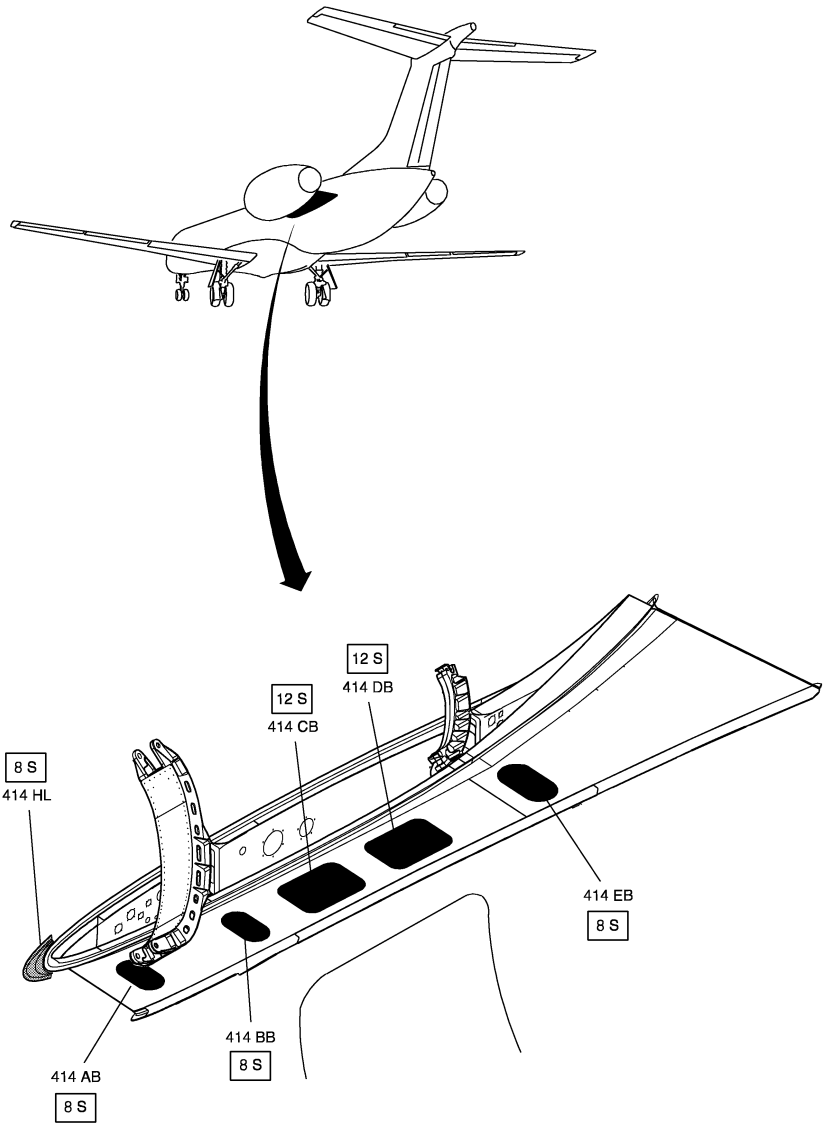

FIGURE 20

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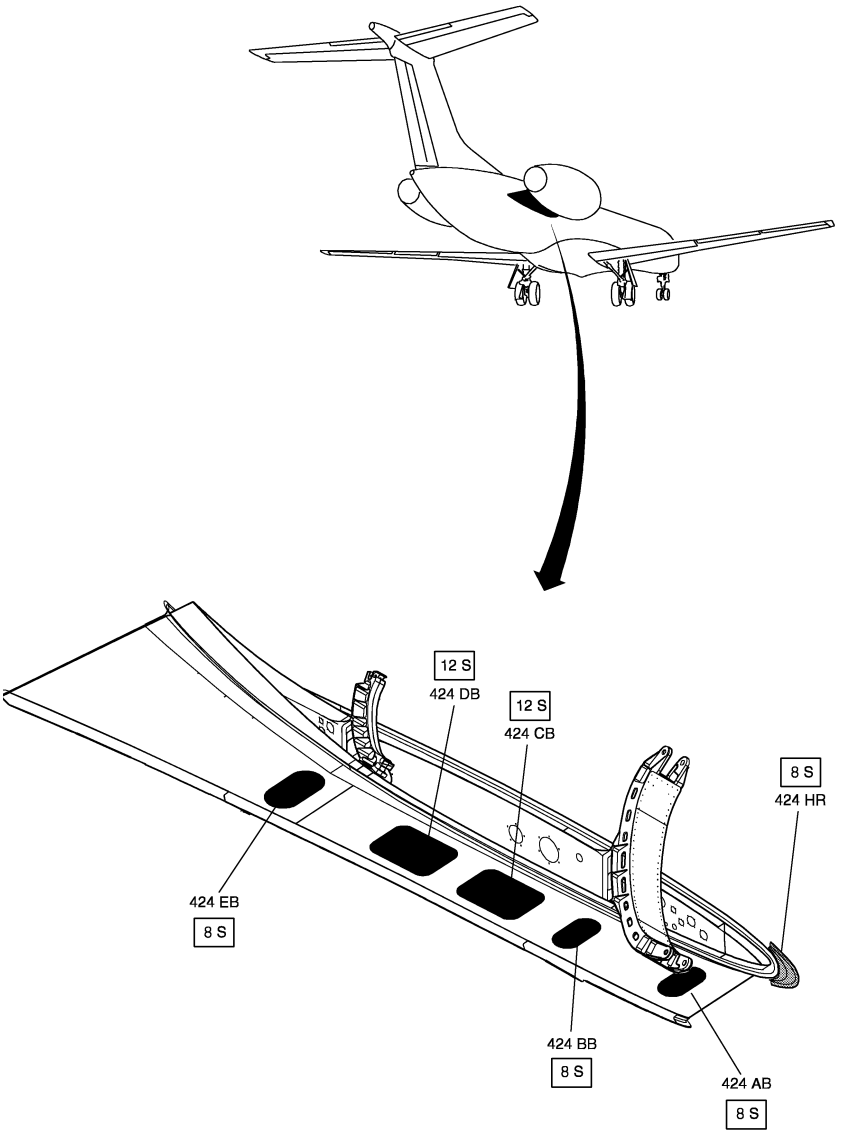

FIGURE 21

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ATA CHAPTER 55 STABILIZERS

System & Sequence ITEM Number	1.	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
55 STABILIZERS				
10-2 Horizontal Stabilizer Access Door (333AB/BB/CB - Figure 22) (334AB/BB/CB - Figure 23)		6	4	A maximum of 1 per side for a total of 2 may be missing with no penalty.
20-2 Elevator Control Rod Fairing (Figure 26)		4	0	May be missing with no penalty.
20-3 Elevator Trim Control Rod Fairing (Figure 26)		2	0	May be missing with no penalty.
20-4 Elevator Access Door (335AB/BB/CB/DB/EB/ FB/GB/HB - Figure 22) (336AB/BB/CB/DB/EB/ FB/GB/HB - Figure 23)		16	15	One may be missing with no penalty. 335AB/BB/CB/DB/EB and 336 AB/BB/CB/DB/EB cannot be missing.
30-1 Vertical Stabilizer Access Door (322AL, 324AL/BL/CL/DL/EL, 325AL/BL/CL/DL/EL - Figure 24) (322BR, 324FR, 325FR/ GR/HR/JR/KR/LR - Figure 25)		19	16	A maximum of 3 in any combination may be missing with no penalty. 324 FR/EL and 325 EL/LR cannot be missing.
40-1 Rudder Access Door (326AL/BL/CL/EL/FL/GL/HL, 327AL/BL/CL/DL - Figure 24) (327ER/FR/GR/HR - Figure 25)		15	13	A maximum of 2 in any combination may be missing with no penalty.

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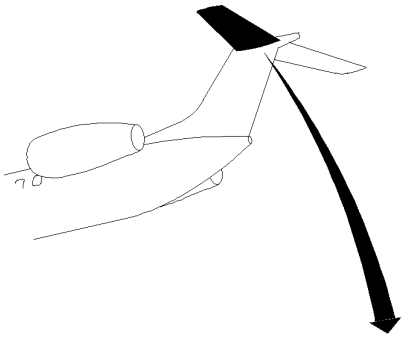

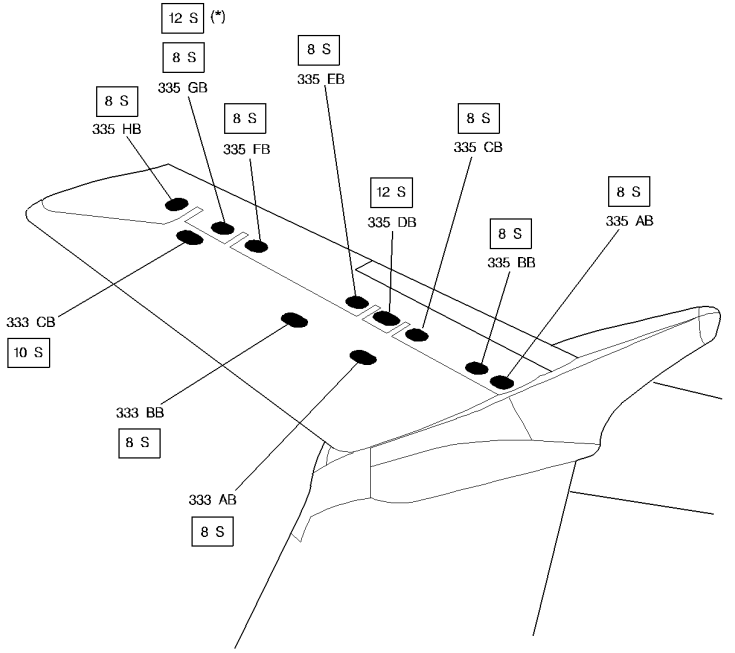

NOTE:
(*) APPLICABLE TO AIRCRAFT 012/999

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FIGURE 22

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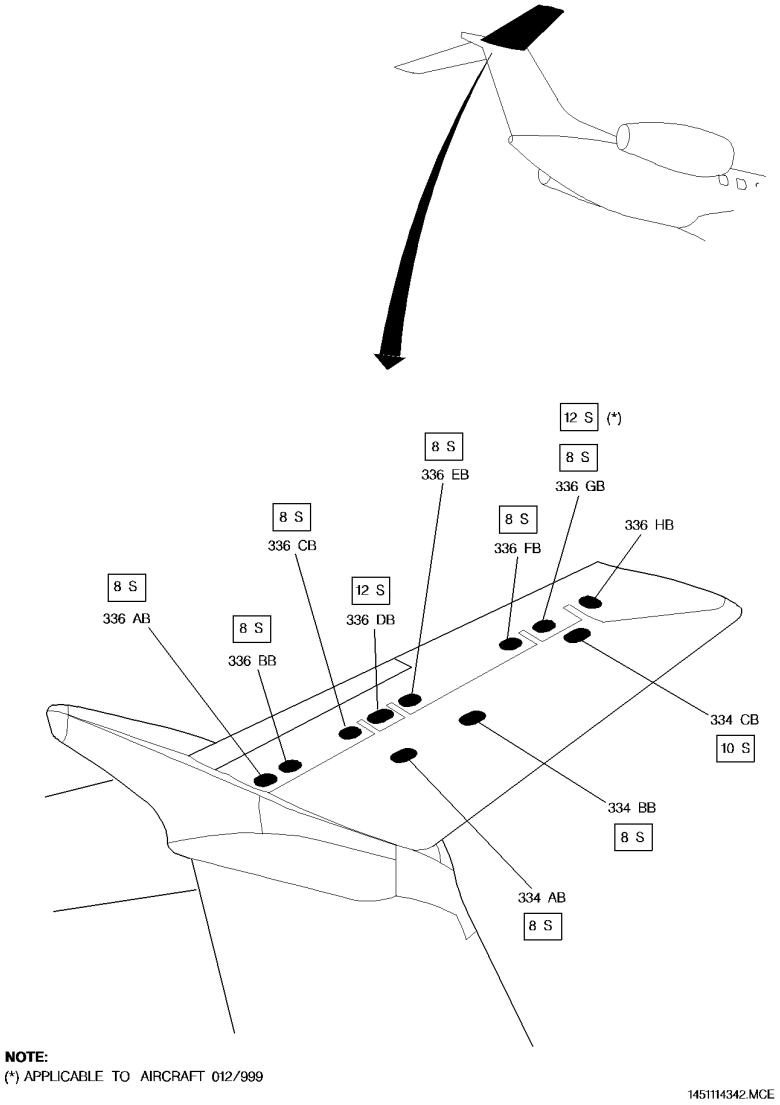

FIGURE 23

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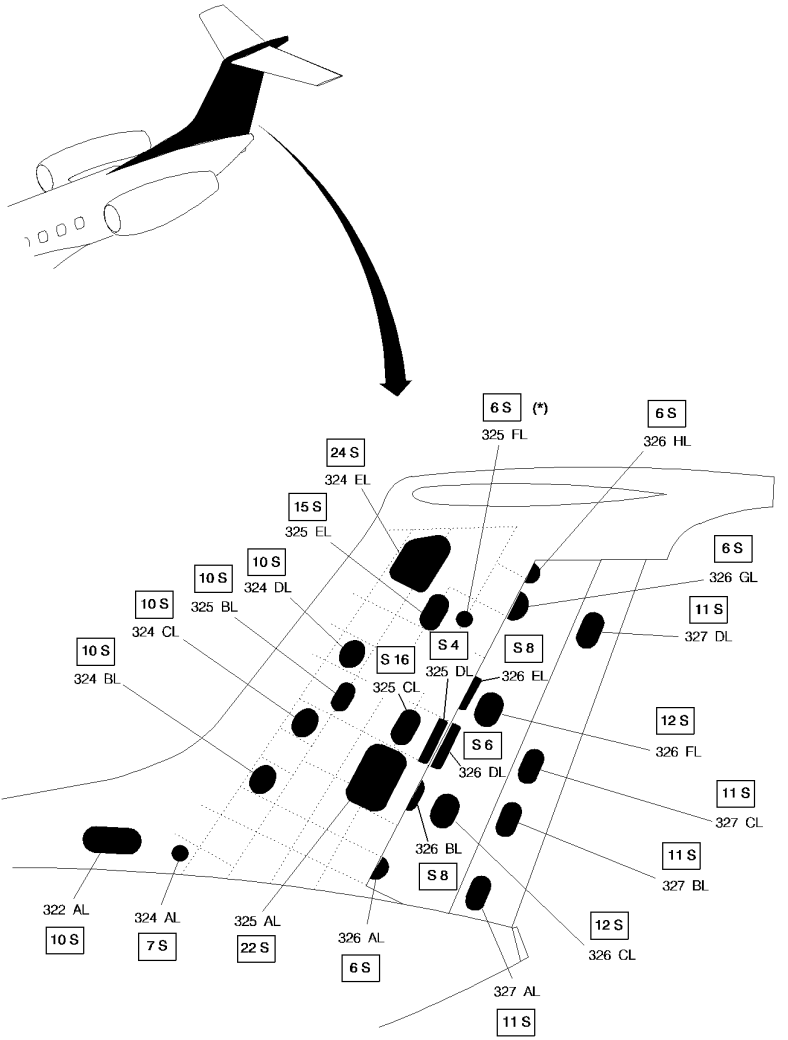

FIGURE 24

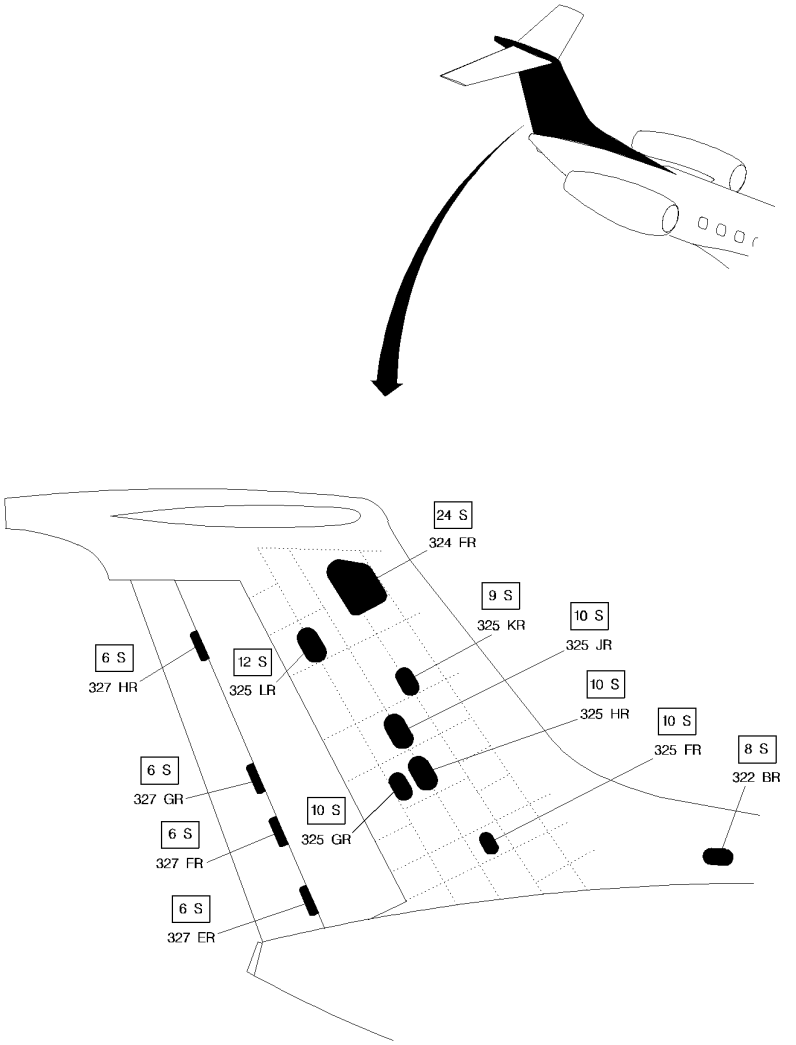

FIGURE 25

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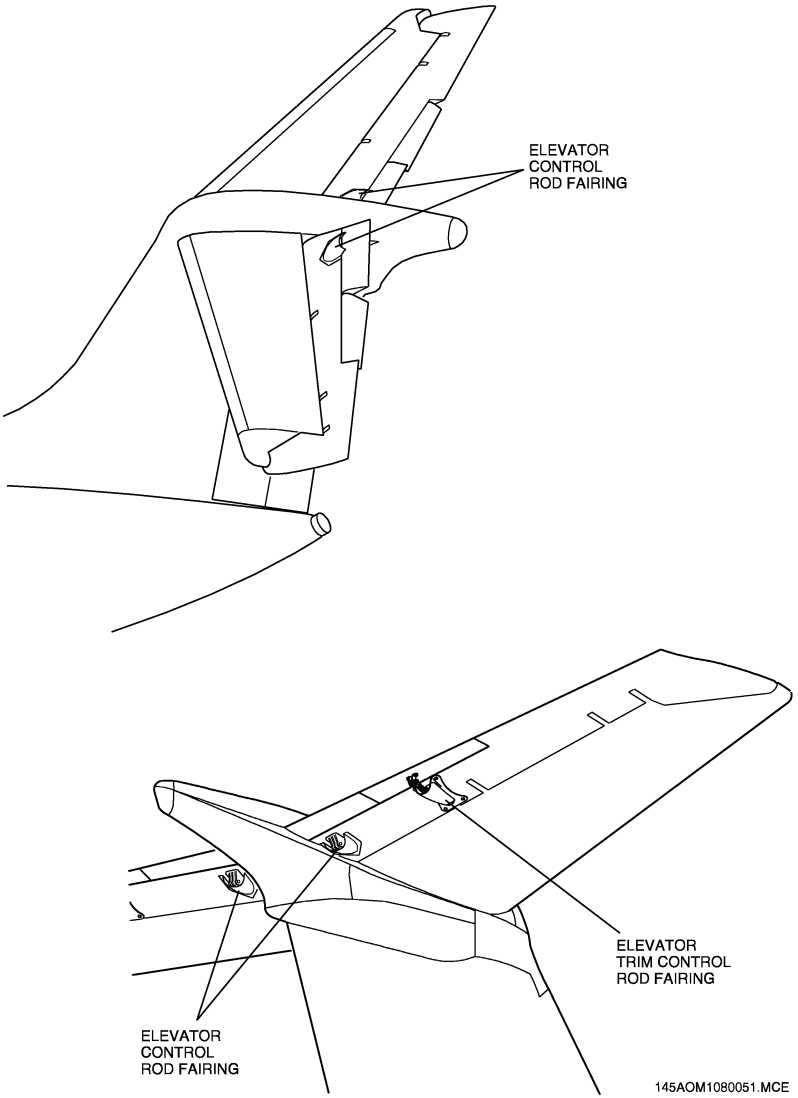

FIGURE 26

ATA CHAPTER 57 WINGS

System & Sequence ITEM Number	1.	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
57 WINGS				
20-1 Vortex Generator (Figure 27)		24	22	A maximum of 1 per wing for a total of 2 may be missing with no penalty.
30-2 Wing Tip Glareshield (Figure 28)		2	0	May be missing with no penalty.
42-1 Wing Grounding Point (Figure 29)		2	0	One or both may be missing with no penalty provided: a) The hole is covered with Scotch Brand Tape (Silver Tape) or similar product and, b) The landing gear grounding point is available.
52-1 Flap Track Fairing (Figure 30)		10	9	One may be missing with no penalty.
52-2 Wing-to-flap seal (Figure 31)		4	3	One may be missing provided maximum airspeed is limited to 250 KIAS / M0.65, whichever is lower.

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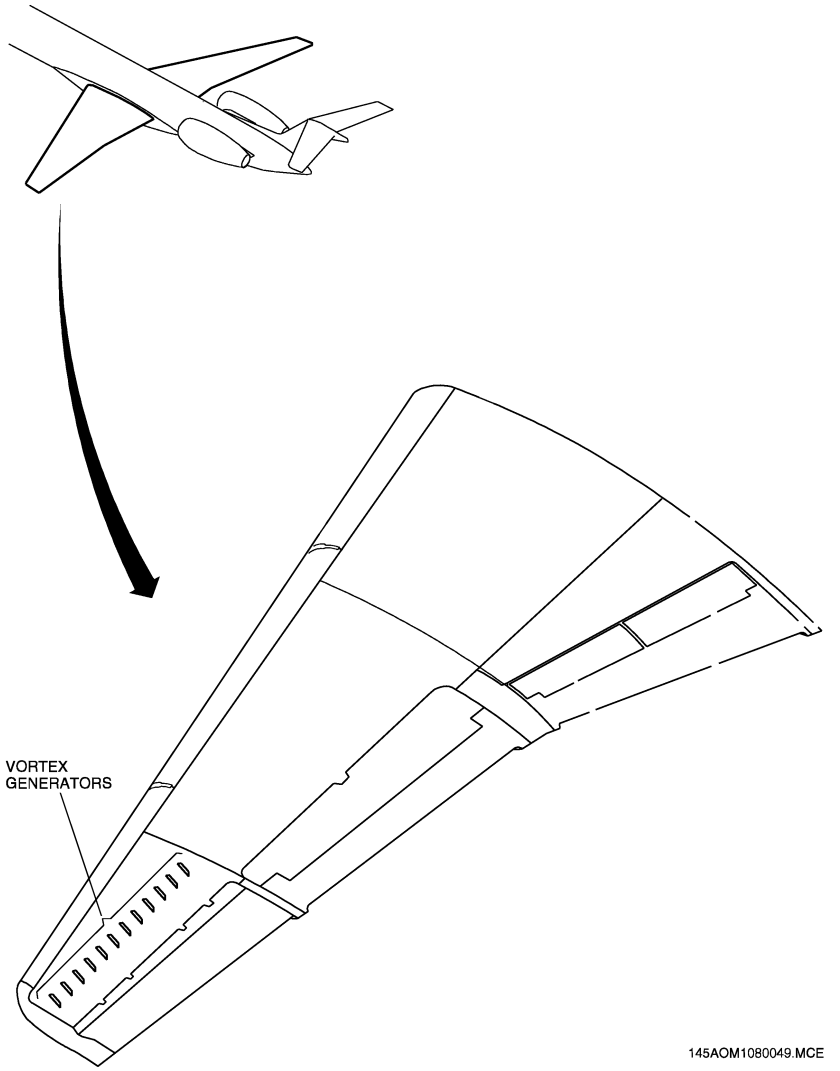

FIGURE 27

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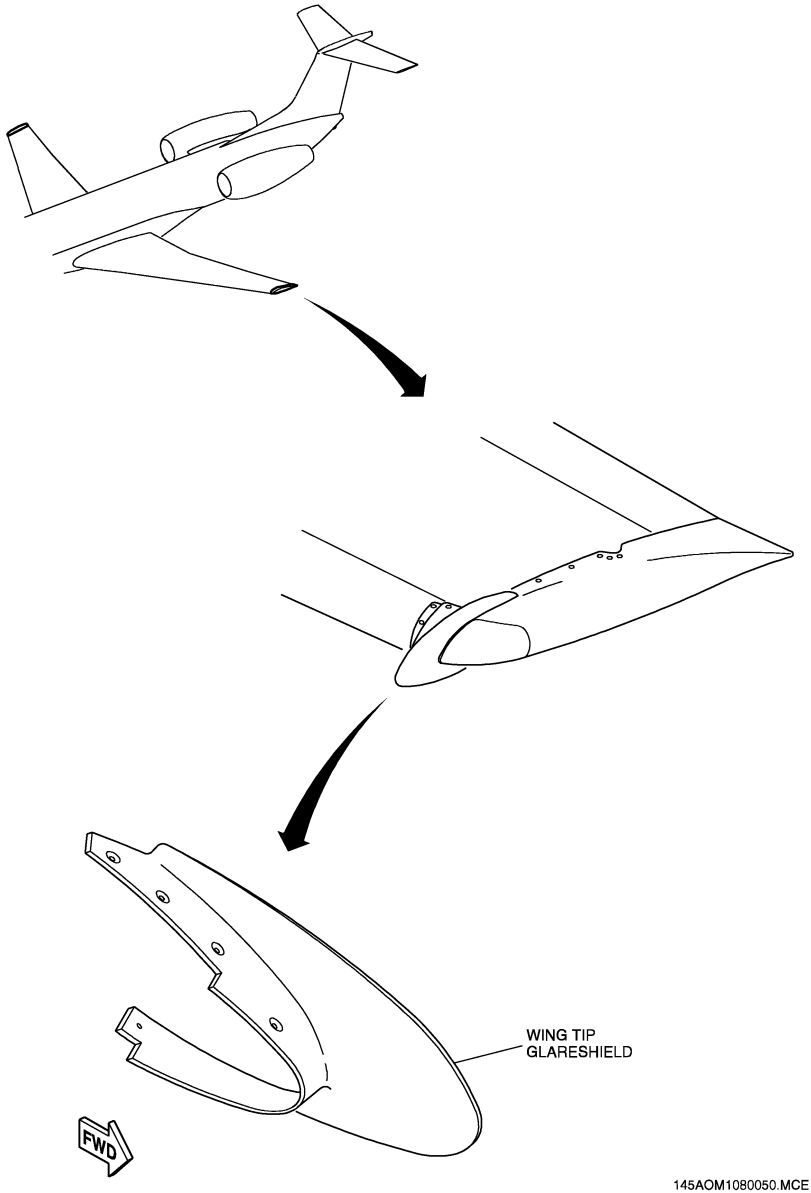

FIGURE 28

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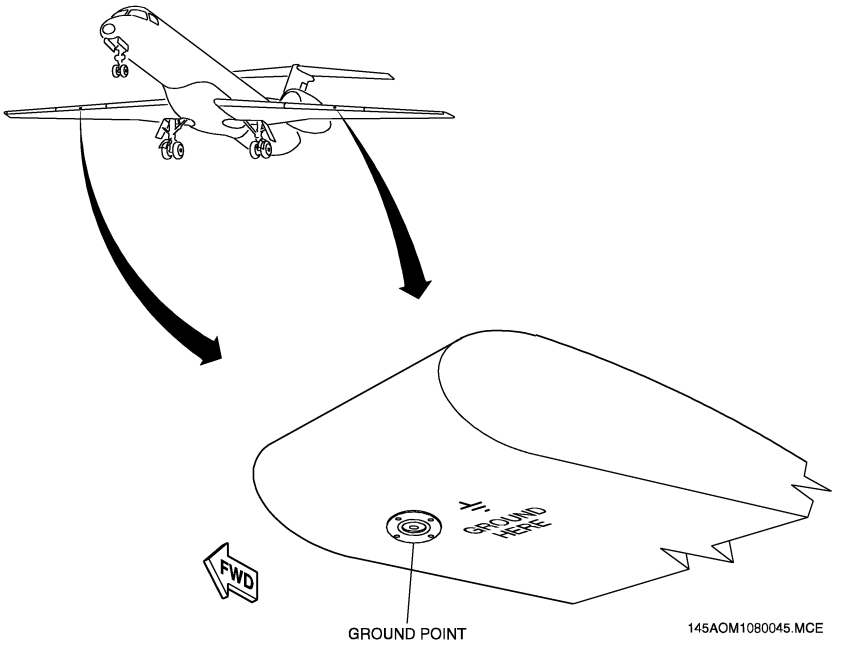

FIGURE 29

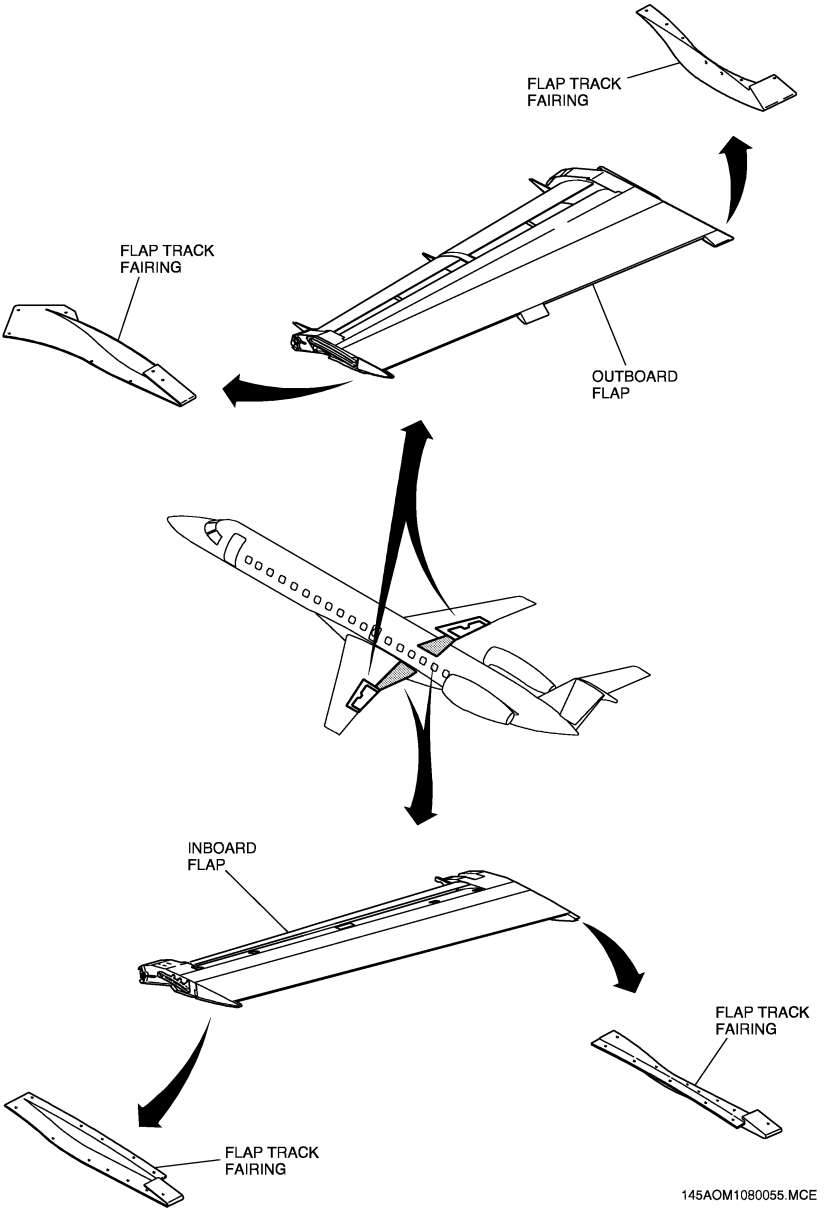

FIGURE 30

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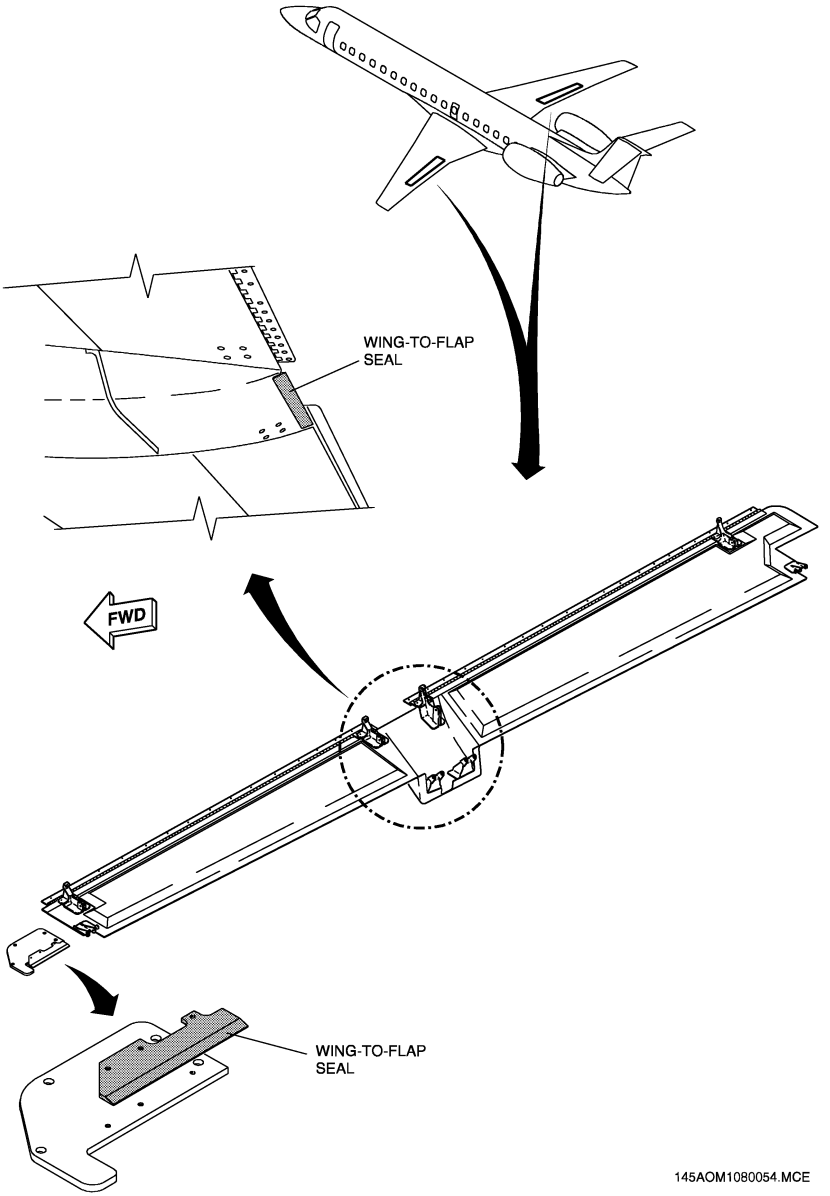

FIGURE 31

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ATA CHAPTER 78 ENGINE EXHAUST

System & Sequence ITEM Number	1.	2. Number installed	3. Number required for dispatch	4. Remarks and/or exceptions
78 ENGINE EXHAUST				
31-1 Plug Inhibition of the Thrust Reversers (Figure 32)		4	0	May be missing with no penalty

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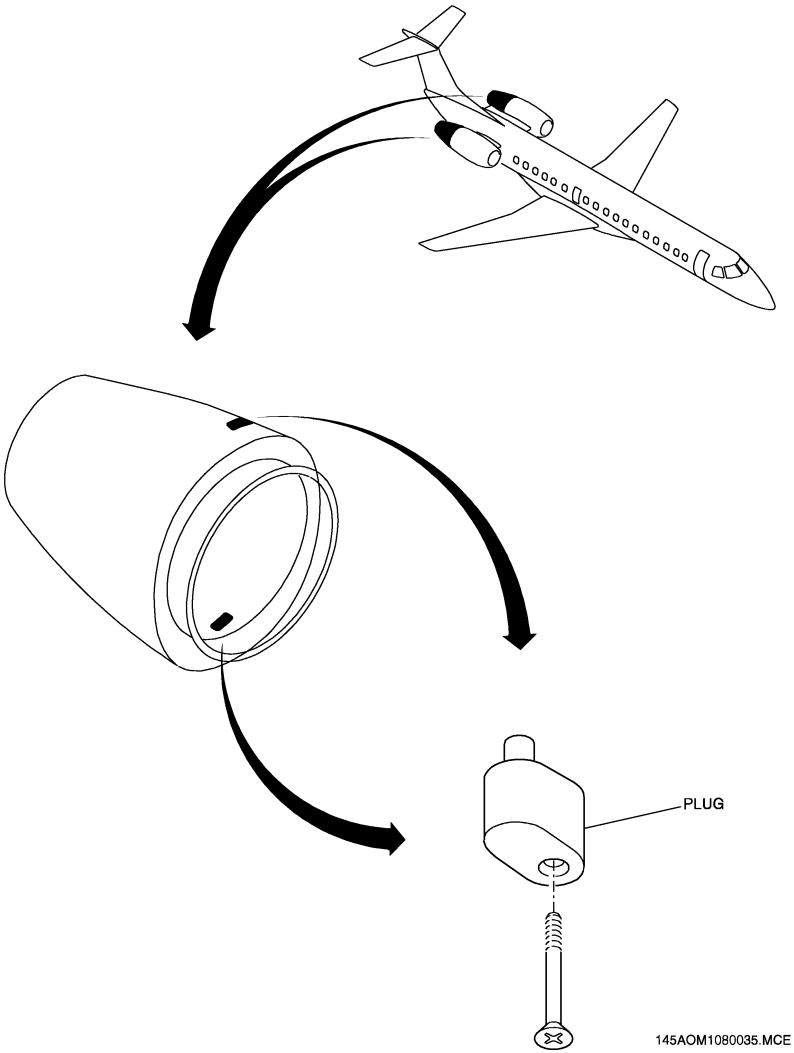

FIGURE 32

SECTION 1-09

DISPATCH DEVIATIONS PROCEDURES MANUAL

This section has been removed from your Airplane Operations Manual. For Dispach Deviations Procedures refer to the publication also named Dispatch Deviations Procedures Manual.

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SECTION 1-10

EMERGENCY INFORMATION

TABLE OF CONTENTS

Page Block

Emergency Equipment 1-10-05
Emergency Equipment Layout (*) 1-10-06
Passenger Oxygen Masks Location (*) 1-10-08
Passenger Floatable Seat and Life Jacket 1-10-10
Fire Extinguisher 1-10-15
Emergency Locator Transmitter (ELT) 1-10-20
Lighting 1-10-25
Oxygen 1-10-25
Navigation and Communication 1-10-25
Least Risk Location (*) 1-10-30
Emergency Exits 1-10-35

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NOTE: Items marked with an asterisk (*) may not be present in this manual.

INTRODUCTION

This Section presents emergency information which may be used, at operators discretion to develop customized emergency procedures. Such procedures may be associated to contingencies not related to the airplane.

Emergency equipment includes those items used during in-flight emergencies (such as first-aid kits and fire extinguishers), and to assist in the airplane evacuation (such as crash hatchet and escape ropes).

The information presented herein is focused on its technical aspects. Being so, it is not mandatory.

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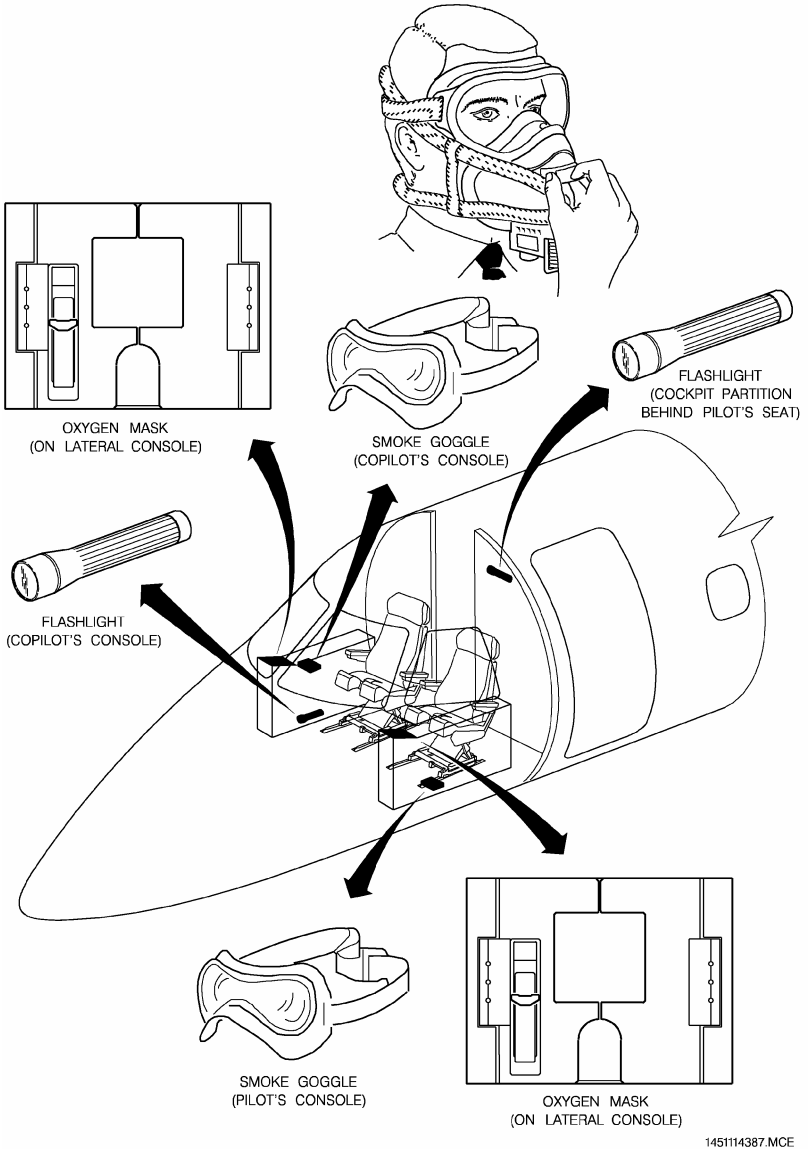
EMERGENCY EQUIPMENT

EMERGENCY EQUIPMENT LOCATION (TYPICAL)



COCKPIT AREA (1 OF 3)

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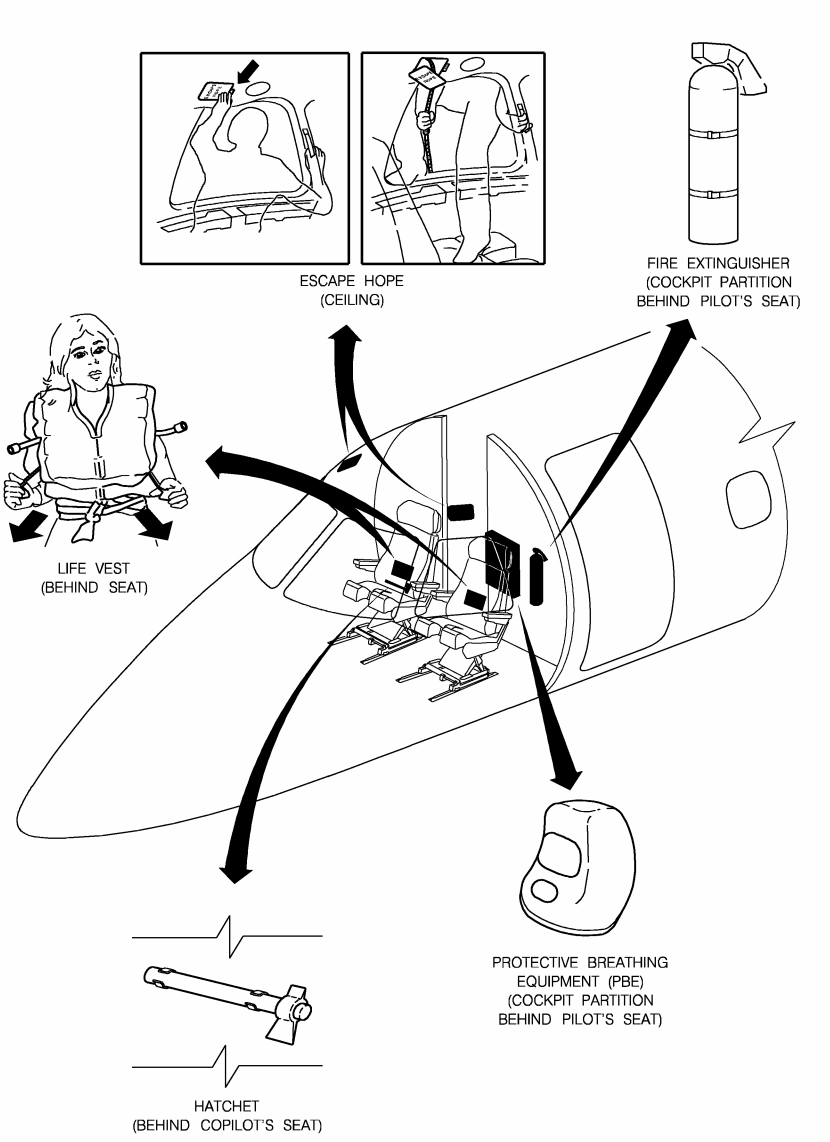

COCKPIT AREA (2 OF 3)

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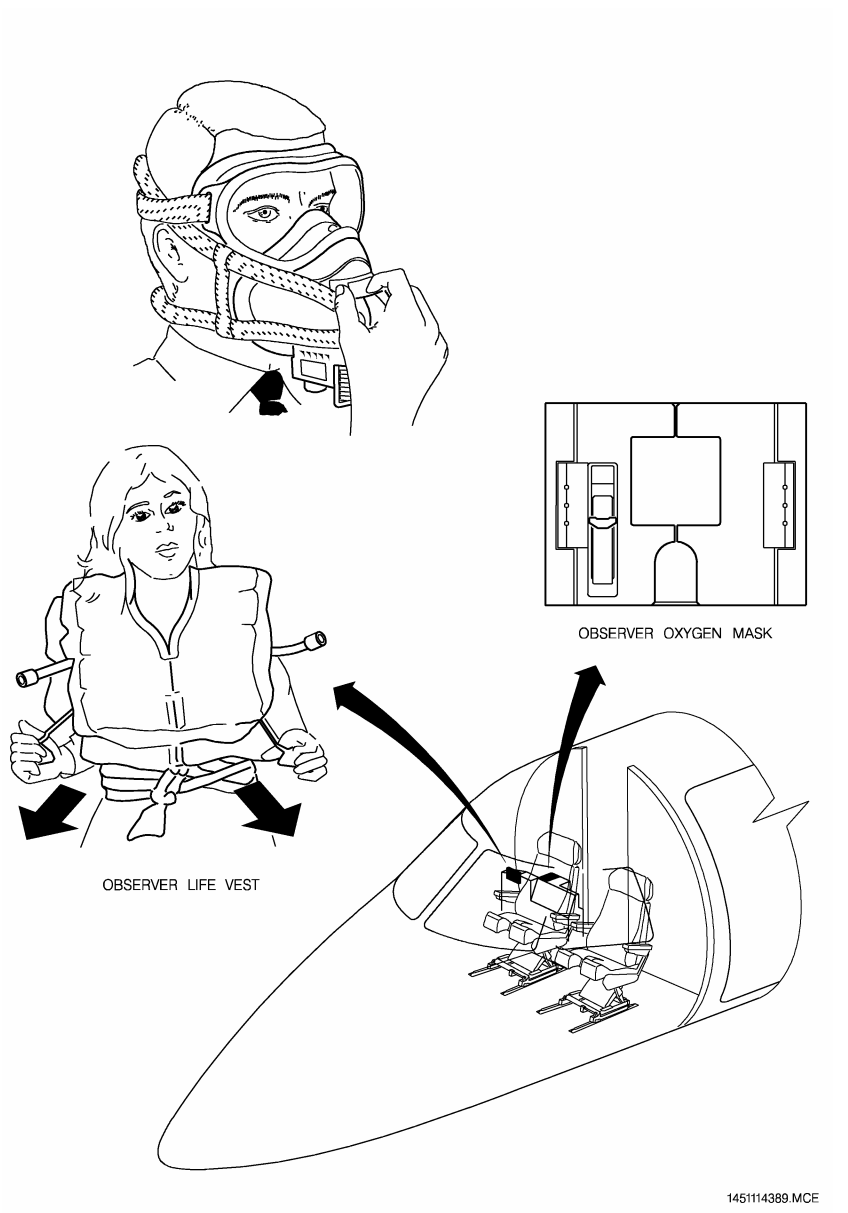
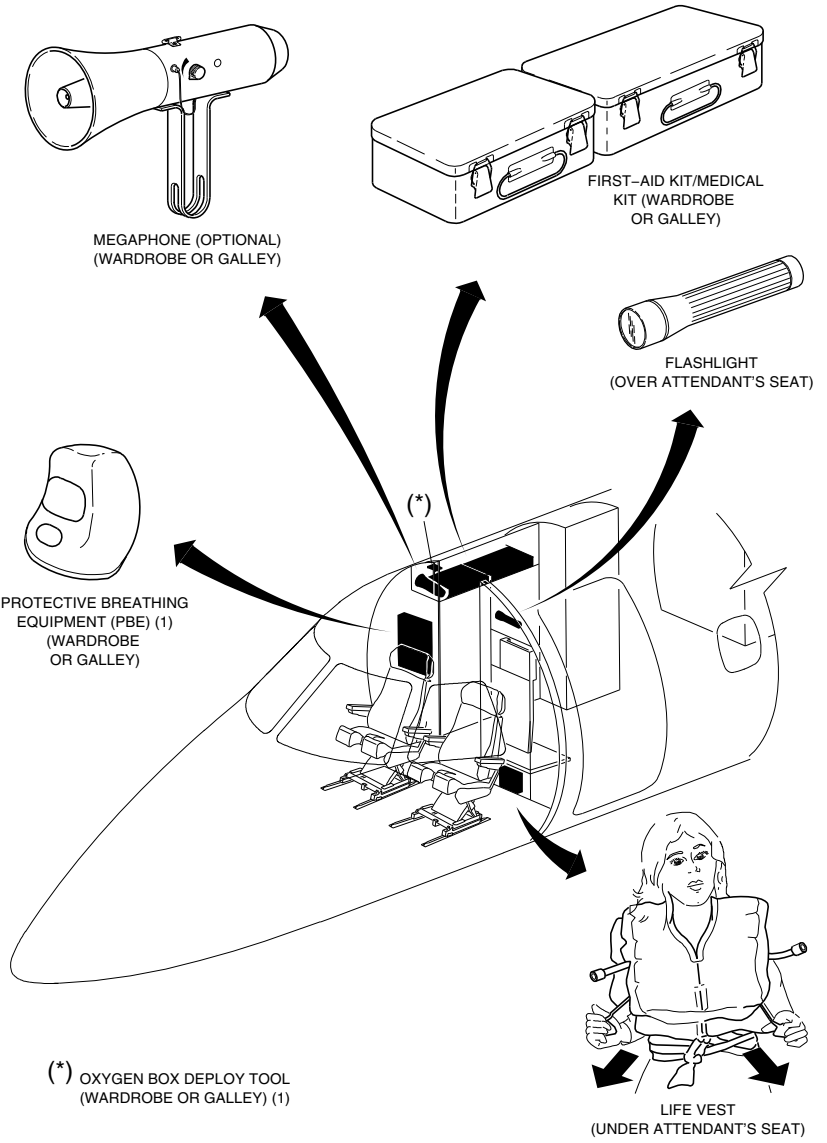


COCKPIT AREA (3 OF 3)



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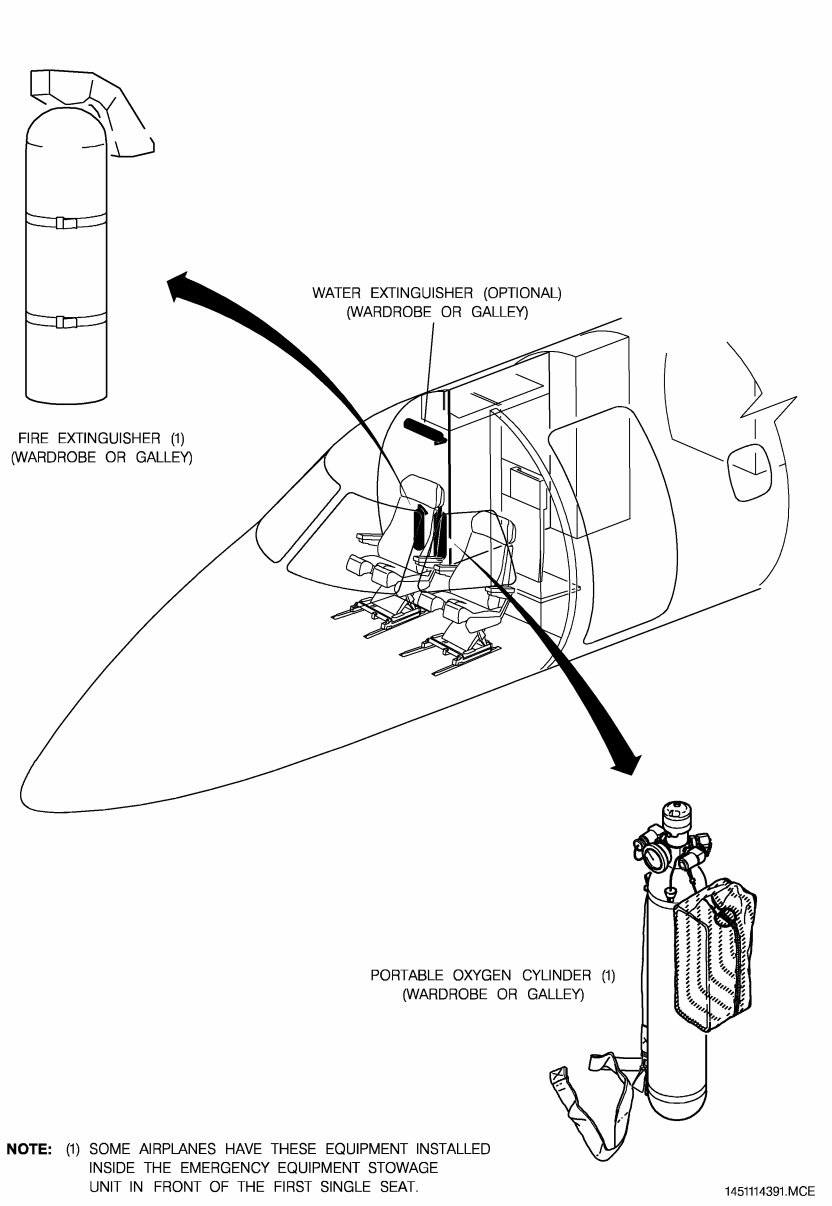
FRONT PASSENGER AREA (1 OF 2)



FRONT PASSENGER AREA (2 OF 2)

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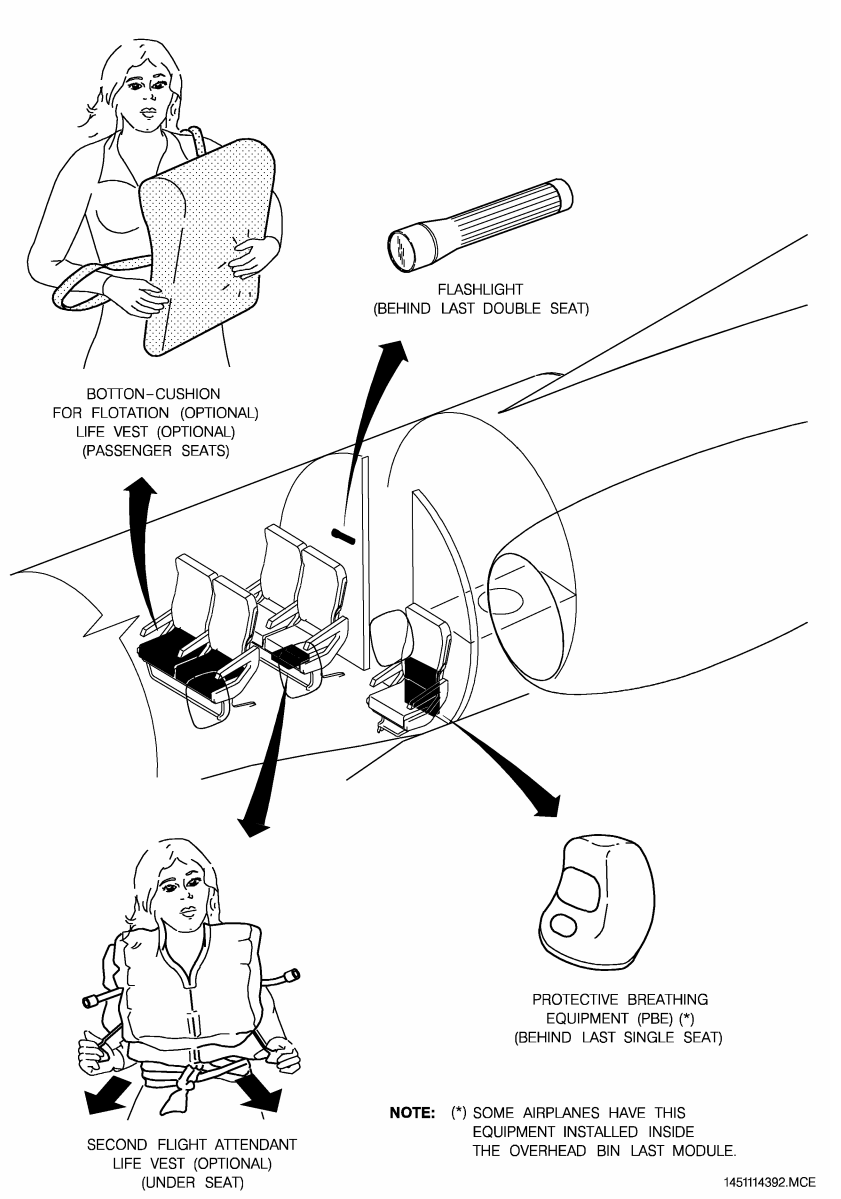

REAR PASSENGER AREA (1 OF 2)

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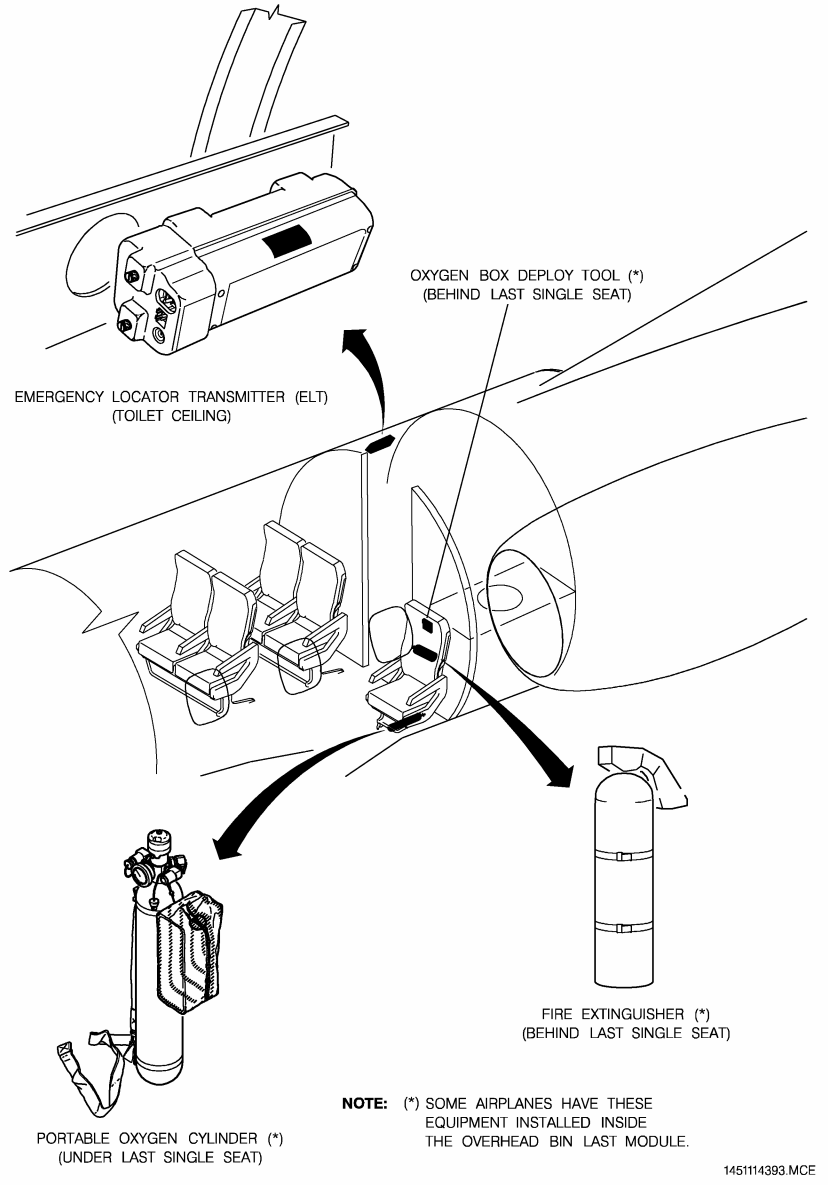

REAR PASSENGER AREA (2 OF 2)

EQUIPMENT CHECKLIST

COCKPIT AREA

Flashlight	CHECK RED LIGHT
Life Vest	ON BOARD
Hatchet	ON BOARD
Smoke Goggle	ON BOARD
Oxygen Mask	CHECK
Protective Breathing Equipment (PBE)	SEALED
Fire Extinguisher	CONDITION

FRONT PASSENGER CABIN AREA

Flashlight	CHECK RED LIGHT
First-Aid Kit	CONDITION
Megaphone (optional)	ON BOARD
Water Extinguisher (optional)	CONDITION
Protective Breathing Equipment (PBE)	SEALED
Fire Extinguisher	CONDITION
Portable Oxygen Cylinder	CONDITION
Oxygen Box Deploy Tool	ON BOARD
Life Vest	ON BOARD

REAR PASSENGER CABIN AREA

Flashlight	CHECK RED LIGHT
Life Vest (optional)	ON BOARD
Portable Oxygen Cylinder	CONDITION
Oxygen Box Deploy Tool	ON BOARD
Protective Breathing Equipment (PBE)	SEALED
Fire Extinguisher	CONDITION

LAVATORY

Fire Extinguisher Bottle	CHECK GREEN RANGE

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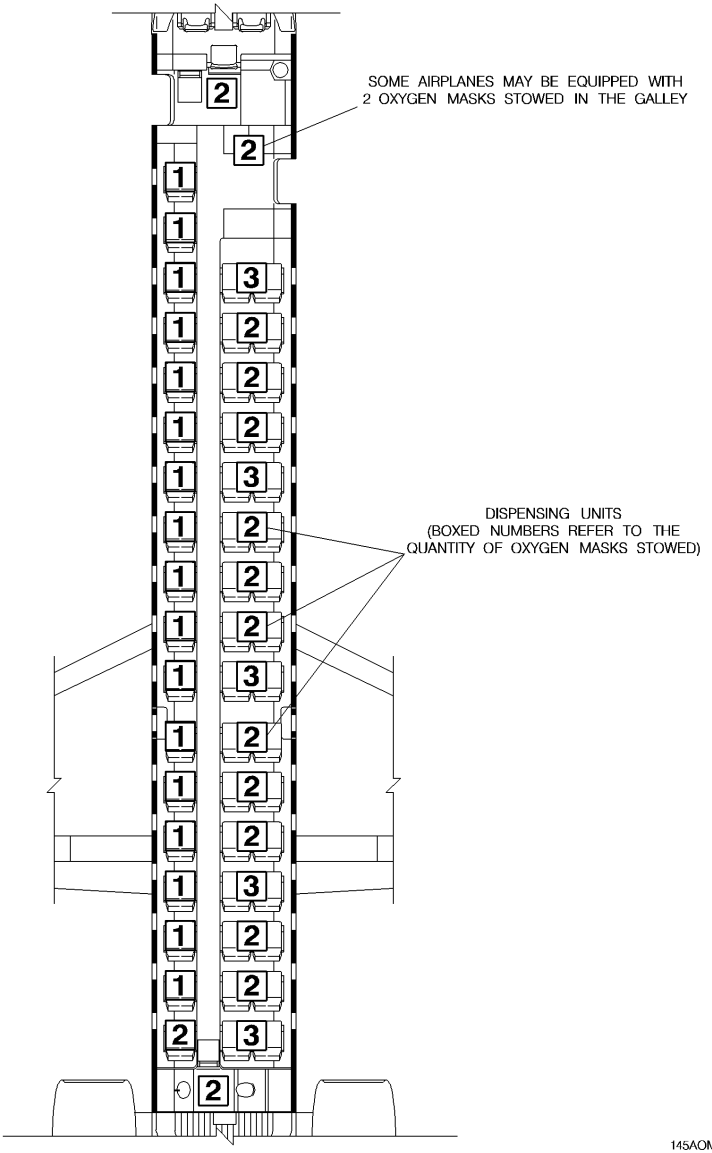
EMB-145 PASSENGER OXYGEN MASKS LOCATION



INTERIOR ARRANGEMENT OPTION 1 (50 SEATS)

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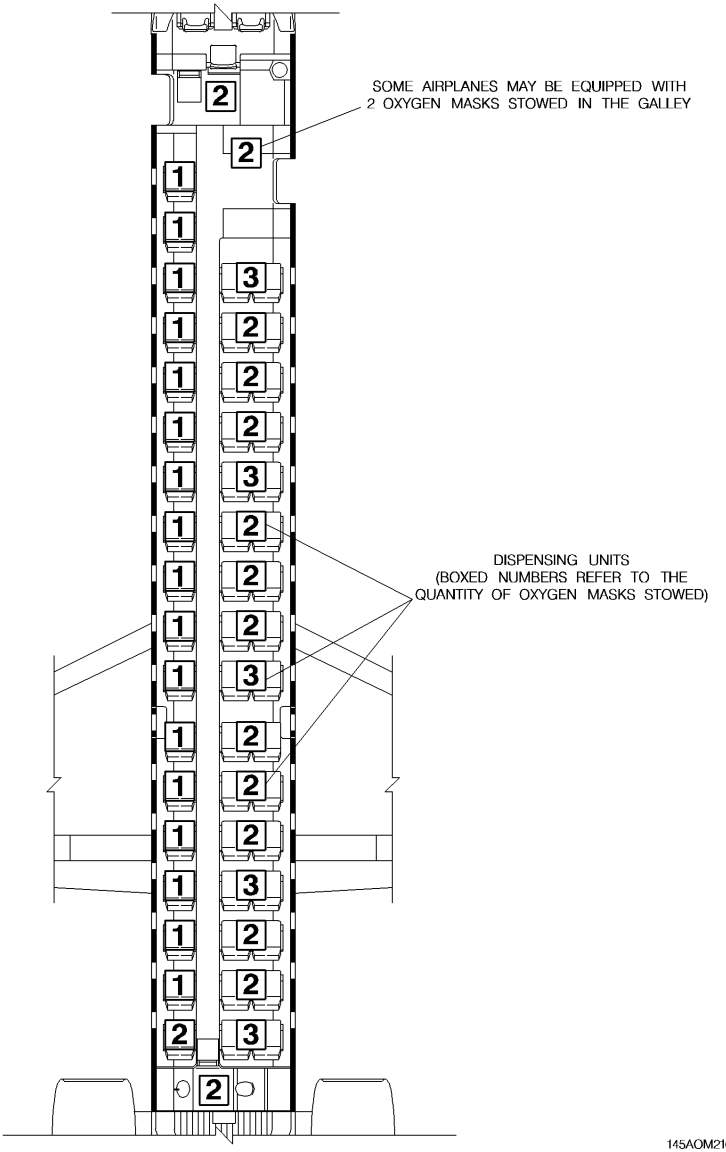

INTERIOR ARRANGEMENT OPTION 2 (50 SEATS)

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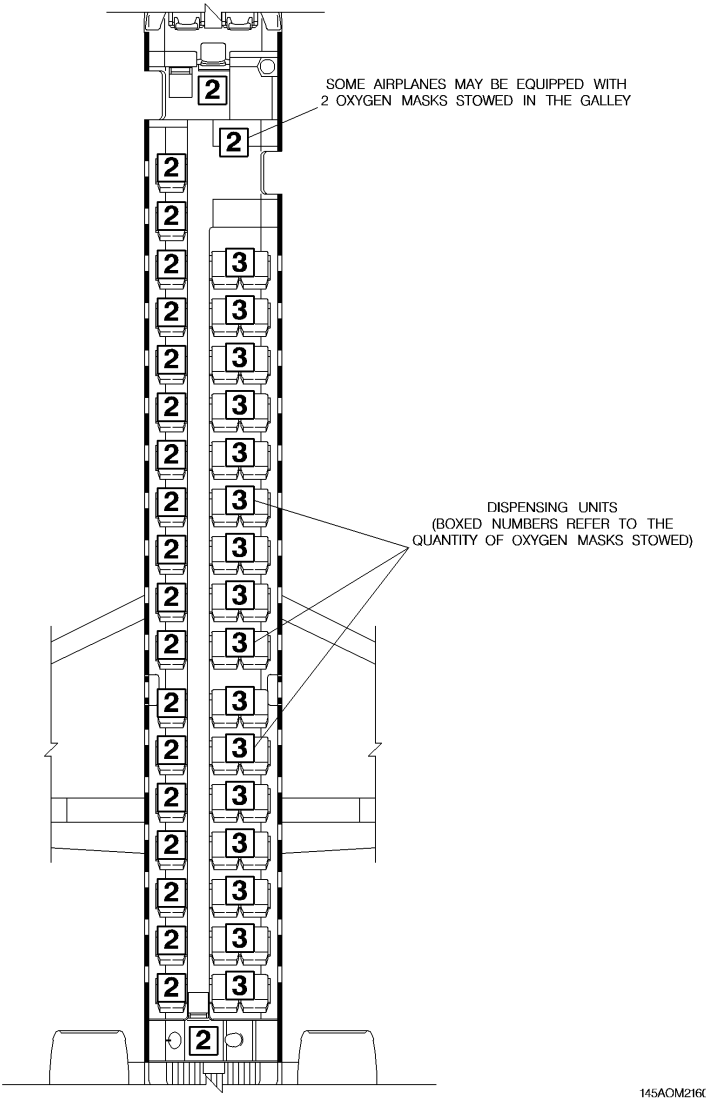

INTERIOR ARRANGEMENT OPTION 3 (50 SEATS)

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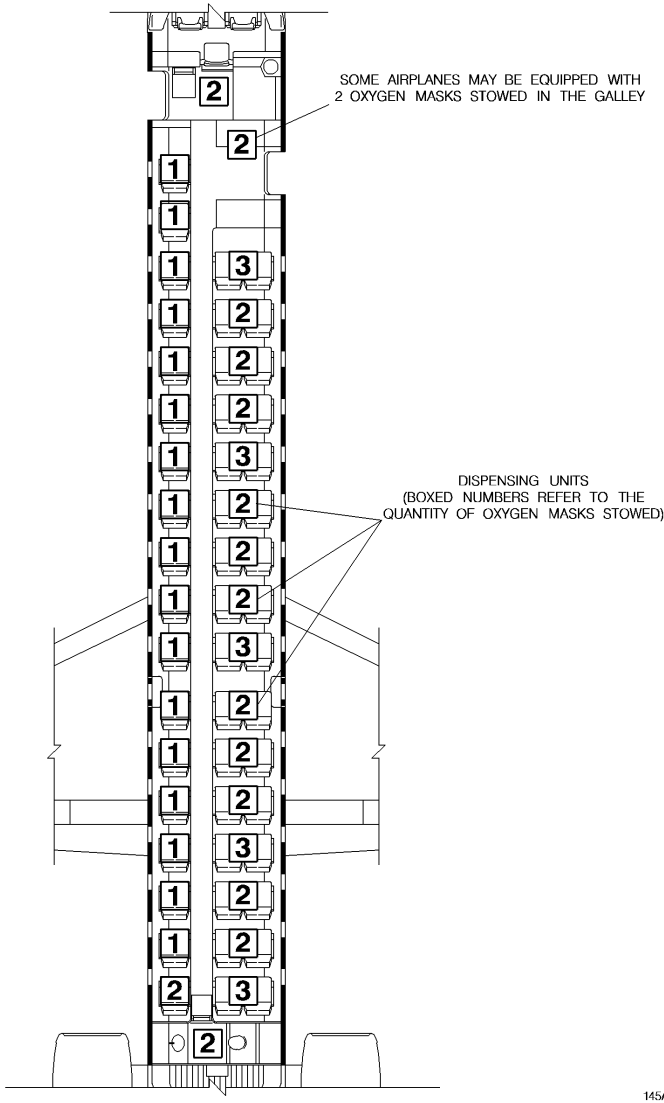

INTERIOR ARRANGEMENT OPTION 3 (50 SEATS)

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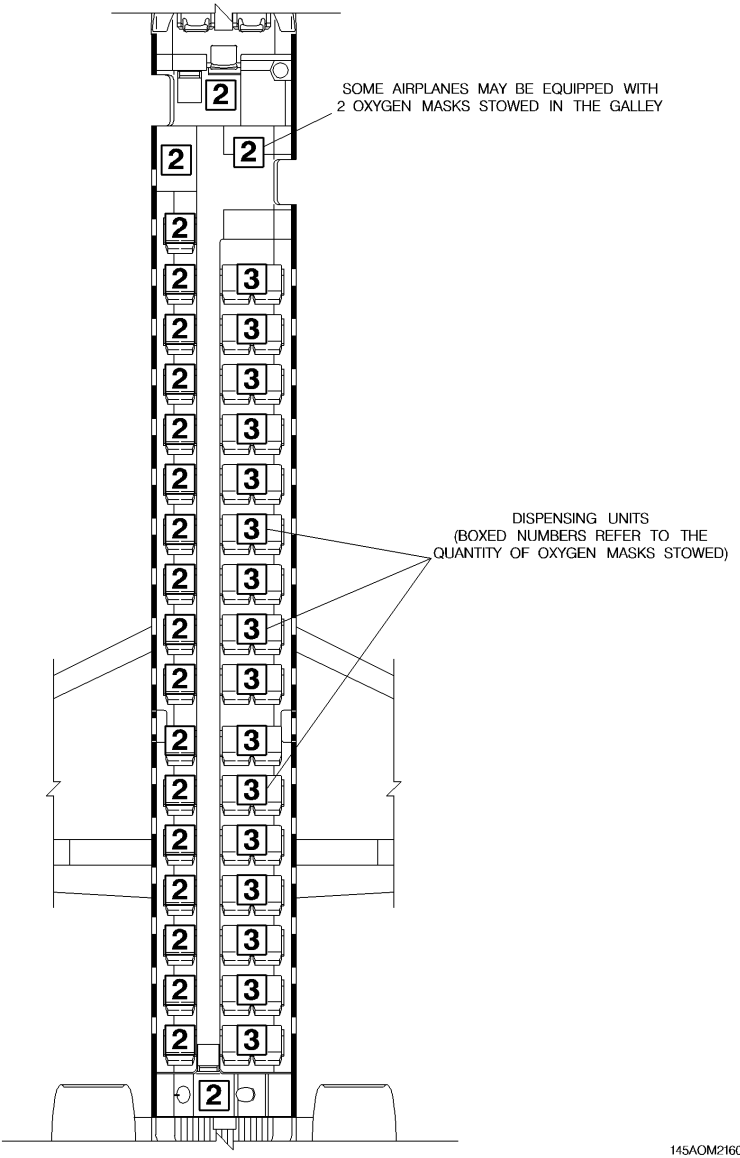

INTERIOR ARRANGEMENT OPTION 4 (49 SEATS)

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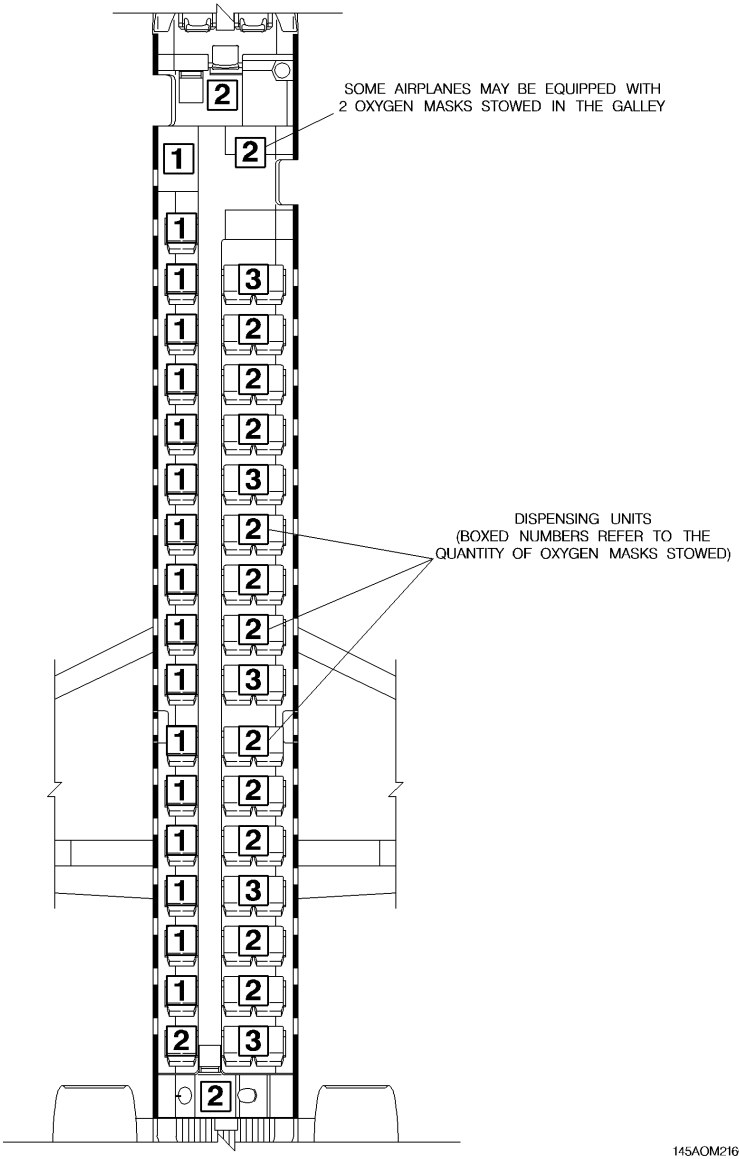

INTERIOR ARRANGEMENT OPTION 4 (49 SEATS)

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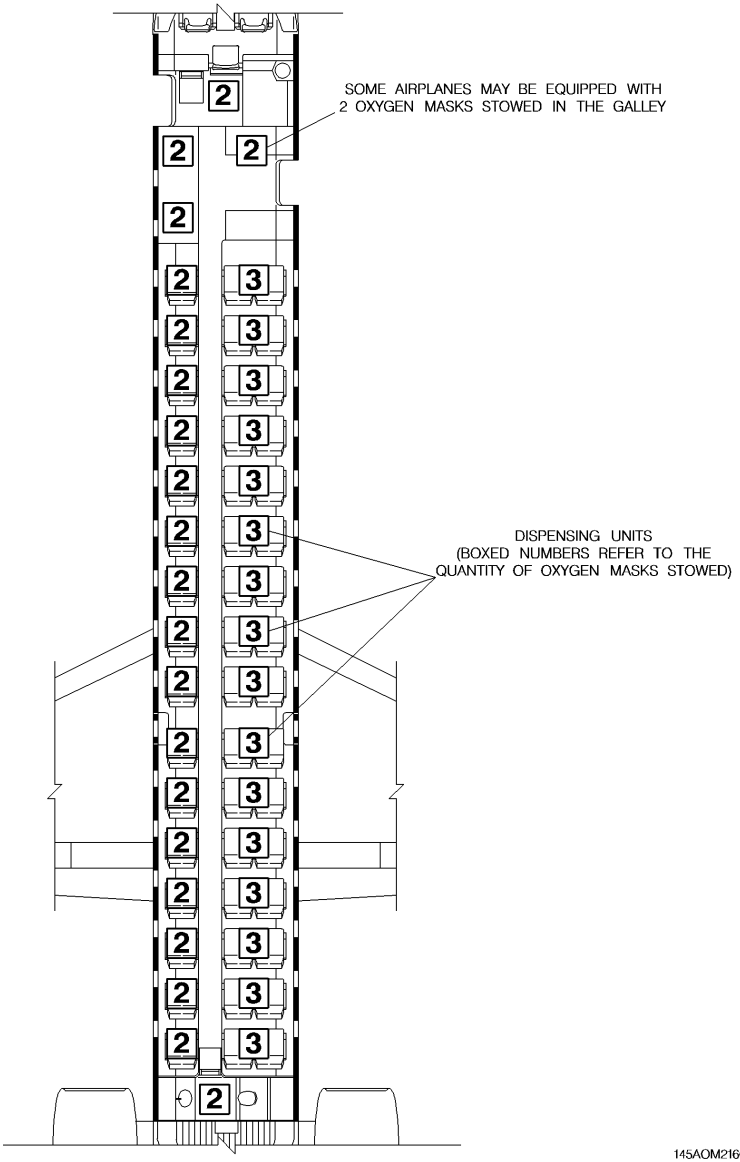

INTERIOR ARRANGEMENT OPTION 5 (48 SEATS)

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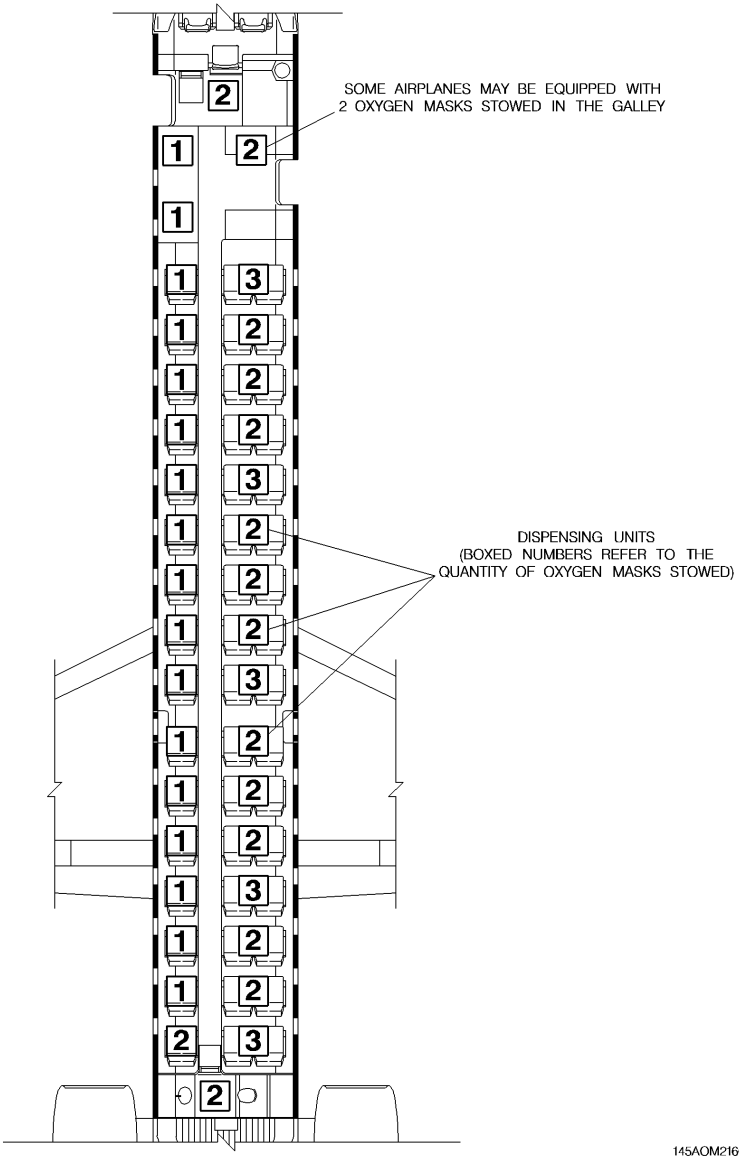

INTERIOR ARRANGEMENT OPTION 5 (48 SEATS)

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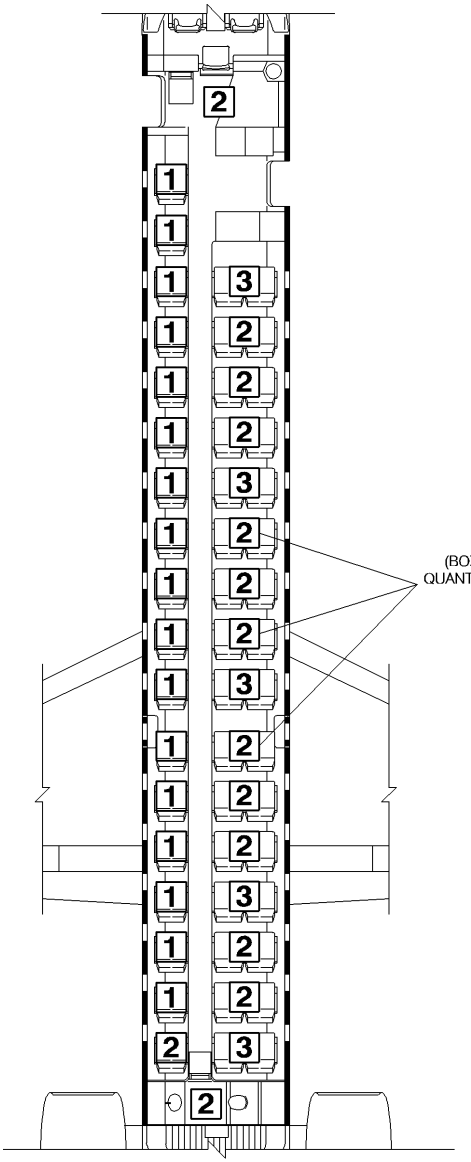

INTERIOR ARRANGEMENT OPTION 6 (50 SEATS)

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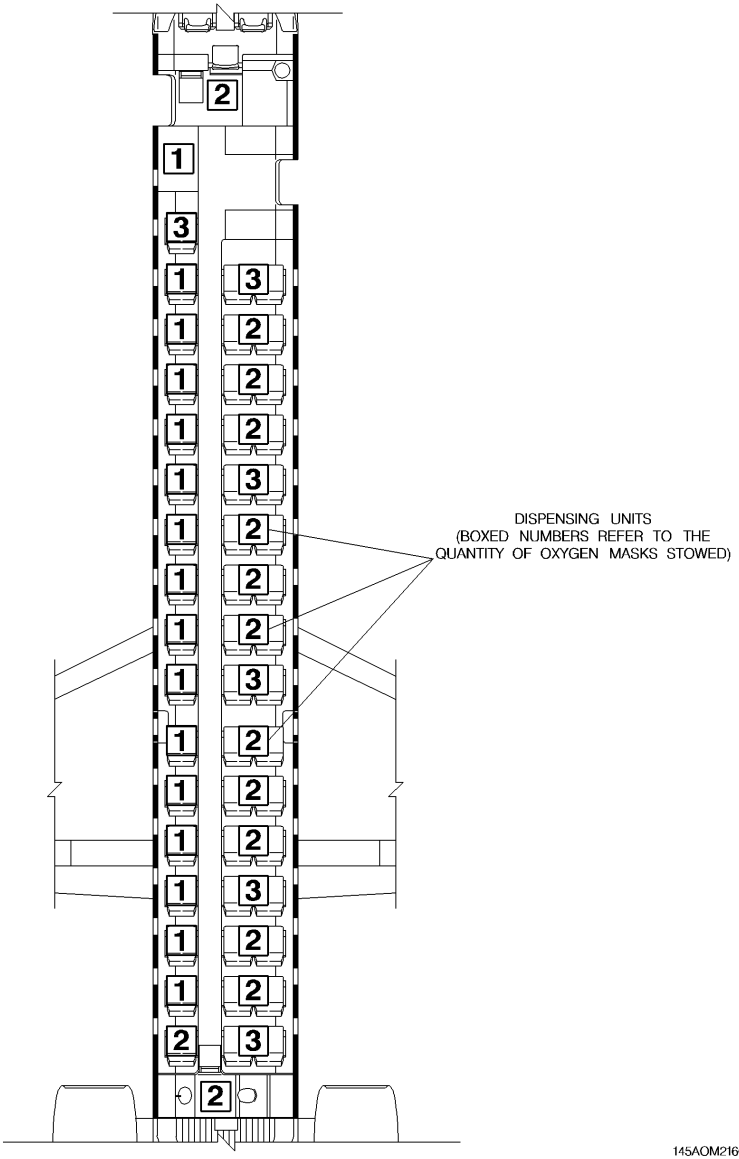

INTERIOR ARRANGEMENT OPTION 4 (49 SEATS)

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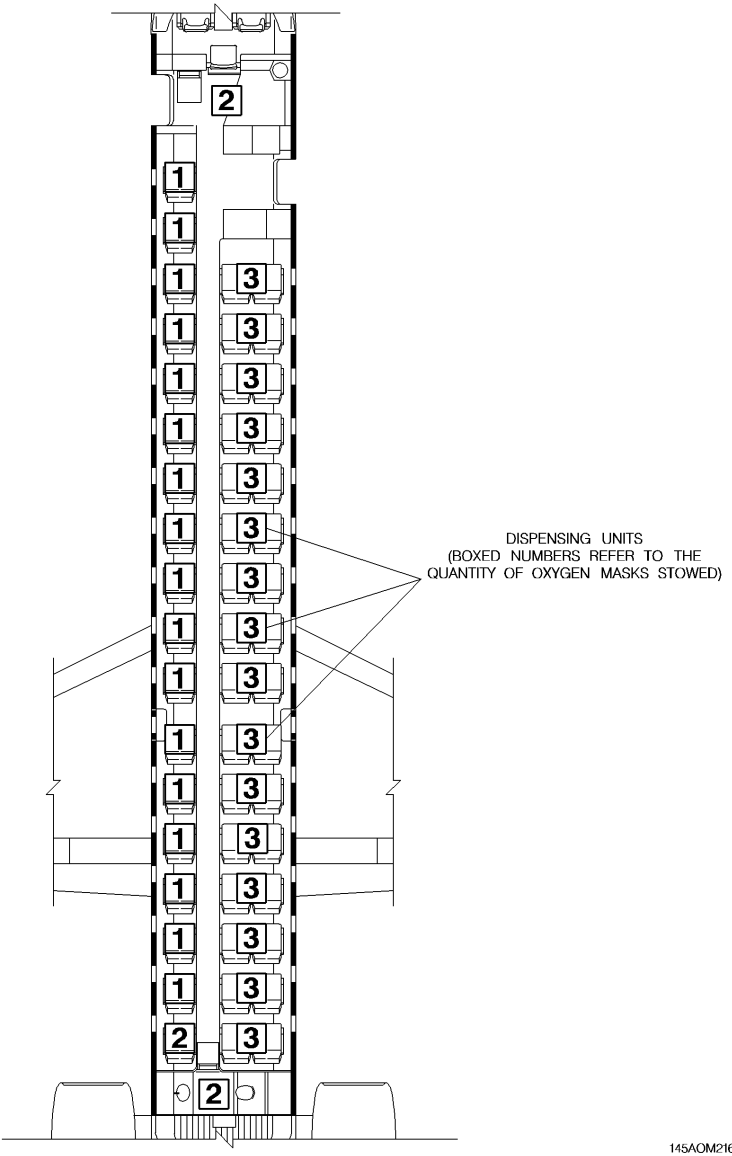

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INTERIOR ARRANGEMENT OPTION 6 (50 SEATS)

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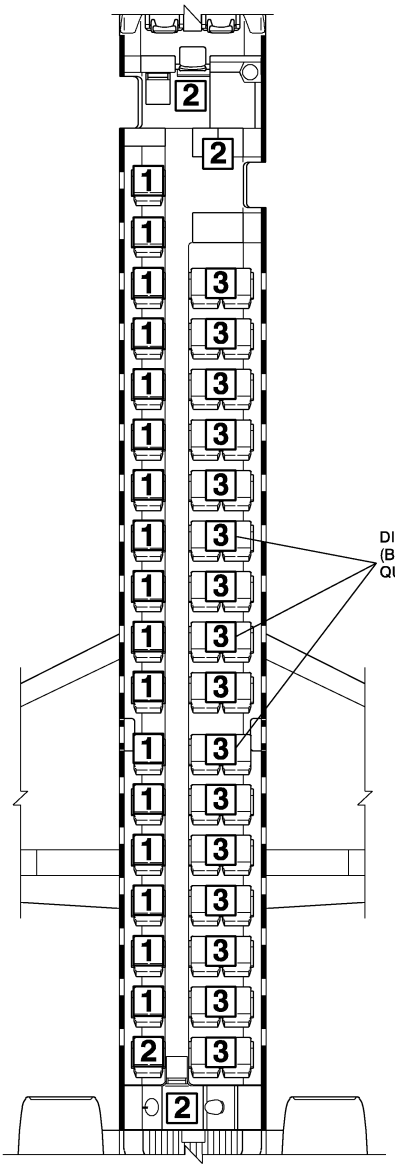

INTERIOR ARRANGEMENT OPTION 1 (50 SEATS)

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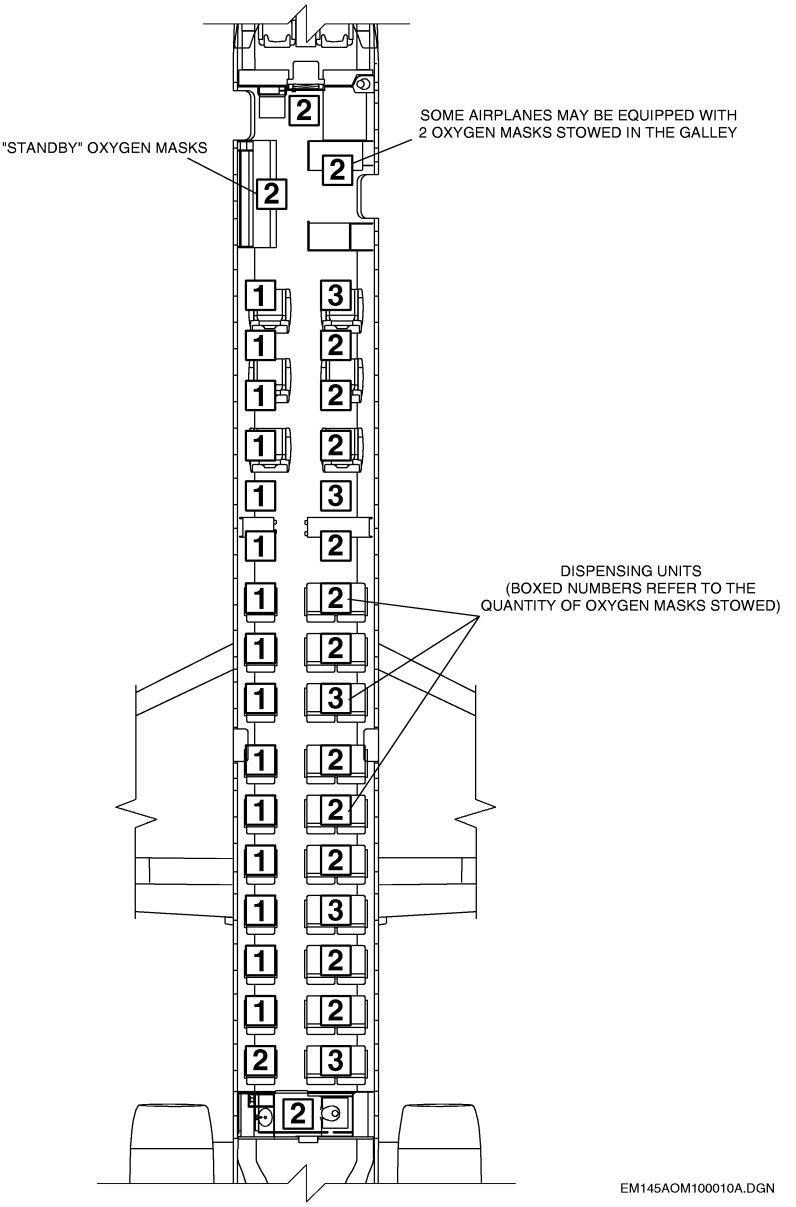

INTERIOR ARRANGEMENT CONFIGURATION FAB VIP (36 SEATS)

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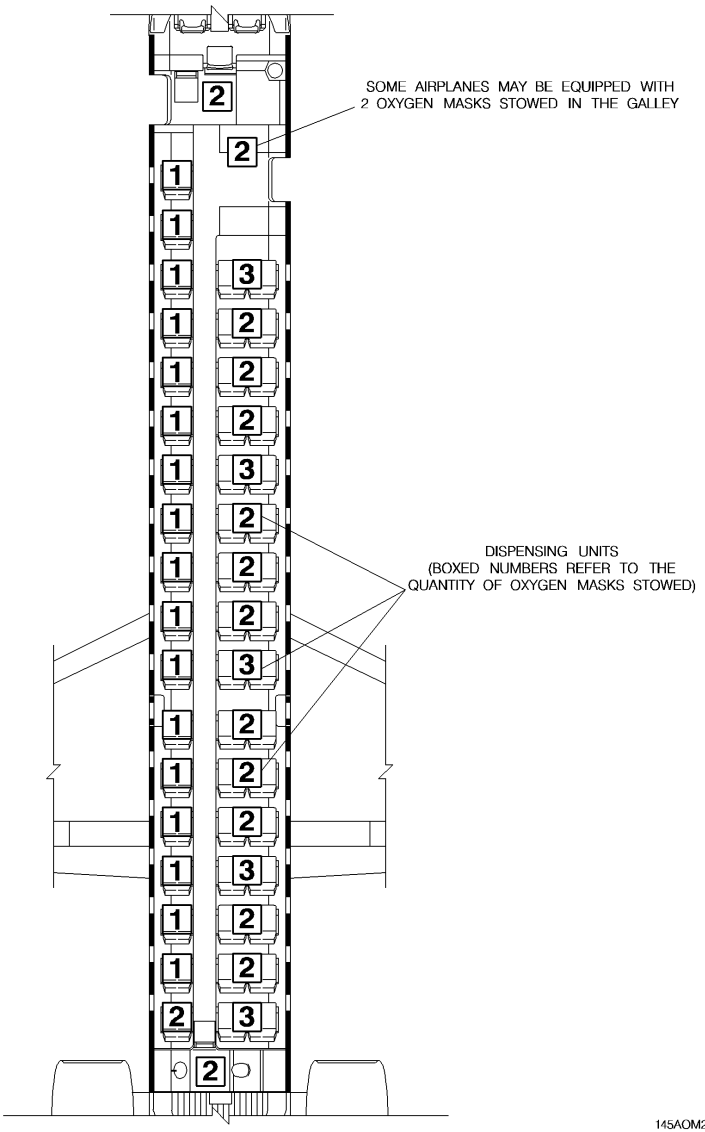

INTERIOR ARRANGEMENT OPTION 6A (50 SEATS)

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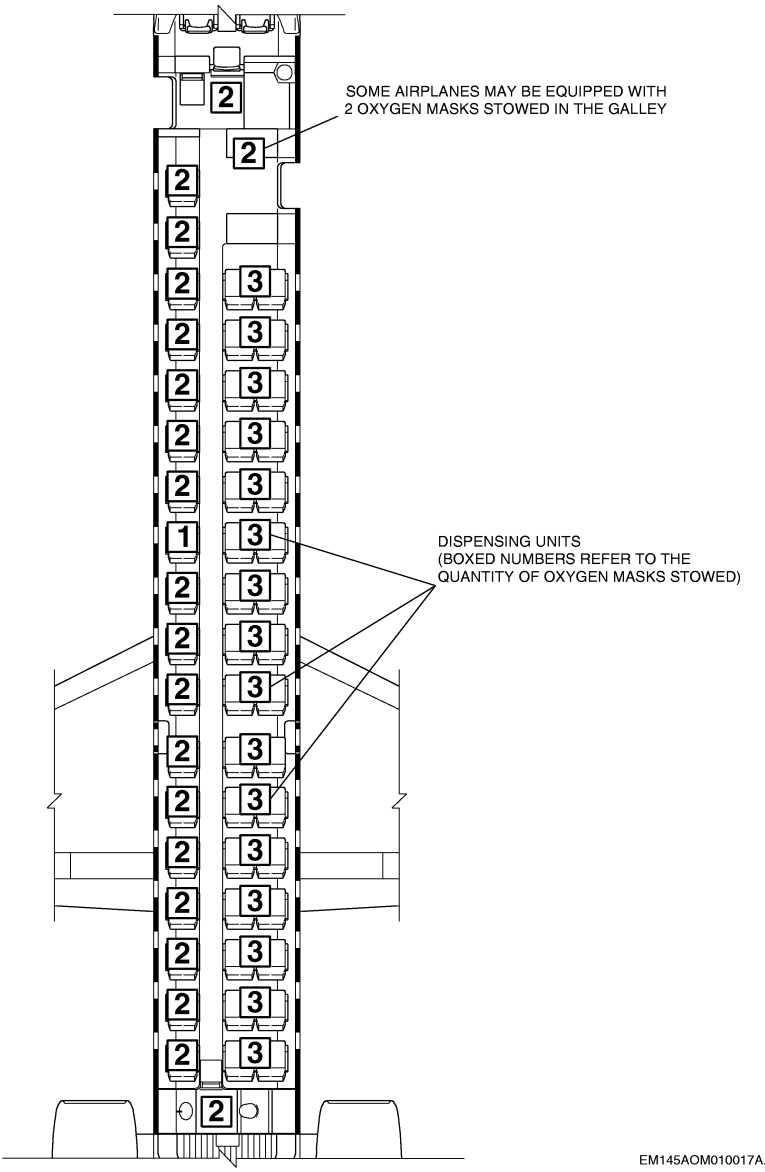

INTERIOR ARRANGEMENT OPTION 3 (50 SEATS)

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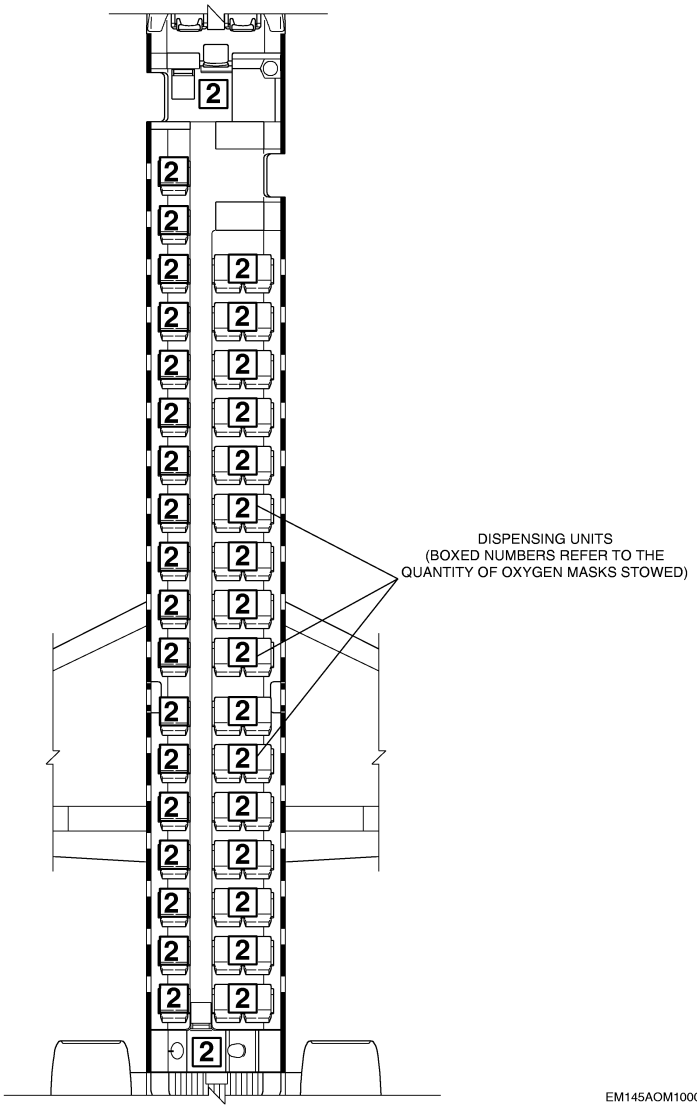

INTERIOR ARRANGEMENT OPTION 2A (50 SEATS)

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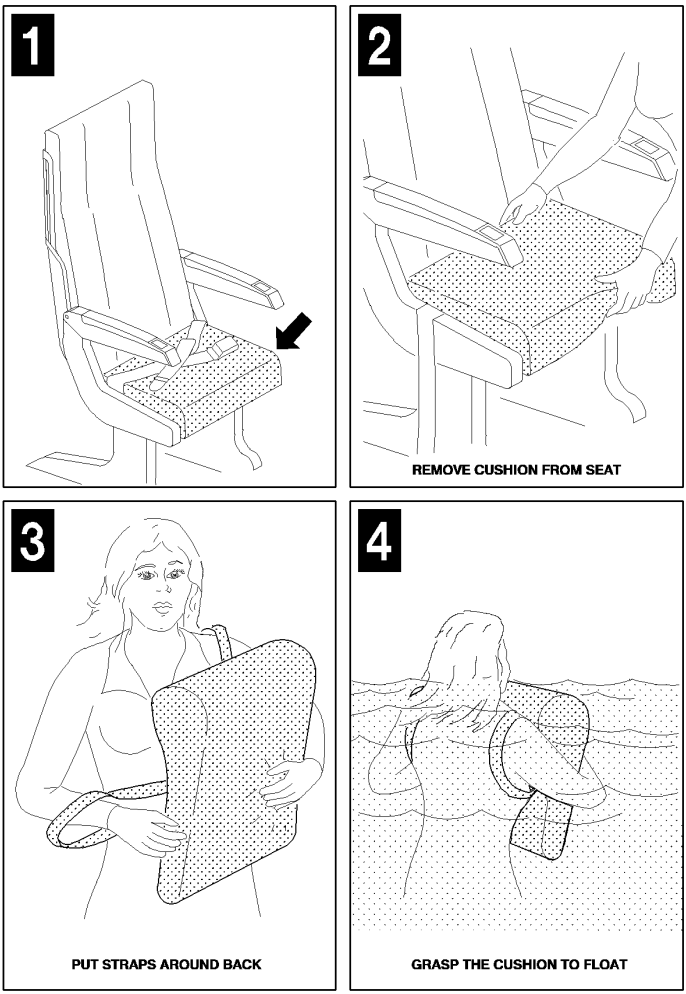
PASSENGER FLOATABLE SEAT AND LIFE JACKET

PASSENGER FLOATABLE SEAT OPERATION



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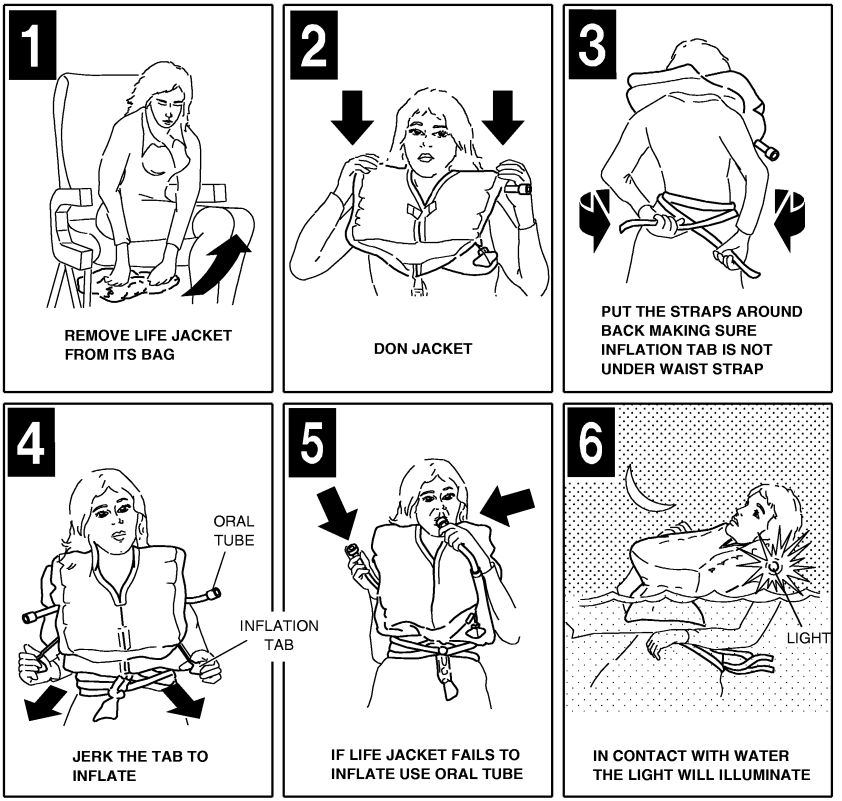
LIFE JACKET OPERATION



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FIRE EXTINGUISHER

HALON FIRE EXTINGUISHER

The Halon fire extinguisher should be used on classes B (oils, greases, flammable liquids) and C (electrical or electronic equipment, live electrical) fire. It is also allowed to be used on class A (paper, wood, fabric, rubber) fires if the cabin configuration permits, according to the fire extinguisher cabin configuration table.

WATER FIRE EXTINGUISHER

The water fire extinguisher is more effective than the Halon against class A (paper, wood, fabric, rubber) fire and should be used only on this class.

CAUTION: DO NOT USE ON ELECTRICAL OR GREASE TYPE FIRE.

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FIRE EXTINGUISHER CABIN CONFIGURATION

	QUANTITY	TYPE	WEIGHT	CLASS
CONFIGURATION 1	2	Halon 1211/1301	2.5 lb	B; C
	or			
	2	Halon 1211	2.5 lb	B; C
CONFIGURATION 2	2	Halon 1211/1301	2.5 lb	B; C
	and			
	1	water based	3.5 lb	A
CONFIGURATION 3	1	Halon 1211/1301	2.5 lb	B; C
	and			
	1	Halon 1211	9.0 lb	A; B; C
CONFIGURATION 4	2	Halon 1211	3.3 lb	B; C
CONFIGURATION 5	2	Halon 1211	3.5 lb	A; B; C
CONFIGURATION 6	1	Halon 1211	2.5 lb	B; C
	and			
	1	Halon 1211	9.0 lb	A; B; C

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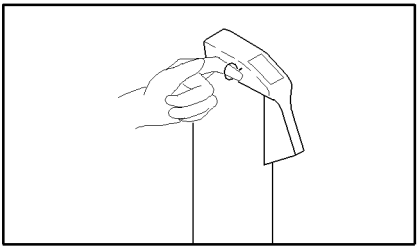
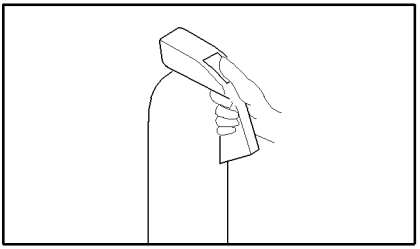
FIRE EXTINGUISHER OPERATION

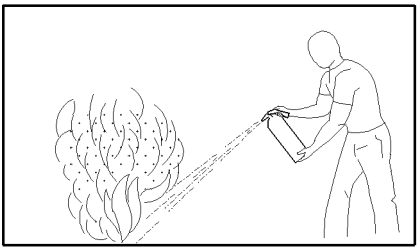


1. UNSNAP "QUICK RELEASE" MOUNTING STRAP AND REMOVE EXTINGUISHER.

2. HOLD UPRIGHT, PULL LOCKING PIN TO UNLOCK SPRAYING LEVER.



3. PRESS LEVER FOR DISCHARGE OPERATION



4. STAND APPROXIMATELLY 2 m (8 ft) AWAY FROM FIRE BEFORE DISCHARGING. AIM DISCHARGE NOZZLE AT FIRE BASE. SPRAY QUICKLY SIDE TO SIDE ACCROSS FIRE WIDTH. MOVE CLOSER AS FIRE IS BEING EXTINGUISHED. DIRECT ALL OF THE DISCHARGING AGENT ONTO THE FIRE AND MAKE SURE THE FIRE IS COMPLETELY EXTINGUISHED.

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Precautions after fire extinguishing:

- Look out for “flashback”;
- Ventilate the compartment as promptly as possible.

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EMERGENCY LOCATOR TRANSMITTER (ELT)

ELT 110-4 MODEL

The ELT 110-4 Model, when activated, transmits a radio signal on frequencies of 121.5 and 243.0 MHz, to facilitate airplane location during search and rescue operations.

The system comprises a transmitter with an ON/OFF switch and an impact switch installed in the lavatory right ceiling panel, an antenna located on the top rear and a remote panel located on the cockpit.

ELT may be manually or automatically activated. In both cases a red light flashes on the cockpit panel to indicate the ELT activation.

Manual activation may be performed when any switch is set to ON position.

Automatic activation occurs when the transmitter switch is set to OFF position, the cockpit switch is set to ARM position and the airplane suffers a deceleration greater than 5 g's.

In both cases (manual and automatic activation) the pilot may deactivate the ELT, performing the TEST/RESET function.

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CONTROLS AND INDICATORS

REMOTE PANEL

1 - ELT ALERT LIGHT (red)

– Flashes when the ELT is transmitting.

2 - ELT SWITCH (guarded)

ON - Activates the ELT.

ARM - Allows the ELT to be automatically activated.

NOTE: - The TEST/RESET function is provided by pressing ON, waiting 1 second and then pressing ARM.

- RESET function allows ELT deactivating, after a manual or automatic activation.

- During TEST/RESET function, the ELT alert light flashes to indicate that the system is transmitting.

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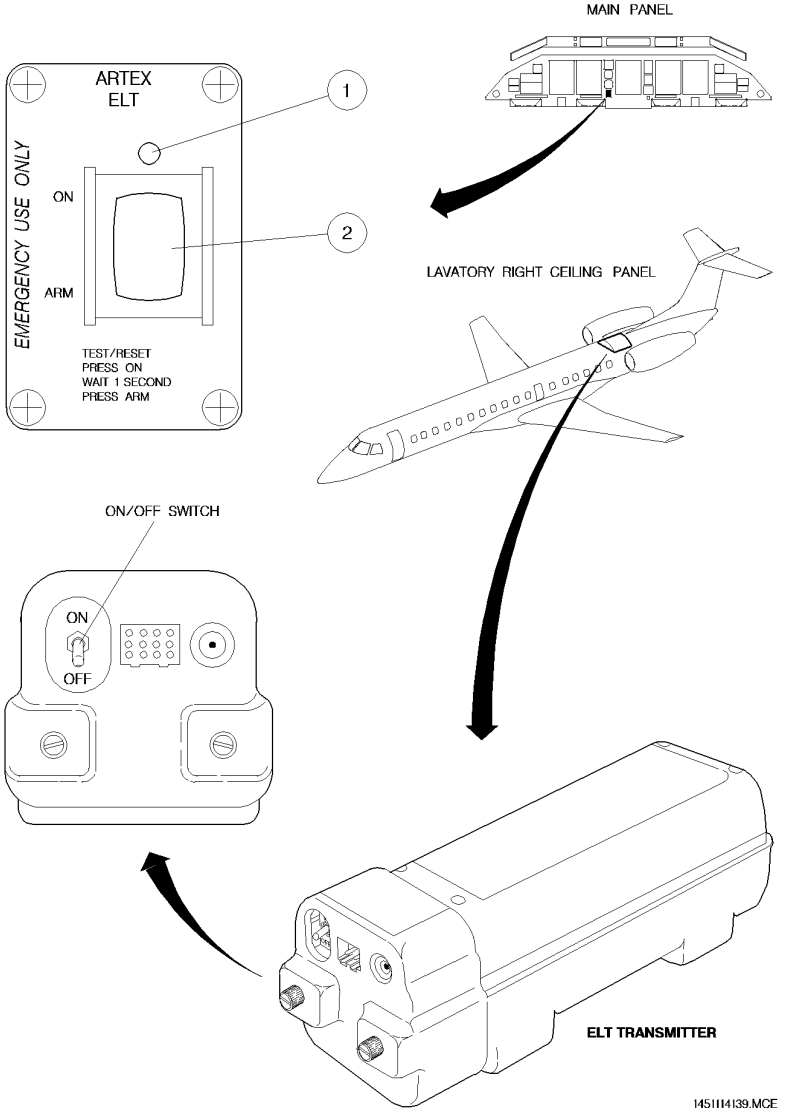

ELT 110-4 MODEL

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EMERGENCY LOCATOR TRANSMITTER (ELT)

ELT 96 MODEL (OR ELT 97 MODEL)

The ELT 96 Model (or ELT 97 Model), when activated, transmits a radio signal on frequencies of 121.5 MHz, 243.0 MHz and 406.0 MHz, to facilitate airplane location during search and rescue operations.

The system comprises a transmitter, which also can be used in a portable mode, and an impact switch installed in the lavatory right ceiling panel, an antenna located on the top rear and a remote panel located on the cockpit.

ELT may be manually or automatically activated. In both cases a red light flashes on the cockpit panel to indicate the ELT activation, provided the portable mode is not removed for ground operation.

Manual activation may be performed either through the ELT front panel switch or remote switch in cockpit, in both cases setting the switch to MAN position.

Automatic activation occurs when the ELT switch and the remote control switch are set to AUTO position and airplane suffers a deceleration as a function of acceleration/time conditions.

In both cases (manual and automatic activation) the pilot may deactivate the ELT, performing the AUTO TEST/RESET function.

PORTABLE MODE OPERATION

To operate the ELT 96 or the ELT 97 in portable mode, perform the following procedures:

- Release the quick-opening fireproof fasteners to remove the ELT from its compartment.
- Disconnect the fixed antenna coaxial plug from the ANT connector.
- Release the auxiliary antenna from its attaching clips and connect it to the ANT connector.
- Set the switch to MAN/RESET position.
- Hold or install the ELT vertically, preferably in a cleared area and as high as possible.

NOTE: When using in temperatures below freezing, keep ELT inside your jacket with antenna outside for longest operations life.

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CONTROLS AND INDICATORS

REMOTE PANEL

1 - ELT ALERT light (red)

- Flashes when the ELT is transmitting.

2 - ELT SWITCH

MAN - Activates the ELT.
AUTO - Allows the ELT to be automatically activated.

3 - AUTO TEST/RESET button

- When pressed allows the ELT to be checked.

  NOTE: The ELT test must be performed only pressing the AUTO TEST/RESET Button.

- During AUTO TEST/RESET function, the ELT alert light illuminates during 2 seconds.
- If a failure is detected during the test, the ELT alert light flashes. For confirmation repeat the operation. If the failure persists set the ELT Switch on transmitter panel to OFF position and report to the maintenance personnel.
- Reset function allows deactivating the ELT, after a manual or automatic activation.

TRANSMITTER PANEL

1 - ELT ALERT LIGHT (red)

- Flashes when the ELT is transmitting.

2 - ELT SWITCH

MAN/RESET - Activates the ELT. Reset function allows deactivating the ELT after a automatic activation.
AUTO - Enables the remote control to automatic operation.
OFF - Deactivates de ELT.

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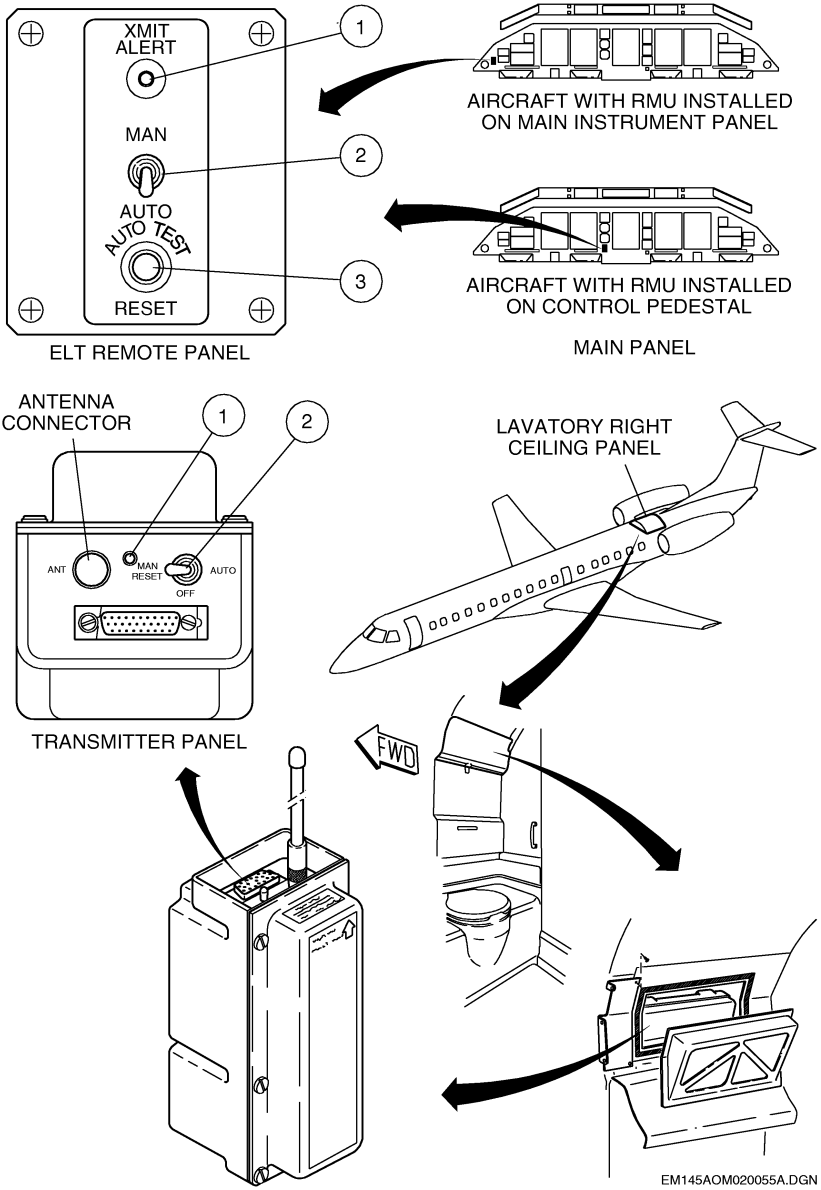

ELT 96 AND 97 MODELS

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EMERGENCY LOCATOR TRANSMITTER (ELT)

ELT C406-2 MODEL

The ELT C406-2 Model, when activated, transmits a radio signal on frequencies of 121.5 and 243.0 MHz, and every 50 seconds, for 520 milliseconds (long message protocol), the transmitter turns on, using the 406.025 MHz frequency, to facilitate airplane location during search and rescue operations.

During 406.025 MHz time an encoded digital message is sent to the satellite. The information contained in that message is shown below:

- Serial number of the transmitter or aircraft ID;
- Country code;
- ID code;
- Position coordinates (when connected to an ARTEX ELT/NAV interface unit).

The system comprises a transmitter with an ON/OFF switch and an impact switch installed in the lavatory right ceiling panel, an antenna located on the top rear and a remote panel located on the cockpit.

ELT may be manually or automatically activated. In both cases a red light flashes on the cockpit panel to indicate the ELT activation.

Manual activation is performed by setting the ON/OFF switch to the ON position.

Automatic activation occurs when the transmitter switch is set to OFF position, the cockpit switch is set to ARM position and the airplane suffers a deceleration greater than 5 g's.

In both cases (manual and automatic activation) the pilot may deactivate the ELT by performing the TEST/RESET function.

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CONTROLS AND INDICATORS

REMOTE PANEL

1 - ELT ALERT LIGHT (RED)

– Flashes when the ELT is transmitting.

2 - ELT SWITCH (GUARDED)

ON - Activates the ELT.
ARM - Allows the ELT to be automatically activated.

NOTE: - The TEST/RESET function is provided by pressing ON, waiting 1 second and then pressing ARM.
- RESET function allows ELT deactivating, after a manual or automatic activation.
- During TEST/RESET function, the ELT alert light flashes to indicate that the system is transmitting.

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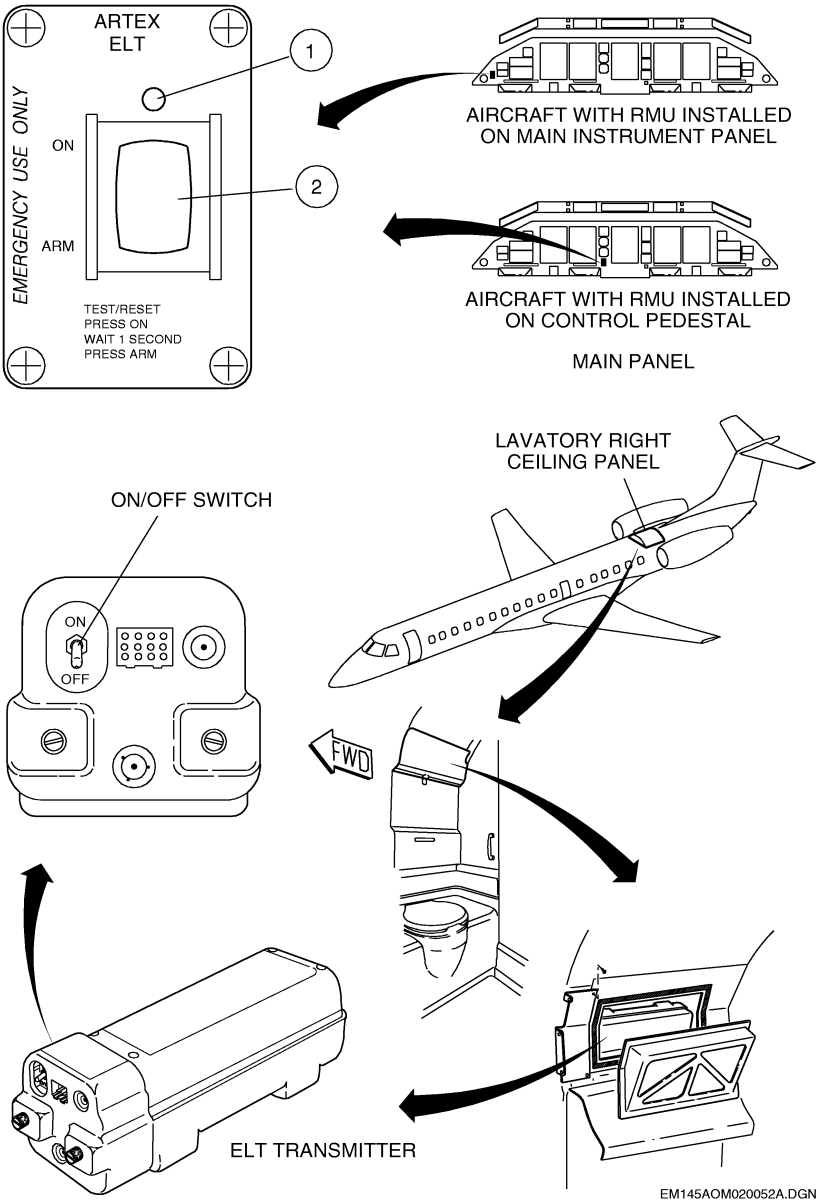

ELT C406-2 MODEL

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LIGHTING

Refer to AOM - VOLUME 2 - Section 2-6 - LIGHTING.

OXYGEN

Refer to AOM - VOLUME 2 - Section 2-16 - OXYGEN.

NAVIGATION AND COMMUNICATION

Refer to AOM - VOLUME 2 - Section 2-18 - NAVIGATION AND COMMUNICATION.

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LEAST RISK LOCATION

The place inside airplane cabin where structural or system damages are the least likely to jeopardize flight safety is the third overhead bin from front of the cabin. A noteworthy system located near this point is the chemical oxygen generator.

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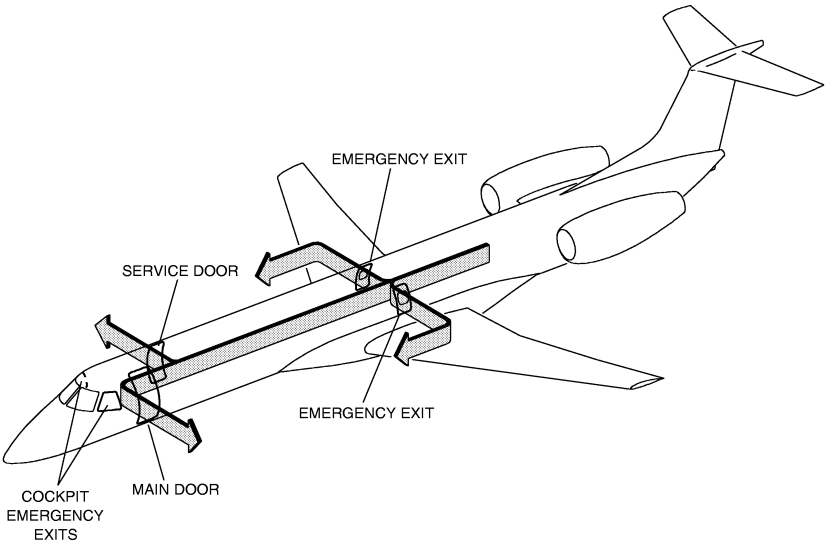
EMERGENCY EXITS

There are two forward doors (main and service), two overwing exits and two cockpit windows, one each side, that can be used for emergency evacuation.



DOORS AND EXITS LOCATION

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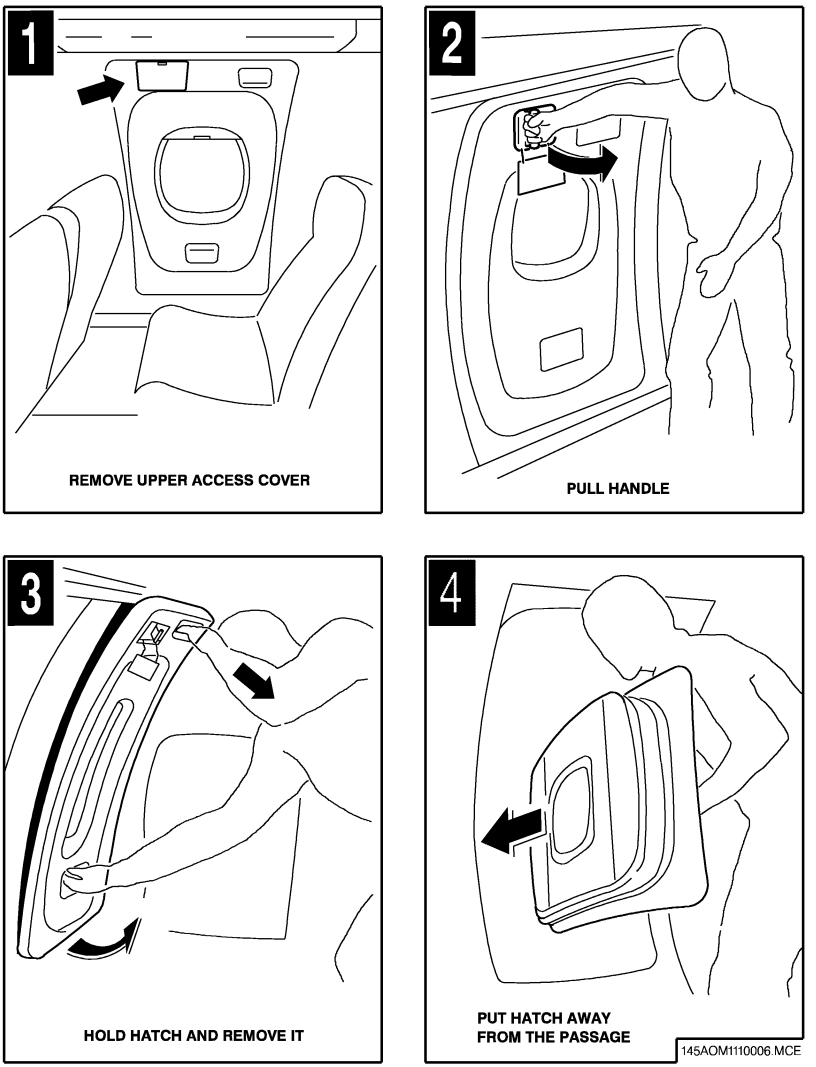
EMERGENCY OVERWING EXITS

Two emergency exit hatches exist for passenger evacuation in the event of an emergency. They are located one on each side of the airplane, centered over the wings.



EMERGENCY EXIT OPERATION (INSIDE CABIN)

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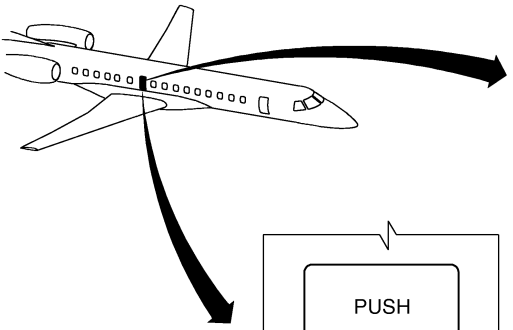
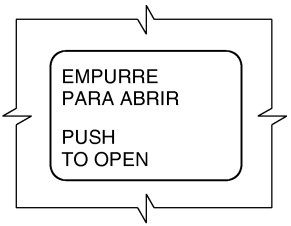
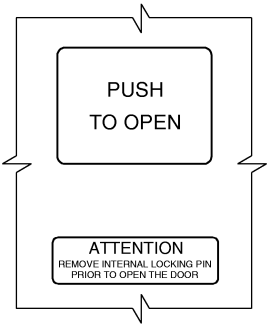




PRE–MOD SB 145–52–0040



POST–MOD SB 145–52–0040

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EMERGENCY EXIT OPERATION (OUTSIDE CABIN)

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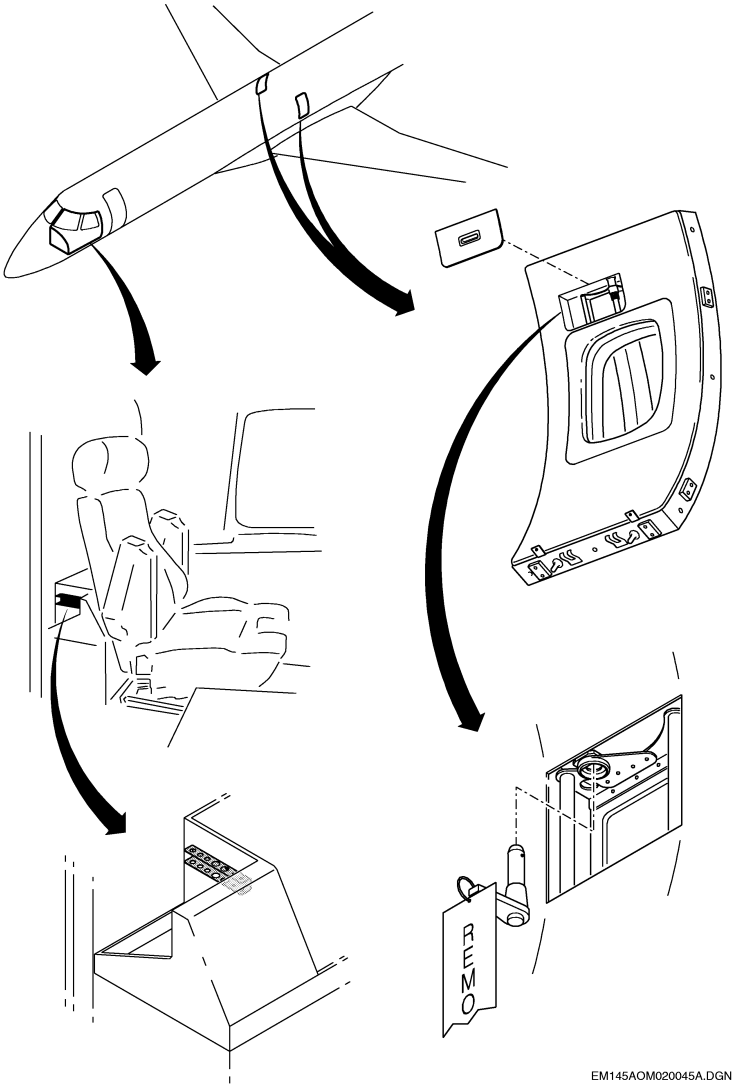
For airplanes Post-Mod. SB 145-52-0040, Part I and III, or equipped with an equivalent modification factory incorporated, the emergency exit hatches can be locked with locking pins.

On ground, at pilot discretion, the pins can be used but it must be removed and guarded in the quick-release pin support, in the LH cockpit rear console, behind the pilot seat, before any flight.



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EMERGENCY EXIT OPERATION

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SECTION 1-11

EMERGENCY EVACUATION

TABLE OF CONTENTS

Page Block
Emergency Evacuation Procedure..... 1-11-05
Doors and Exits..... 1-11-40
Emergency Rescue Charts 1-11-45

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

INTRODUCTION

This Section presents information which may be used, at operators discretion, to develop customized evacuation procedures.

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EMERGENCY EVACUATION PROCEDURE

CAPTAIN

Parking Brake (if necessary) ..... APPLY
Cabin ..... DEPRESSURIZE
Fire Extinguishing Handles ..... PULL
APU Fuel Shutoff Valve ..... CLOSE
APU and Engine Fire Extinguishing
Bottles (if necessary) ..... DISCHARGE
Ventral Tank Transfer Knob (if applicable) ..... OFF
Electric Fuel Pumps ..... OFF
Electric Hydraulic Pumps ..... OFF
Cabin Crew ..... NOTIFY
Emergency Lighting ..... ON
Evacuation ..... INITIATE

NOTE: Cockpit door blow-out panels may be broken to be used as an alternative way to leave cockpit.

Before leaving the airplane:

Batteries ..... OFF

FIRST OFFICER

ATC ..... NOTIFY

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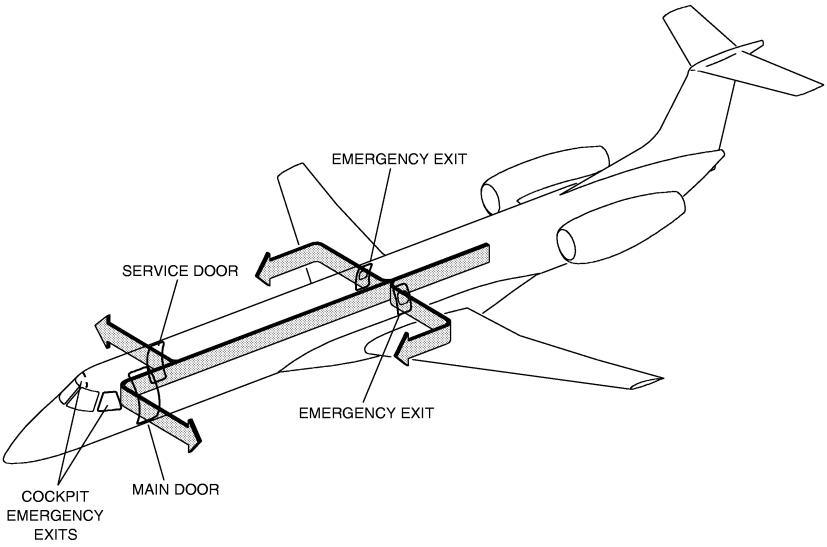
DOORS AND EXITS

There are two forward doors (main and service), two overwing exits and two cockpit windows, one each side, that can be used for emergency evacuation.



DOORS AND EXITS LOCATION

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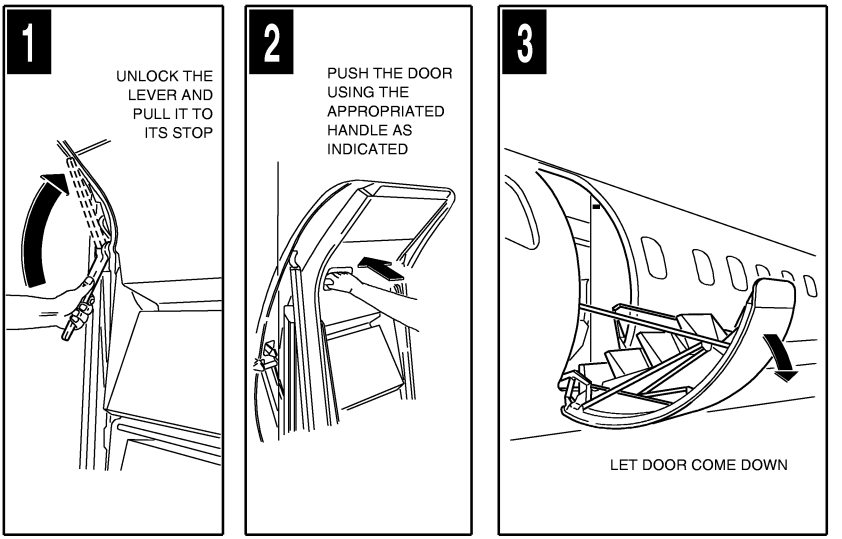
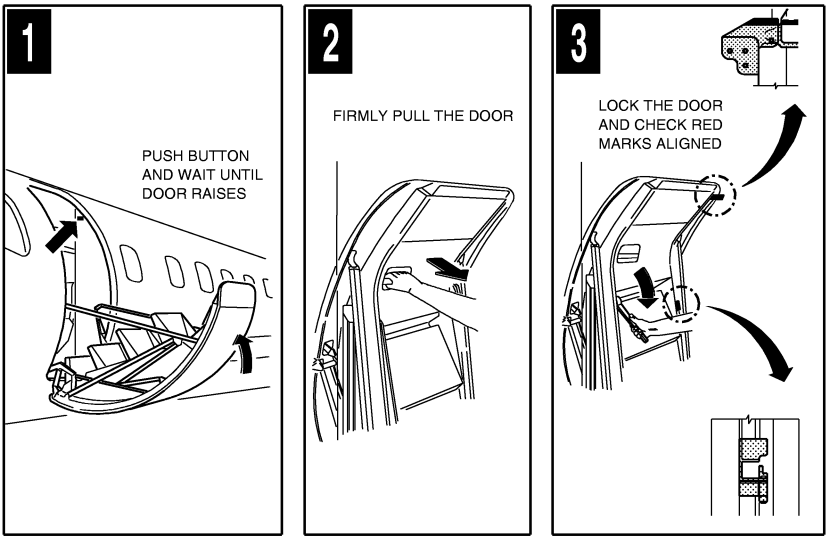
MAIN DOOR

The main door (airstair or jetway type) is located at the fore left side of the fuselage.

TO OPEN:



TO CLOSE:



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AIRSTAIR MAIN DOOR OPERATION (INSIDE CABIN)

NOTE: Some airplanes may have only the upper right red mark.

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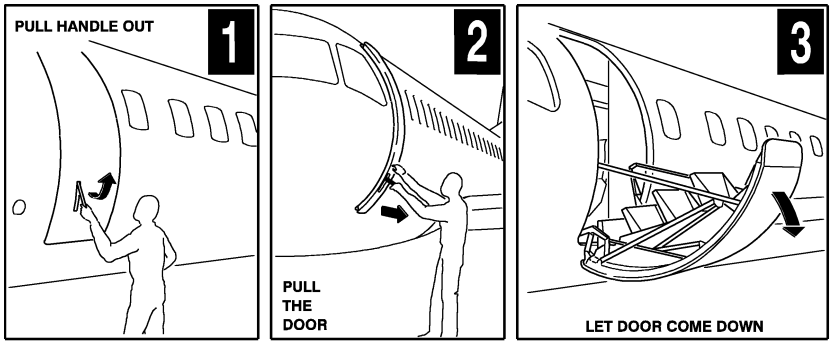
TO OPEN:



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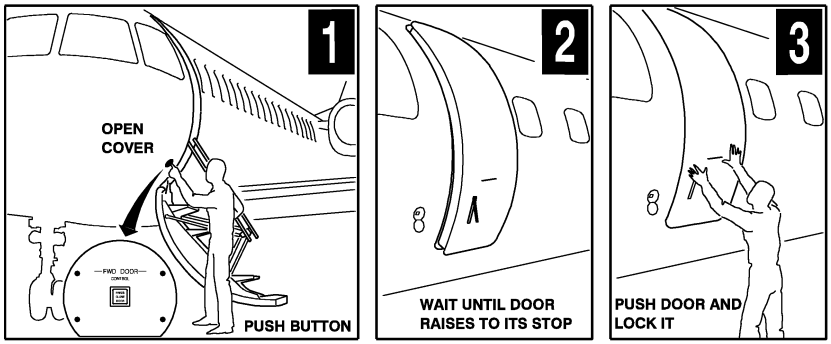

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AIRSTAIR MAIN DOOR OPERATION (OUTSIDE CABIN)

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JETWAY MAIN DOOR OPERATION (INSIDE CABIN)

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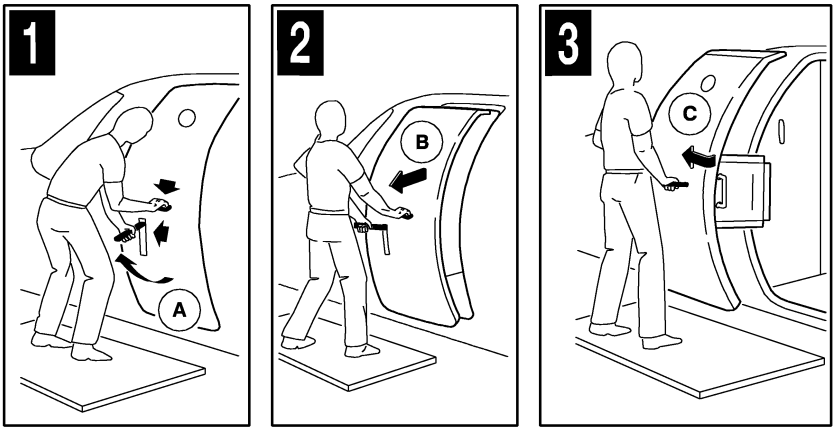
TO OPEN:

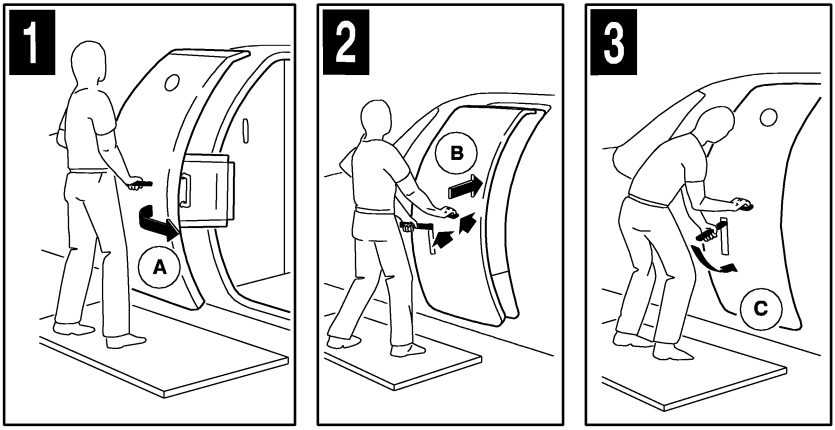


A — LIFT THE LEVER TO UNLOCK THE DOOR

B — PULL THE DOOR TO OPEN POSITION

C — FULLY OPEN THE DOOR AND LOCK IT OPENED

TO CLOSE:



A — HOLD THE DOOR HANDLE TO UNLOCK THE DOOR AND BRING IT TO CLOSURE POSITION

B — PULL THE DOOR TO THE CLOSED POSITION

C — LOWER THE LEVER TO LOCK THE DOOR CLOSED

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JETWAY MAIN DOOR OPERATION (OUTSIDE CABIN)

SERVICE DOOR

The service door, provided at the right side of the forward passenger cabin, is used for galley servicing and also as an emergency exit.

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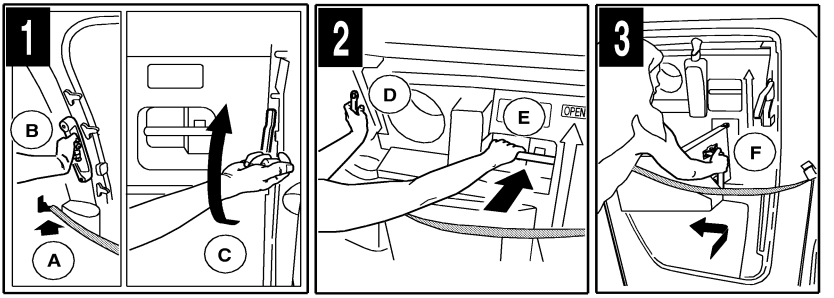
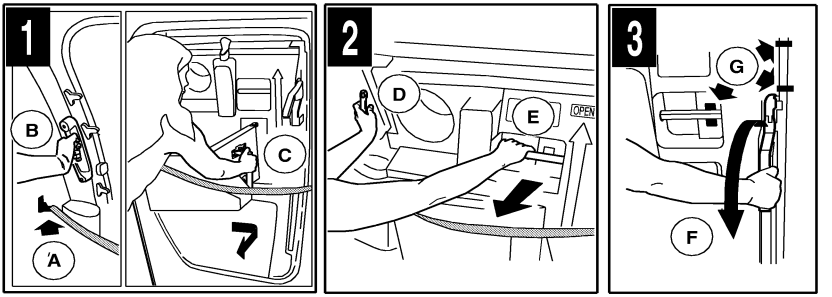
TO OPEN:



- A — MAKE SURE THAT THE SAFETY STRAP IS IN ITS CORRECT POSITION
- B — HOLD THE ASSISTANCE HANDLE
- C — LIFT THE LEVER TO UNLOCK THE DOOR
- D — KEEP HOLDING THE ASSISTANCE HANDLE
- E — PUSH THE DOOR TO OPEN
- F — MOVE THE DOOR UNTIL IT LOCKS IN THE OPEN POSITION

TO CLOSE:



- A — MAKE SURE THAT THE SAFETY STRAP IS IN ITS CORRECT POSITION
- B — HOLD THE ASSISTANCE HANDLE
- C — PULL THE LOWER HANDLE TO UNLOCK THE DOOR FROM THE OPEN POSITION AND BRING IT TO THE CLOSED POSITION
- D — KEEP HOLDING THE ASSISTANCE HANDLE
- E — FIRMLY PULL THE DOOR
- F — LOWER THE LEVER TO LOCK THE DOOR
- G — CHECK RED MARKS ALIGNED

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SERVICE DOOR OPERATION (INSIDE CABIN)

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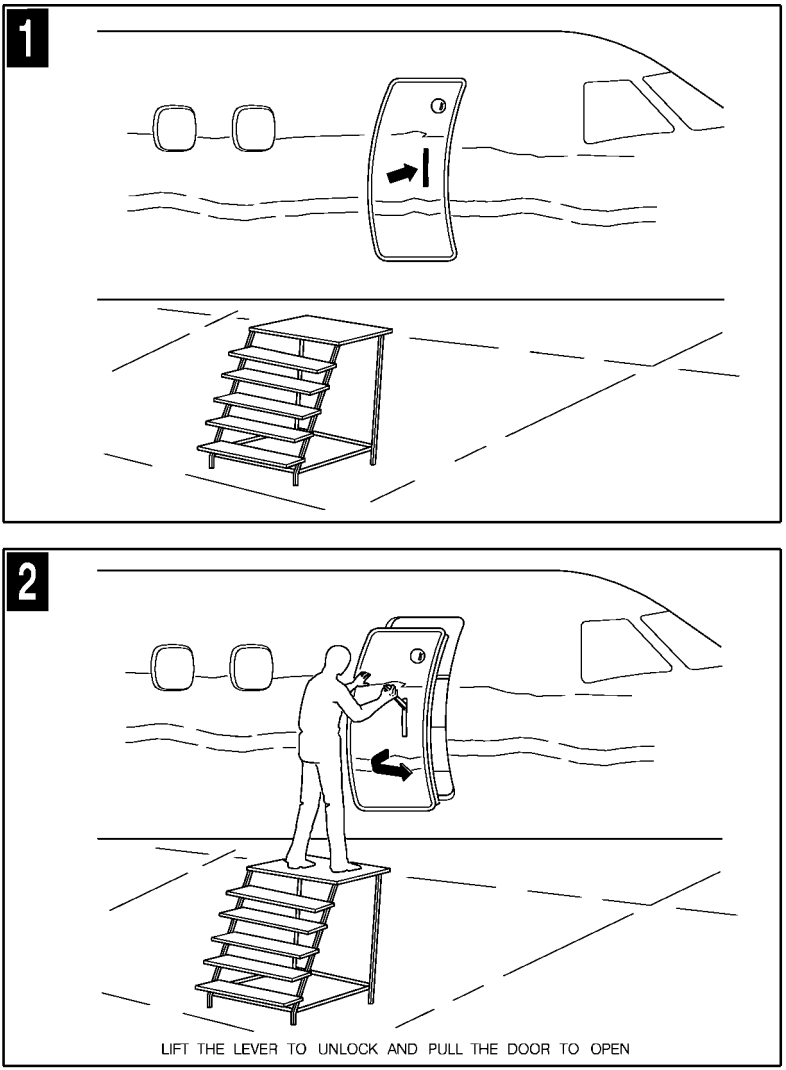

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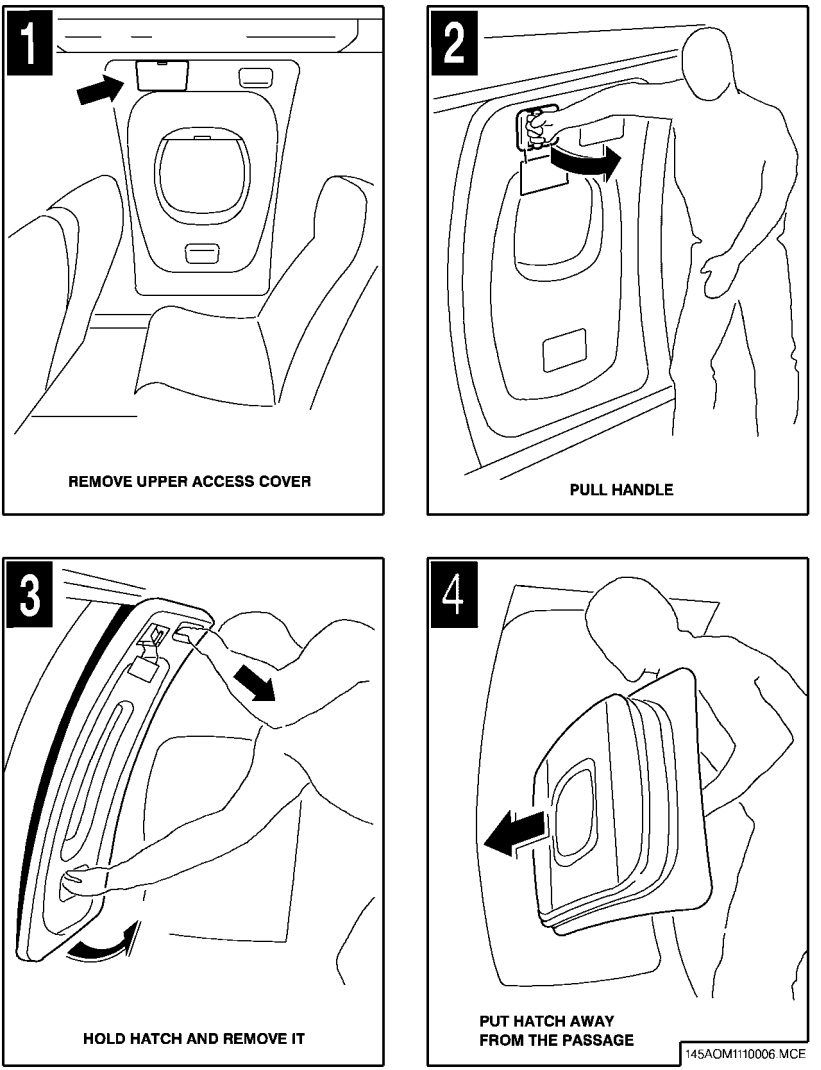
SERVICE DOOR OPERATION (OUTSIDE CABIN)

EMERGENCY EXITS

EMERGENCY OVERWING EXITS

Two emergency exit hatches exist for passenger evacuation in the event of an emergency. They are located one on each side of the aircraft, centered over the wings.



EMERGENCY EXIT OPERATION (INSIDE CABIN)

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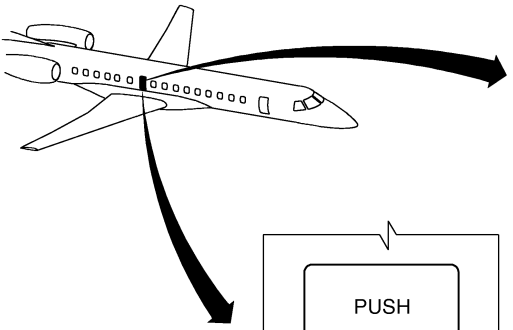

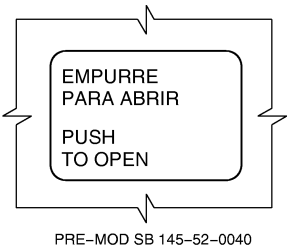

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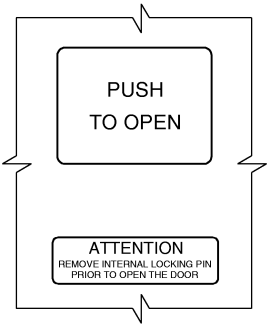

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EMERGENCY EXIT OPERATION (OUTSIDE CABIN)

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COCKPIT EVACUATION

COCKPIT WINDOWS

Cockpit windows may be partially open on the ground, and may be totally removed in case of loss of visibility through the windshield or for cockpit emergency evacuation.
If window removal is necessary, facilitate removal by moving the associated pilot seat backward.

NOTE: Windows can not be opened from outside.

A rope is positioned above each window to assist evacuation.

COCKPIT DOOR

Cockpit door located between passengers cabin and cockpit is provided with an emergency exit. This emergency exit is accessible when the blow-out panel is removed.
The airplane is equipped with one of the two types of cockpit doors, the cockpit security door or the cockpit standard door. Each of them has a different emergency exit opening procedure.

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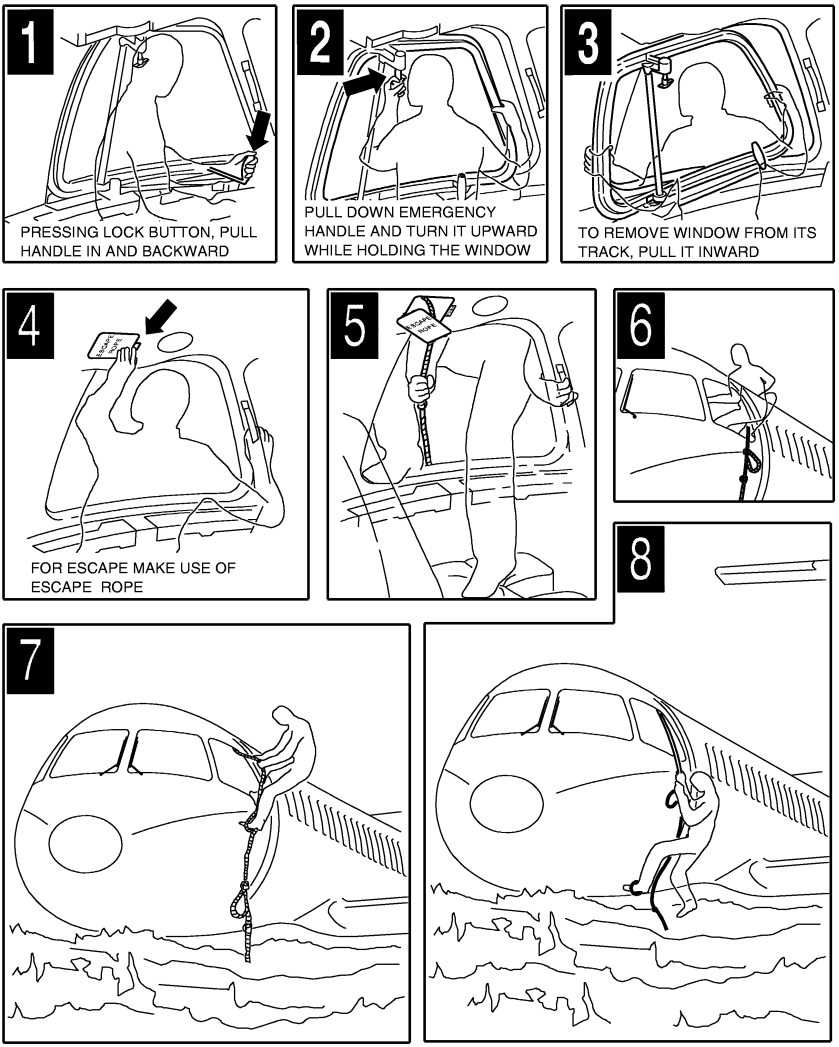

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COCKPIT WINDOW REMOVAL AND EVACUATION PROCEDURE

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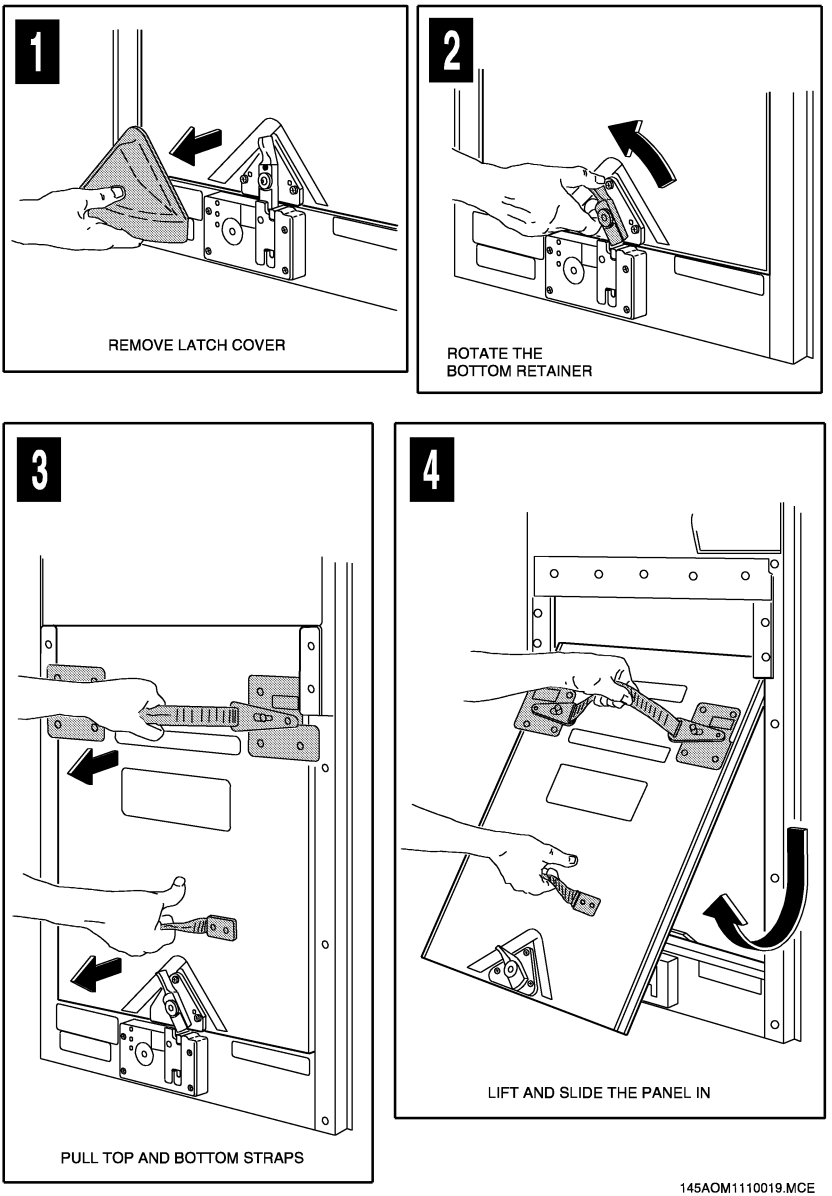

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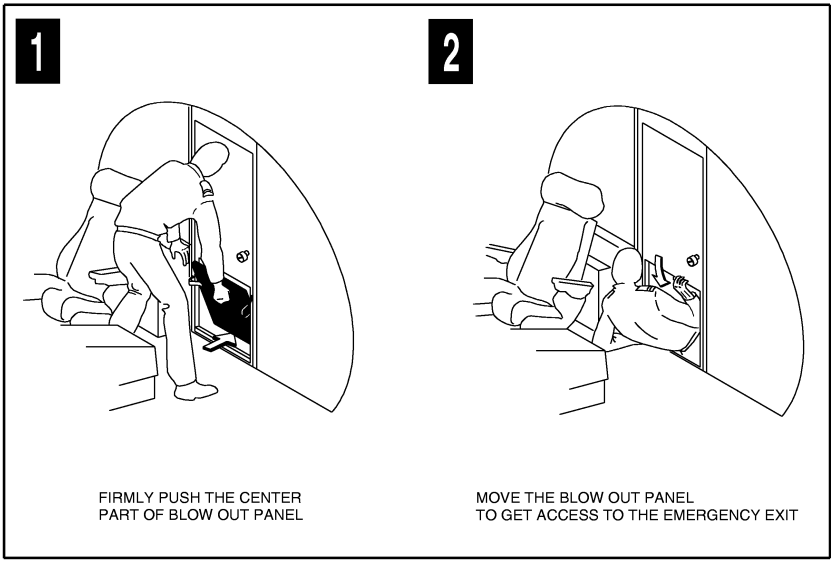
SECURITY DOOR EMERGENCY EXIT PROCEDURE



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STANDARD DOOR EMERGENCY EXIT PROCEDURE

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EMERGENCY RESCUE CHARTS

The Emergency Rescue Charts present emergency equipment location as well as emergency evacuation schematic. These charts may be used, at operators discretion, to develop customized evacuation procedures.

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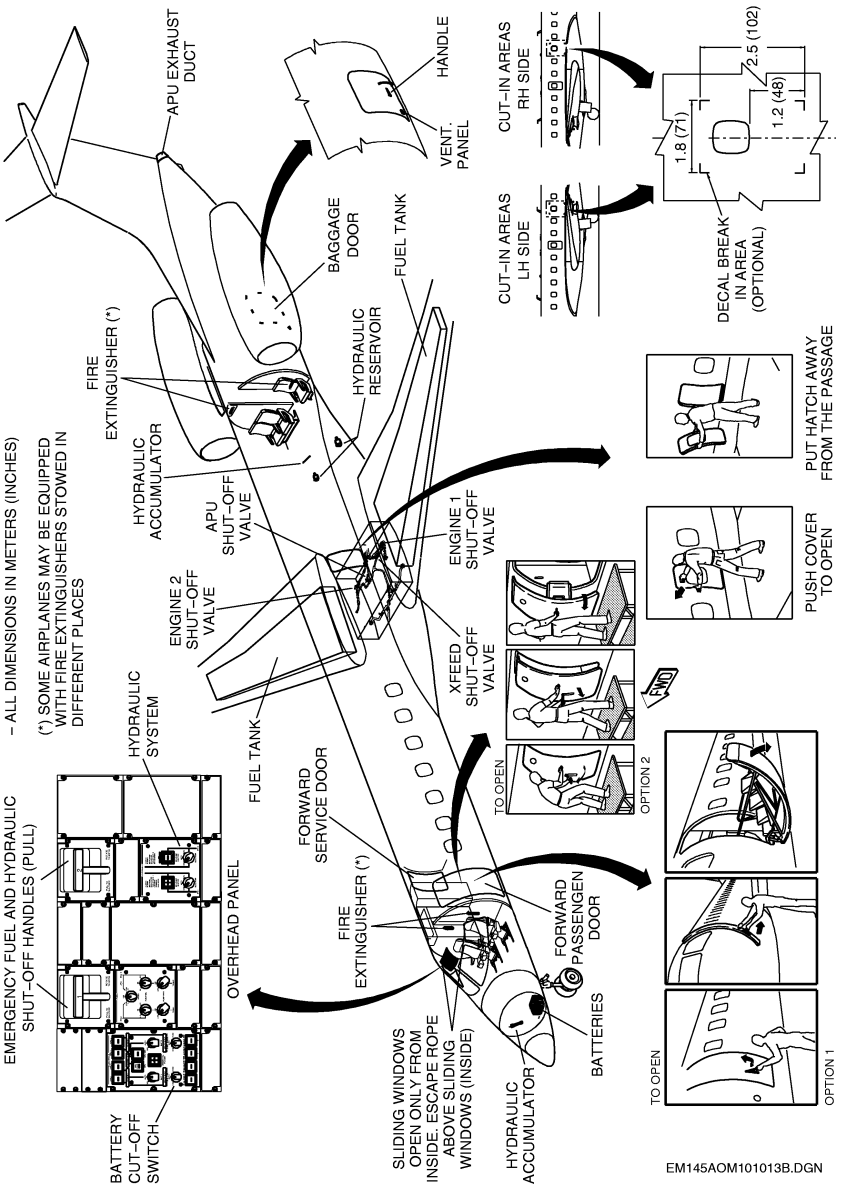
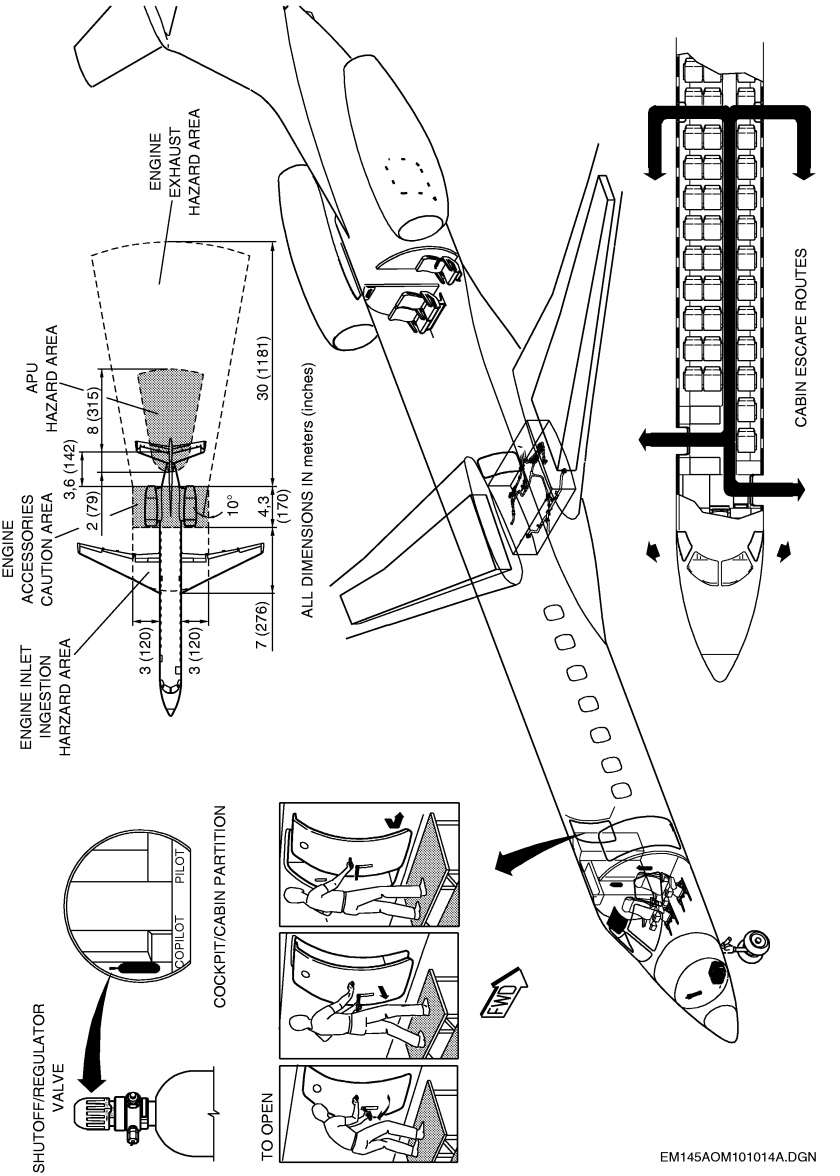


EMERGENCY RESCUE CHART (1 OF 2)



EMERGENCY RESCUE CHART (2 OF 2)

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SECTION 1-12

GROUND SERVICING

TABLE OF CONTENTS

Page Block

INTRODUCTION 1-12-00
EXTERNAL CONNECTIONS 1-12-05
TOWING 1-12-10
PARKING/MOORING 1-12-15
COLD WEATHER OPERATION 1-12-20
FUEL SYSTEM SERVICING 1-12-25
ENGINE OIL SERVICING 1-12-30
APU OIL SERVICING 1-12-35
HYDRAULIC/LANDING GEAR SERVICING 1-12-40
OXYGEN SERVICING 1-12-45
WATER/TOILET SERVICING 1-12-50
GROUND RESETS 1-12-60

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INTRODUCTION

General guidelines are provided herein related to the ground handling and servicing of the airplane. They are intended to make flight crews familiar with the ordinary aspects of the subject, as those tasks described herein normally are the responsibility of the maintenance personnel.

For further instructions pertaining the subjects covered herein refer to the Aircraft Maintenance Manual.

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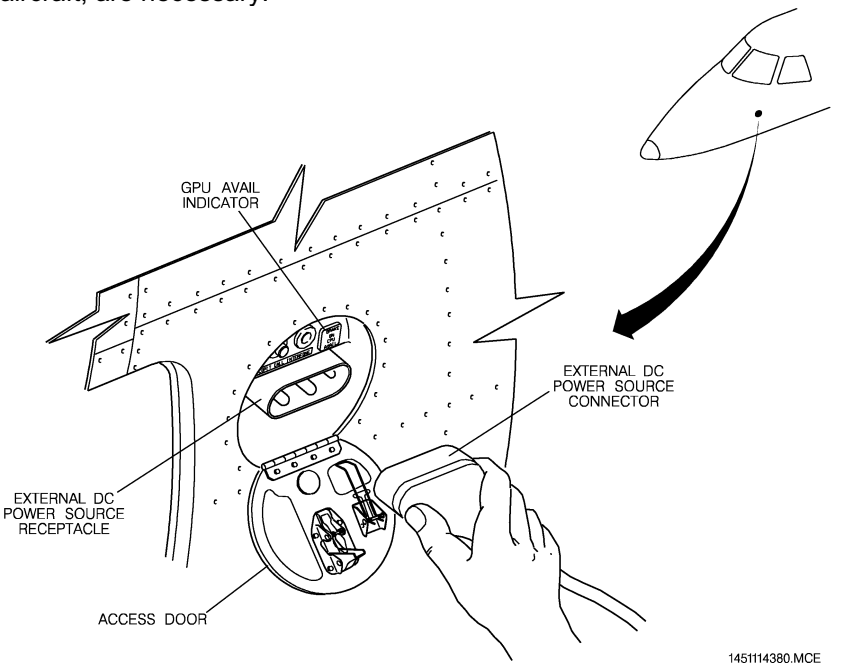
EXTERNAL CONNECTIONS

CONNECTING ELECTRICAL POWER SUPPLY

A 28 V DC external power supply source can be connected to the aircraft through the receptacle installed on the left side of the fuselage nose.

It is recommended that the external power source be capable of supplying at least 300 A, with maximal 1% steady-state voltage deviation. The voltage shown in the MFD electrical page should be 28.0 V (-2.0 V +1.0 V) DC when the GPU status is 'AVAILABLE'. The power source must be able to maintain the voltage within this range when the GPU status is 'IN USE'. Connecting a source out of these specifications may lead to electrical problems and therefore should be avoided.

Before energizing the aircraft, it must be assured that aircraft systems are in a safe condition, and that energizing will not cause any injury to persons or damage to equipment. When using an AC fed external power source, a ground connection between the hangar structure and the power source, and another one between the power source and the aircraft, are necessary.



CONNECTING ELECTRICAL POWER SUPPLY

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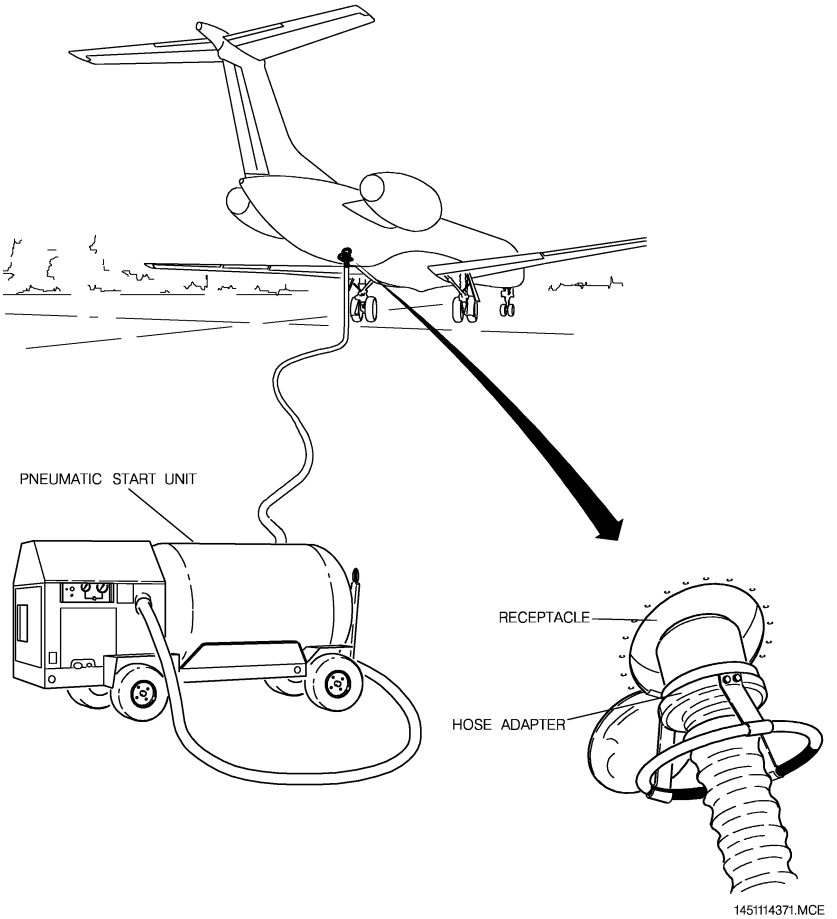
CONNECTING THE PNEUMATIC START UNIT

The pneumatic start unit is connected to the aircraft through the receptacle on the right side of the rear fuselage. The output of the unit must be set between 40 and 45 psi. This pressure allows the opening of the valve to let external air in.



PNEUMATIC START UNIT CONNECTION

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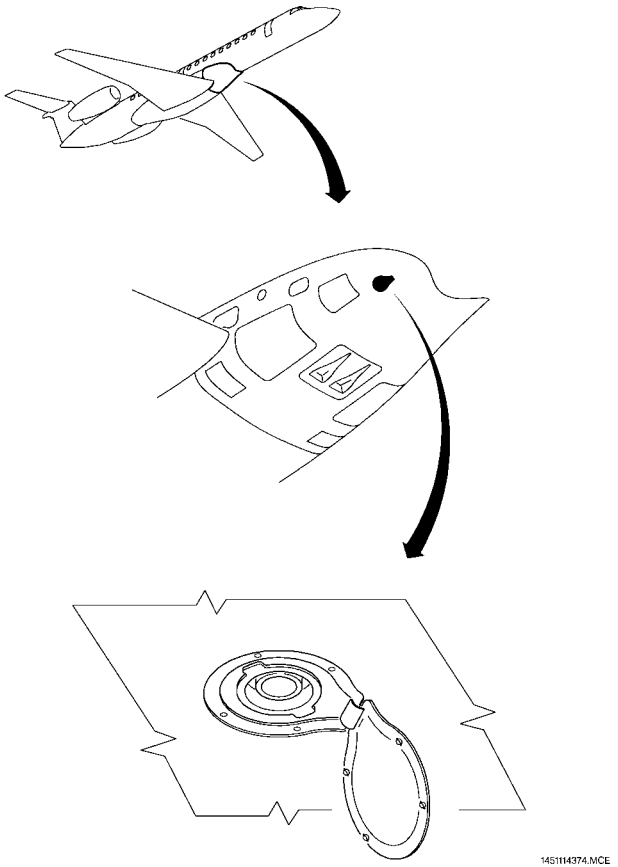
AIR CONDITIONING GROUND CONNECTION

An external conditioned air-source can be connected to the airplane to supply hot or cold air directly into the cabin.

The operation consists of connecting the source and starting supply to the aircraft. Supplied air pressure must not exceed 127 mm H_2O (5 in H_2O), maximum air temperature must not exceed 71°C (160°F) and maximum flow must not exceed 3,6 m^3/min (127 ft^3/min, 96 lbm/min). The source must be capable of supplying 50040 BTU/h.

The use of external conditioned air does not require any setting of the aircraft systems since the external conditioned air goes directly to the distribution ducts. However, it is recommended that the main door be left open when external air is being used, to prevent inadequate external source operation and to avoid cabin bump.



AIR CONDITIONING GROUND CONNECTION

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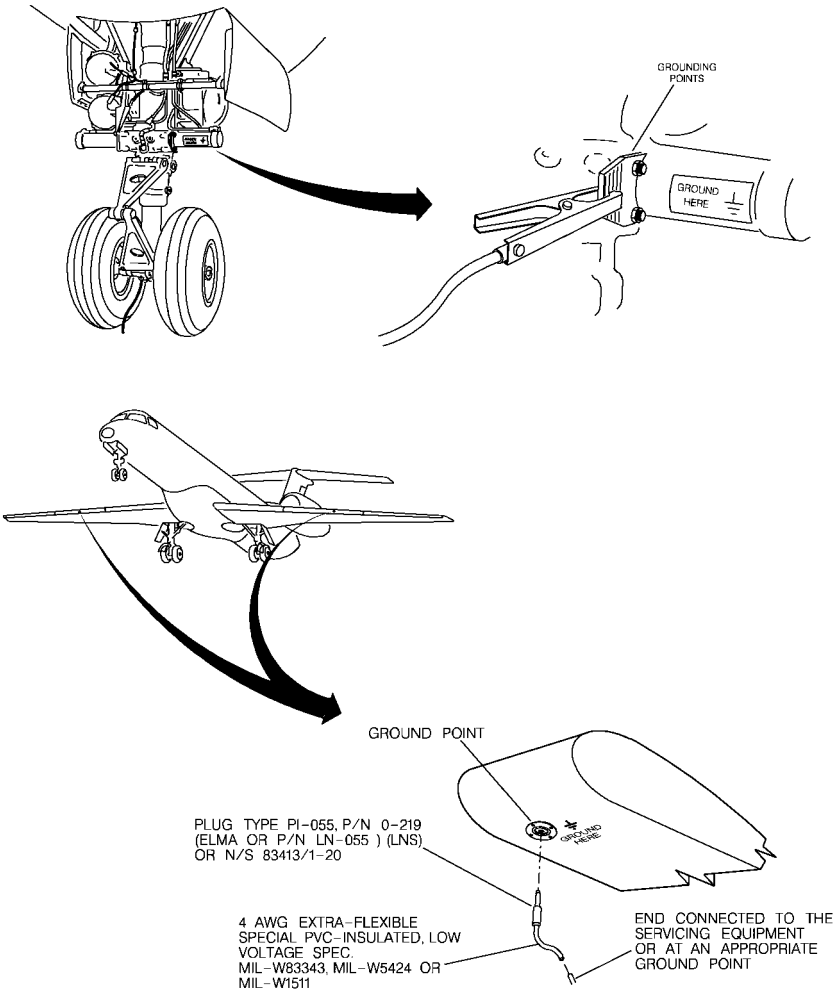
STATIC GROUNDING

There are three grounding points on the aircraft. Two of them are installed on the lower surface of each wing leading edge and one is aft of the nose landing gear.



STATIC GROUDING

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To ground the aircraft properly, proceed as follow:

– Make sure that the aircraft is parked adjacent to an approved grounding point.

NOTE: - For general grounding, use a 4-AWG extra-flexible special PVC-insulated, low voltage cable, and a PL-055-type plug (specification MS 3493).

- To ground the refueling nozzle or the oxygen charger adapter, use a 3/32"-diameter steel cable (specification MIL-W-83343, MIL-W-5424 or MIL-W-1511) with plug (specification MIL-C-83413/4) and an alligator clip.

– Examine the static ground cable for damage and to make sure that the end-fittings are correctly attached.

CAUTION: USE THE GROUNDING POINTS SHOWN IN FIGURE ABOVE ONLY. THE USE OF OTHER POINTS MAY RESULT IN POOR GROUNDING.

– Connect the static ground cable plug to one of the grounding points on the lower surface of each wing leading edge and the other end to an earth grounding point.
– Connect the static grounding cable of the ground support equipment to an earth grounding point.
– Connect static grounding cable plug of ground support equipment to one of the aircraft grounding points.
– Connect the applicable ground support equipment.

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TOWING

The towing operations are performed in compliance with the appropriate operational requirements using towbar or towbarless towing vehicles that are designed and operated to preclude damage to the airplane nose landing gear, steering system and associated fuselage structure.
Towbar and towbarless towing vehicles that are specifically accepted for this type of airplane are listed in the AMM Chapter 9.

NOTE: Towbarless towing is permitted only for airplanes Post-Mod. SB 145-32-0065 or SB 145-32-0086 or SB 145-32-0102 or equipped with an equivalent modification factory incorporated.

Maximum nosewheel displacement during towing is 170º to the left or to the right.
The maximum recommended wind speeds for airplane Towing, Pivoting, Turning and Taxi are:

- Dry Runways ..... 50 kts
- Wet Runways ..... 45 kts
- Snow Covered Runways .... 30 kts
- Ice Covered Runways ..... 10 kts

NOTE: For abnormal conditions such as soft mud and snow the main landing gear has hard points to attach winch or cables for towing the airplane fore and aft. For this specific procedure, IGFER (Instructions for Ground Fire Extinguishing and Rescue) must be consulted (only applicable to towbar towing).

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TOWING PREPARATION

The following precautions apply when towing the airplane:

- During the towing operations, a properly trained person must stay in the cockpit to set the emergency/parking brake, if necessary.

CAUTION: EFFICIENT COMMUNICATION BETWEEN THE TOWING VEHICLE OPERATOR AND THE COCKPIT PERSON MUST BE ESTABLISHED BEFORE THE AIRPLANE IS TOWED.

- Turn on the anti-collision lights.

CAUTION: MAKE SURE THAT THE AIRPLANE WINGTIPS AND TAIL CAN BE SEEN CLEARLY.

- Close the main door (except for airplanes equipped with wheeled main door).
- If it is not necessary to tow the airplane with the hydraulic systems 1 and 2 pressurized:
  - Depressurize hydraulic systems 1 and 2.
  - Make sure that the emergency/parking brake accumulator is pressurized.
    If it is suspected that emergency/parking brake has no accumulator charge to supply power for an eventual actuation, turn electric hydraulic pump #2 on for a few seconds and then turn electric hydraulic pump off again.

    NOTE: Turning on an electric hydraulic pump using batteries only can discharge the batteries. The use of the APU generator to supply electrical power is recommended.

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User: fnhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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- If it is necessary to tow the airplane with hydraulic systems 1 or 2 pressurized (e.g., engines running):
  - Keep hydraulic systems 1 and 2 pressurized.
  - Make sure that the emergency/parking brake accumulator is pressurized.

    NOTE: To prevent hydraulic fluid transference from system 1 to system 2 or vice versa, always apply brakes with the pedals before pulling and releasing the emergency/parking brake handle.
- Set the emergency/parking brake handle up. Check if emergency/parking brake light is ON.
- Disengage the steering system through the Steering Disengage Button located on the control wheel (pilot or copilot). The STEER INOP message is displayed on the EICAS.

NOTE: For airplanes Post-Mod. SB 145-32-0057 the steering system is disengaged alternatively by ground personnel setting the external steering disengagement switch to the “DISENGAGED” position.

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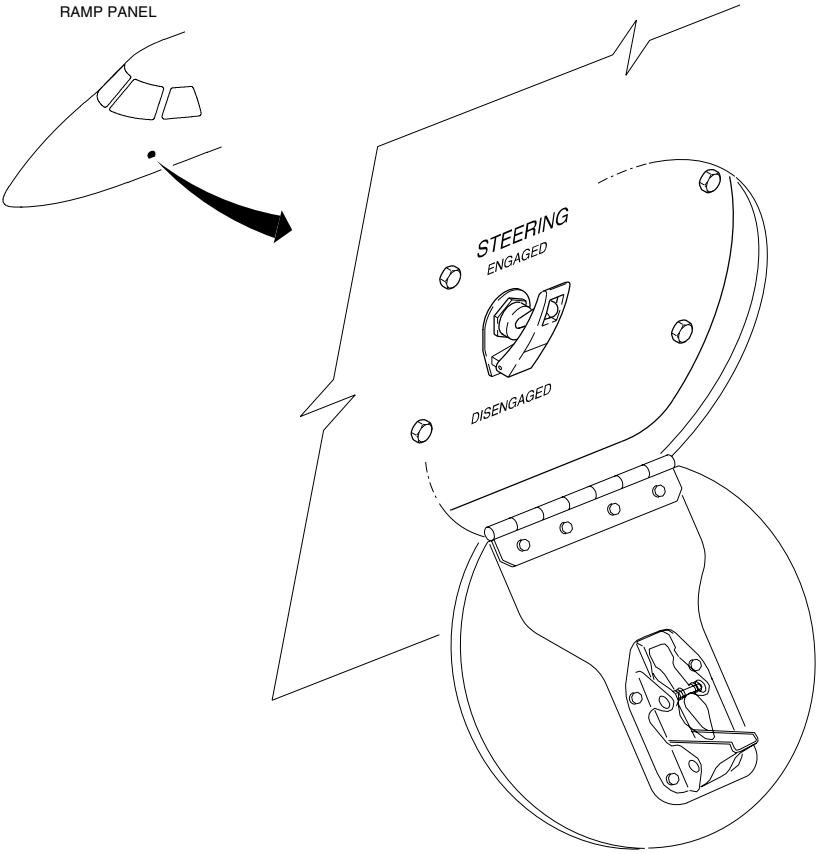

STEERING DISENGAGEMENT SWITCH COMPARTMENT

TOWBAR TOWING

EQUIPMENT

Ground towbar towing is normally accomplished by using ground support equipment P/N 01-1201-0000 (towbar) and 01-0582-0010 (towbar attachment) coupled to the nose landing gear.

The towbar incorporates breakable sections (fuse) with the purpose of causing the towbar to break in case of any towing abnormality, to protect the airplane structure or the nose landing gear from damage. Maximum towbar fuse push/pull design force is 4418 kgf (9740 lbf). Maximum design torque is 4300 N.m (3171.5 lbf.ft).

PROCEDURES

Towbar Towing operation is accomplished following the steps below:

WARNING: WHEN THE ENGINES AND APU ARE RUNNING DURING THE TOWING PROCEDURES MAKE SURE THAT ALL PERSONS ON THE GROUND STAY AWAY FROM HAZARDOUS AREAS.

- Remove the lock pin from the guide pin on towbar assemblies.
- Install towbar on the nose landing gear.
- Put the guide pin into the towing point of the nose landing gear.
- Lock the guide pin with the lock pin.
- Install the other side of towbar assemblies to the tractor.
- Remove the wheel chocks.
- Release the emergency/parking brake. Check if the brake ON light goes off.

NOTE: - The person in cockpit must coordinate with ground personnel to release and apply the airplane emergency/parking brake.

- To prevent hydraulic fluid transference from system 1 to system 2 or vice versa, always apply brakes with the pedals before pulling and releasing the emergency/parking brake handle.

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User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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– Tow the airplane slowly straight ahead before turning. Complete the airplane towing in a straight line for a minimum of 3 m (10 ft) in order to align the steering as close as possible to the 0º position.

NOTE: Do not stop the airplane when turning if it is not necessary.

CAUTION:

- DO NOT OVERSTEER. THE MAXIMUM TOWING ANGLE IS 170º TO THE RIGHT AND 170º TO THE LEFT. IF THE MAXIMUM TOWING ANGLE IS EXCEEDED DAMAGE TO THE NOSE LANDING GEAR CAN OCCUR. TAKEOFF IS NOT ALLOWED WITH DAMAGED NOSE LANDING GEAR.
- DO NOT APPLY THE AIRPLANE BRAKES DURING THE TOWING PROCEDURE. REGARDLESS OF THE SPEED. USING BRAKES CAN CAUSE DAMAGE TO THE AIRPLANE STRUCTURE AND/OR TO THE NOSE LANDING GEAR. ONLY WHEN THERE IS A RISK OF COLLISION OR DAMAGE TO THE AIRPLANE AND IN ACCORDANCE TO THE TRACTOR OPERATOR, USE THE AIRPLANE BRAKES TO STOP THE AIRPLANE.

After towing operation is finished:

– Apply the emergency/parking brake or install the wheel chocks, as required.

NOTE: If hydraulic systems 1 and 2 are pressurized, always apply brakes with the pedals before pulling and releasing the emergency/parking brake handle to prevent hydraulic fluid transference from system 1 to system 2 or vice versa.

– Make sure that nose wheel displacements are below the maximum operational limit.

NOTE: Steering handle actuation with nose wheels beyond their operational limits may cause damage to the nose wheel steering system.

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User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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- Remove towbar.
- Remove the lock pin from the guide pin on the towbar assembly.
- Remove the guide pin from the towing point of the nose landing gear.
- Remove the towbar assembly from the nose landing gear.

CAUTION: CHECK WITH GROUND PERSONNEL IF THE NOSE WHEEL IS NEAR THE CENTER POSITION (CLOSE TO 0º) BEFORE PRESSURIZING THE HYDRAULIC SYSTEM.

- Pressurize the hydraulic system if it is depressurized.
- Engage the steering system through the steering handle. Check if the STEER OFF message is not displayed on EICAS.

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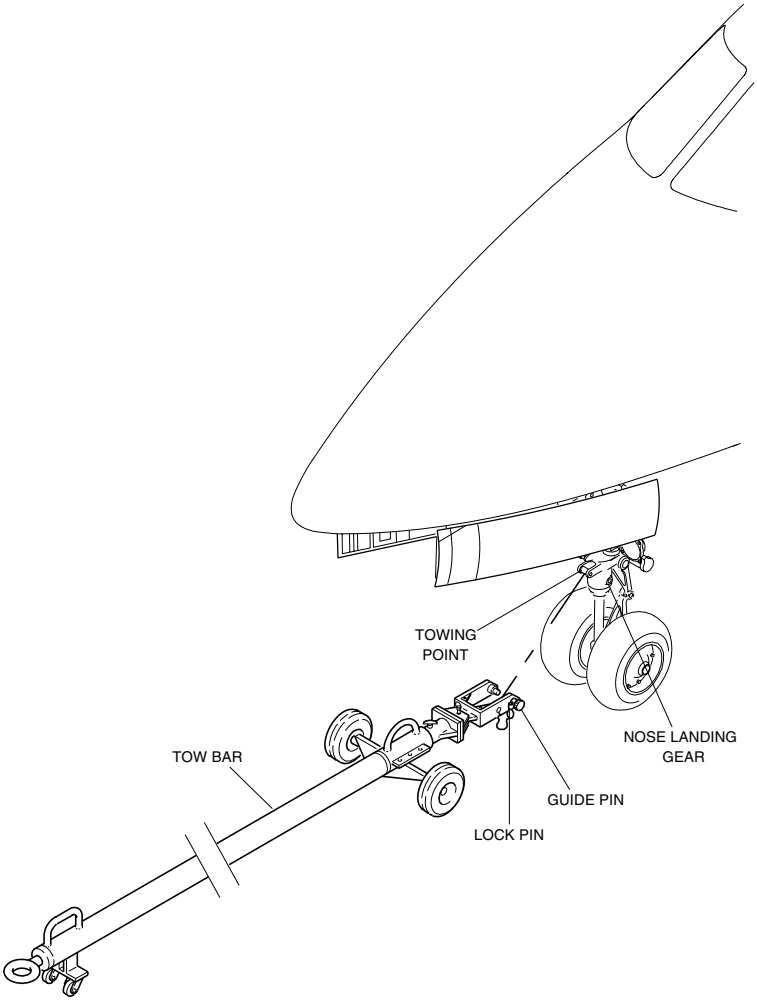

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TOWBAR TOWING EQUIPMENT

TOWBARLESS TOWING

EQUIPMENT

Towbarless towing vehicles that are specifically accepted for this type of airplane are listed in the AMM Chapter 9.

PROCEDURES

Towbarless Towing operation is accomplished following the steps below:

WARNING: WHEN THE ENGINES AND APU ARE RUNNING DURING THE TOWING PROCEDURES MAKE SURE THAT ALL PERSONS ON THE GROUND STAY AWAY FROM HAZARDOUS AREAS.

- Put the tug vehicle in the correct position near the nose wheels.
- Remove the wheel chocks from the main wheels.
- Connect the tug vehicle to the airplane.
- Release the emergency/parking brake. Check if the brake ON light goes off.

NOTE:
- Coordinate with ground personnel to release and apply the airplane emergency/parking brake.
- To prevent hydraulic fluid transference from system 1 to system 2 or vice versa, always apply brakes with the pedals before pulling and releasing the emergency/parking brake handle.

- Tow the airplane slowly straight ahead before turning. Complete the airplane towing in a straight line for a minimum of 3 m (10 ft) in order to align the steering as close as possible to the zero-degree position.

NOTE: Do not stop the airplane when turning if it is not necessary.

CAUTION:
- DO NOT OVERSTEER. THE MAXIMUM TOWING ANGLE IS 170º TO THE RIGHT AND 170º TO THE LEFT. IF THE MAXIMUM TOWING ANGLE IS EXCEEDED DAMAGE TO THE NOSE LANDING GEAR CAN OCCUR. TAKEOFF IS NOT ALLOWED WITH DAMAGED NOSE LANDING GEAR.

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User: fhherna0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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- DO NOT APPLY THE AIRPLANE BRAKES DURING THE TOWING PROCEDURE. REGARDLESS OF THE SPEED. USING BRAKES CAN CAUSE DAMAGE TO THE AIRPLANE STRUCTURE AND/OR TO THE NOSE LANDING GEAR. ONLY WHEN THERE IS A RISK OF COLLISION OR DAMAGE TO THE AIRPLANE AND IN ACCORDANCE TO THE TRACTOR OPERATOR, USE THE AIRPLANE BRAKES TO STOP THE AIRPLANE.

After towing operation is finished:

– Set the emergency/parking brake and, with the airplane energized, make sure that the brake light is ON.

NOTE: To prevent hydraulic fluid transference from system 1 to system 2 or vice versa, always apply brakes with the pedals before pulling and releasing the emergency/parking brake handle.

– Make sure that nose wheel displacements are below the maximum operational limit.

NOTE: Steering handle actuation with nose wheels beyond their operational limits may cause damage to the nose wheel steering system.

– Install the chocks forward and aft of the left and right main landing gear wheels.

– Remove the airplane towing vehicle.

CAUTION: CHECK WITH GROUND PERSONNEL IF THE NOSE WHEEL IS NEAR THE CENTER POSITION (CLOSE TO 0º) BEFORE PRESSURIZING THE HYDRAULIC SYSTEM.

– Pressurize the hydraulic system if it is depressurized.

– Engage the steering system through the steering handle. Check if the STEER OFF message is not displayed on EICAS.

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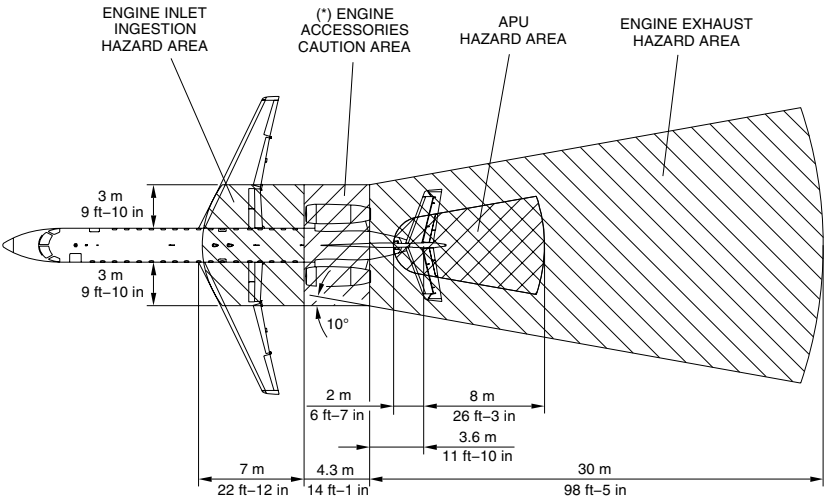
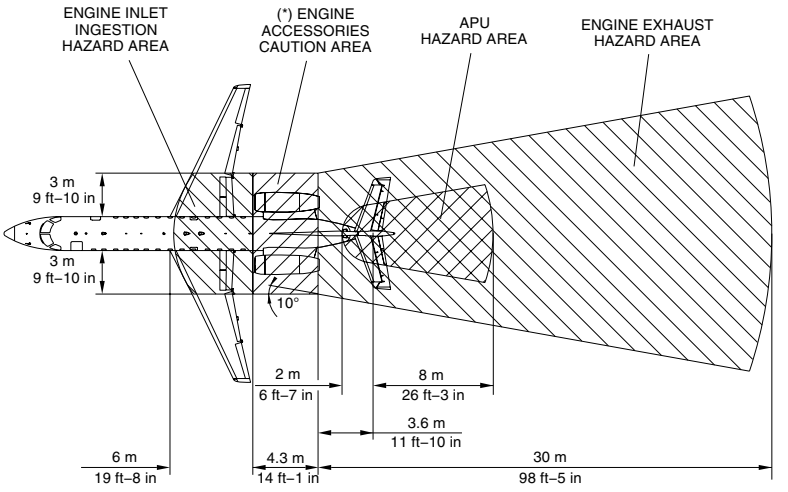
HAZARD AREAS



EMB–145 MODEL



EMB–135 MODEL

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(*) Access to this area is permitted just with engine running in idle speed.

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PARKING

The instructions contained herein cover only normal parking, i.e. parking between flights and the overnight stop. In case of prolonged parking, or parking under extremely adverse weather conditions, the assistance of a maintenance technician is required.

PREPARATION

Make sure there is a minimum distance in relation to other parked airplane so as to permit airplane movement, further assuring that there is a minimum distance of 4.5 meters between the APU´s exhaust port and an adjacent airplane fuel tank vent.

The gust lock must be in the locked position whenever the airplane is on the ground, except for flight controls checks.

NOTE: - The airplane must be sheltered in a hangar when there are wind speeds higher than 50 knots (for the mechanical gust lock system) or above 65 knots (for the electromechanical gust lock system).

- If the airplane is exposed to wind gusts with the gust lock in the unlocked (FREE) position or the airplane is exposed to winds exceeding the limit specified for each gust lock system, an inspection according to TASK 05-50-04-200-802-A (AMM) should be performed.

PARKING

Normal parking is performed according to the procedure below:

– Make sure that the safety pins are installed in each landing gear.

CAUTION: IF THE RELATED LANDING GEAR SAFETY PINS ARE NOT INSTALLED, INJURY TO PEOPLE AND/OR DAMAGE TO THE AIRPLANE/EQUIPMENT MAY OCCUR.

NOTE: Before parking the airplane, move it approximately three meters in a straight line to remove all torsional stresses applied to landing gear components and tires during a turn.

– Ground the airplane.
– If there is ice or snow in the parking area, put mat, thick sand or other applicable material under the tires, to prevent them from freezing.

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CAUTION: IF THE BRAKES ARE TOO HOT, DO NOT APPLY PARKING BRAKES UNTIL THEY ARE COOLER. THIS WILL PREVENT BRAKE DISCS FROM BONDING.

- Set the emergency/parking brake.
- Retract the flaps if they are extended.
- Set the gust lock lever.
- Put the chocks against the landing gear wheels.
- To prevent the courtesy light from discharging the battery, pull the COURTESY LIGHT (A22) circuit breaker.
- Install the covers to the pitot tubes, total-air-temperature (TAT) sensor, tail cone, nose cowl, ice detector, engine/APU air intakes and exhaust nozzles, and anemometrical static ports.

RETURN TO SERVICE

- Remove the chocks from the landing gear wheels.
- Remove the covers from the pitot tubes, TAT sensor, tail cone, nose cowl, ice detector, engine/APU air intakes and exhaust nozzles, and anemometrical static ports.
- Make sure that the control handle of the landing gear is at the down position.
- Make sure that the safety pins are installed to each landing gear.

CAUTION: MAKE SURE THE SAFETY PINS ARE REMOVED BEFORE TAXYING THE AIRPLANE FOR TAKEOFF.

- Unground the airplane.

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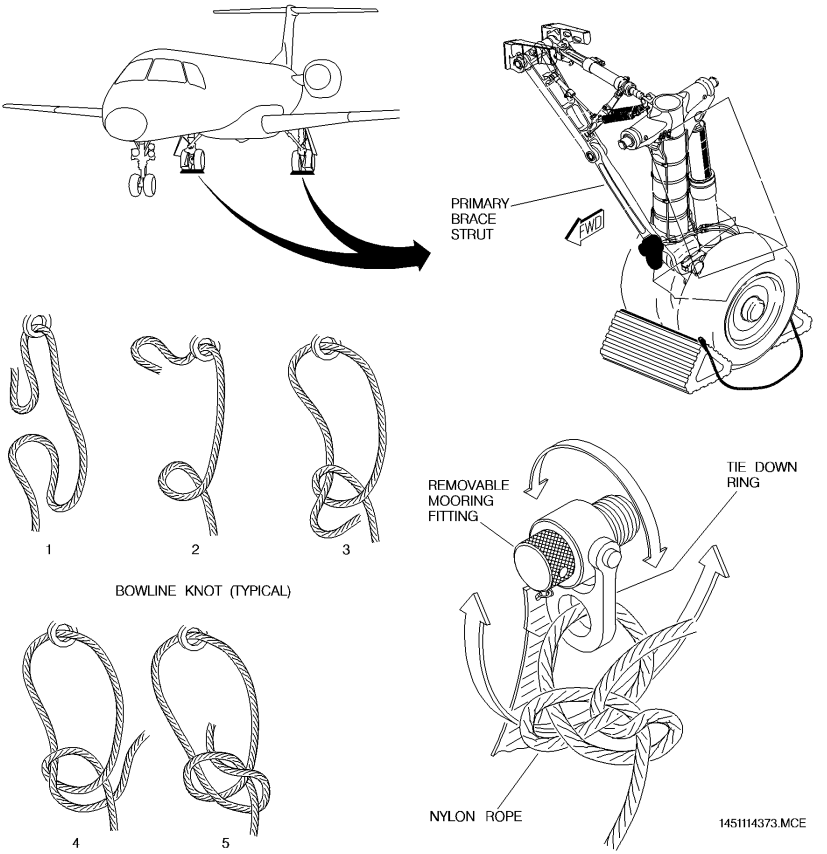
MOORING

Mooring is necessary when the weather conditions are bad or unknown. The area where the aircraft is to be parked in and moored must be paved and level, with ground tiedown anchors available.



MOORING THE AIRPLANE

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The following table gives the surface conditions and wind velocities at which mooring is necessary;

Wind Limitation Table

Surface Condition	Wind Velocity
Ice	25 Kt
Snow	40 Kt
Wet Concrete	55 Kt
Dry Concrete	60 Kt

To moor the aircraft, proceed as follows:

- Tow the aircraft to a parking area where there are tiedown anchors available.
- Carry out the normal parking procedure.
- Install the tiedown rings (two), one in each primary brace strut of the main landing gear.
- Attach a nylon rope to the tiedown ring with a bowline knot, and then attach the other end of the rope to the tiedown anchor on the ground by knotting it with a bowline knot. See the corresponding illustration on the previous page.

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COLD WEATHER OPERATION

COLD SOAK PREPARATION

The procedures below should be applied in the event of extended airplane exposure at low temperatures. In the event that the airplane is off the maintenance base, the crew should ensure that all actions have been accomplished.

- Put the wheel chocks against the landing gear wheels.
- For an icy ramp, leave Emergency/Parking Brakes applied. Otherwise, Emergency/Parking Brakes must not be applied to avoid freezing of the brakes.
- Install protective covers on engines and APU inlets/outlets, pitot, TAT probes, and wheels.
- Drain water and waste from all water tanks, if cold soak temperature is expected to be below 0°C (32°F).
- Remove the batteries if temperatures are expected to be below -15°C (5°F). This protects the batteries and ensures their duration in case of electrical emergency.
- All doors and windows must be closed to avoid snow and humidity from entering into the airplane.

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APPLICATION OF DEICING AND ANTI-ICING FLUIDS

ANTI-ICING AND DEICING FLUIDS

When airplane surfaces are contaminated by frozen precipitation or frost before departure, they must be deiced. When the risk of freezing precipitation exists at dispatch or freezing precipitation is actually taking place, the airplane must be anti-iced. While deicing removes ice, anti-icing protects against additional icing for a certain period of time, called hold-over time. A combination of both anti-icing and deicing may be performed based on the judgment of the flight crew and procedures developed by the operator.

Deicing and anti-icing fluids lower the freezing point of frozen precipitation thus delaying the accumulation of contamination on the airplane. When applied to a clean surface, the fluid forms a thin layer that has a lower freezing point in precipitation. The fluid is highly soluble in water, thus the precipitation or ice melts on contact with fluid. These fluids also delay the onset of frost on airplane surfaces. As the ice melts, the fluid dilutes with the water, thereby causing the mixture to become less effective or to run off. Ice can begin to form again after enough dilution has occurred and freezing point begins to rise.

Deicing/anti-icing fluids are not intended to provide icing protection during flight. The fluid must flow-off the surface during takeoff, or they may cause undesirable performance effects. EMBRAER performed flight tests to investigate the effects of approved fluids on performance and handling characteristics. These tests demonstrated these fluids did not have a measurable effect on takeoff and climb performance.

Fluids are generally mixtures of glycol, water, inhibitors, thickening agents and wetting agents. Glycol lowers the freezing point and prevents the formation of ice contamination at temperatures below freezing. The wetting agent allows the fluid to conform to the airplane surfaces. The inhibitors prevent corrosion and increase the flash point. The thickening agent, normally propylene glycol with polymers, enables the coating of fluid to remain on airplane surfaces for longer periods.

Type I Fluid is unthickened, while fluids from Type II to IV are thickened.

Type I Fluid characteristically forms a thin wetting film which provides relatively limited holdover time, and provides protection against refreezing when no precipitation is present.

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A deicing fluid may be pure heated water, or a mixture of heated water and type I, II, III or IV fluids. Heating is applied to a minimum temperature of 60°C to assure maximum deicing efficiency.

Anti-icing fluids include types I, II, III or IV fluids in a mixture with water or undiluted.

Type I fluid is diluted with water to result in a freezing point approximately 10°C below ambient temperature. No additional holdover time is obtained by increasing the concentration of this fluid in the fluid/water mixture. However, increasing the concentration of fluids II, III and IV in a fluid/water mixture results in an additional holdover time.

The holdover time of the type IV fluid is greater than that of type II, which in its turn has a longer holdover time than type III fluid.

Type I fluid is normally pink or reddish orange in color, type II fluid is normally straw-colored, type III is bright yellow and type IV is green.

Type IV is an enhanced-performance fluid and offers significant operational advantages in terms of holdover times. However, thickened fluids may dry out during flight and residues may accumulate in aerodynamically quiet areas. The residues may turn to a gel which can freeze in flight, potentially restricting the movement of flight controls. Operators are reminded to frequently inspect control surfaces, gaps and tab hinges for signs of residual gel. If an approved fluid during actual use shows gelling, poor water wash off or unusual dry-out, EMBRAER should be notified.

THE USE OF HOLDOVER TIMES

Holdover times for the fluids are derived for each specific fluid brand, under various temperatures, fluid concentration and precipitation category. Note that the lower limit of the published holdover time is used to indicate the estimated time of protection during moderate precipitation, and the upper limit indicates the estimated time during light precipitation. Heavy conditions are not covered. Therefore, crew experience and airline orientation is required to clearly settle what is heavy, moderate or light. It is very important to determine the appropriate holdover time for the prevailing environmental conditions, and apply them on the line.

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Holdover times should be seen as rough approximations. They simply reflect the average, estimated time an anti-icing fluid should prevent the formation of frozen contaminants on the protected surfaces. Actual holdover times can be reduced or extended due to many factors influencing fluid effectiveness, such as high wind velocity, jet blast, heavy precipitation rates or high moisture content. Recommended practice is to use holdover times in conjunction with a pre-takeoff check to ascertain that frozen deposits have not started to accumulate on treated surfaces. This is a check normally conducted from inside the cockpit.

The pre-takeoff contamination check is normally accomplished from outside the airplane when the airplane cannot be effectively inspected by a pre-takeoff check or when the holdover times has been exceeded. The pilot-in-command must ask for the assistance of trained and qualified ground personnel to assist in the pre-takeoff contamination check, so that wing, empennage and fuselage, which are not visible from the cockpit or cabin, can also be inspected. If contamination is suspected, the airplane should be returned for additional deicing or anti-icing. For practical results, the holdover time must be equal to or greater than the estimated time from start of anti-icing to start of takeoff based on existing weather conditions.

Ensure that deicing and anti-icing are performed at the latest possible time before taxiing to the takeoff position. Always takeoff before hold-over time expires, so as to minimize the period when the airplane stays in line for takeoff and is exposed to contamination. Hold-over time should not be considered an exact figure. It is just an average time, which can be reduced by many factors affecting the fluid effectiveness. In the case of ice build-up after deicing/anti-icing fluid application, do not assume that ice will be blown off during takeoff roll. Ask for deicing/anti-icing fluid reapplication. If the hold-over time expires, carry out a pre-takeoff contamination check and another deicing/anti-icing fluid application is required.

No holdover time guidelines exist for the conditions of snow pellets, snow grains, ice pellets, moderate and heavy freezing rain and hail. In such, takeoffs in snow pellets, snow grains, ice pellets or hail must be preceded by a careful contamination check shortly before takeoff. Takeoff in conditions of moderate and heavy freezing rain is not approved.

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DEICING AND ANTI-ICING PROCEDURES

Application of deicing and anti-icing fluid must be done by trained and qualified personnel. It is the pilot's responsibility to decide whether or not to accept the airplane for flight. Therefore, it is essential that pilots understand not only how the fluid works and how it is applied, but also the flight crew must be able to determine if the airplane is safe for flight following treatment.

Deicing is required to clean airplane surfaces contaminated by ice, snow, frost or slush. Anti-icing is required to prevent ice accumulation. If both anti-icing and deicing are required, the procedure may be performed in either one or two-step process depending on weather conditions, available equipment, available fluids and the holdover time. However, the frequent use of thickened de/anti-icing fluids in one-step process can result in the accumulation of fluid residues in aerodynamically quiet areas. These residues may re-hydrate when exposed to moisture (e.g., rain or humidity) and subsequently freeze at low temperatures, possibly restricting the movement of the airplane's control surfaces.

Thus, a two-step deicing/anti-icing fluid application is recommended to be performed so that the residues accumulation in the critical areas is minimized. The use of hot water or heated mix of type I fluid/water for the first step of a two step deicing/anti-icing process may also help to clean away residues of thickened fluids from previous applications.

In two separate steps, the airplane is first deiced using heated water only, or a heated mixture of deicing fluid and water. After completion of the deicing operation, anti-icing is performed with diluted or undiluted anti-icing fluid. The second step must be applied before residual liquids from the first deicing step freezes, typically within three minutes. This is especially important where only heated water is used to deicing. Mixing fluids in a two-step procedure may only be performed if approved by the fluid manufacturer.

It is important to keep in mind that in case of a one-step deicing/anti-icing procedure, holdover time starts to run from the beginning of the procedure. With a two-step procedure, the holdover time starts to run at the beginning of the second step.

Under no circumstances should an airplane that has been previously anti-iced receive a further spray of anti-icing fluid directly on top of the anti-icing contaminated film. If an additional protection is necessary before flight, a complete deicing/anti-icing procedure must be performed. Residues from previous treatment must be flushed off first.

All fluids must be used in accordance with the manufacturers' recommendations.

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GROUND DEICING STRATEGY

The flight crew must understand the overall deicing and anti-icing strategies and insure that the procedures are performed properly to assure themselves that they have a safe airplane for flight.

All soft snow can be mechanically removed by blowing cold air across the airplane surface, using brooms, soft hand scrappers or rubber scrappers. Do not use tools to scrape or scratch compacted snow from the airframe surfaces or from the gaps between fixed or movable surfaces.

Flaps should be up and ailerons in neutral position, parking brake and gust lock should be applied. All doors should be closed.

For fluid applies, the following guidelines are recommended:

- Wings: Apply the fluid from the tip inboard to the root, sweeping from the leading edge in the aft direction. No frozen contamination is allowed on the wing upper surface. A 3 mm (1/8 in) frost layer is permitted on the underwing surfaces.
- Horizontal Stabilizer: It is recommended to set Pitch Trim to any position between 0° and full nose down to prevent APU soft Foreign Object Damage (FOD) ingestion. The best spray is straight in relation to the airplane centerline, in the aft direction (see figure). This is applicable when spraying either over or under the stabilizer surface. Straight spraying (cleaning from the stabilizer tip to the root), will make the fluid flow aft, away from the leading edge area. Spray angles up to 45° are acceptable (see figure), provided the stabilizer is set to full nose down. Back spraying (from trailing edge to leading edge - see figure) is not recommended as it will make spray flow forward and drip from the leading edge into the APU. Side spraying (90° in relation to airplane centerline) has also proved to flow fluid into the APU, either when cleaning the upper or the lower side of the stabilizer.

  Cross spraying the upper side of the stabilizer (truck positioned on the left side of the airplane, aiming the spray the right elevator/stabilizer - see figure) has been proven also to be very effective in removing contaminants and preventing fluids from flowing down into the APU.

  However, cross spray directs fluid to the stab/elevator gap. It may result in fluid accumulation and subsequent dry out in the quiet areas. Therefore, when cross spraying with fluids Type II, III or IV, additional care is required to comply with the requirements of the SNL 145-30-0006 that prescribes residues inspections on those areas.

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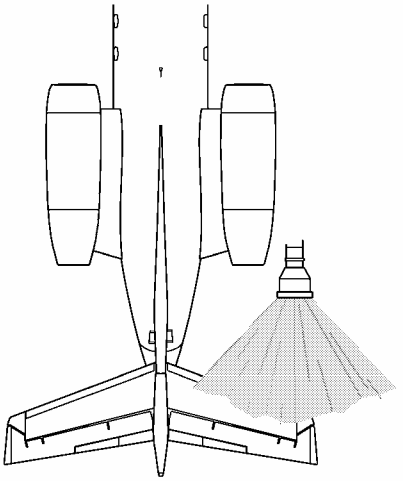

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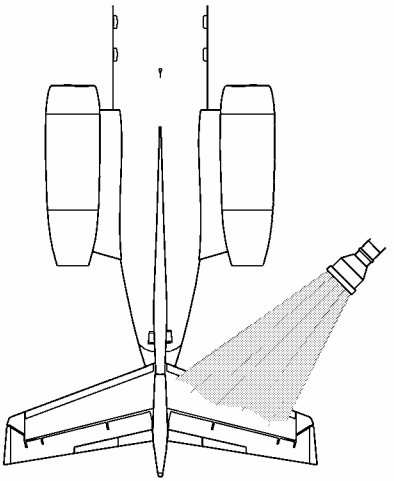
STRAIGHT APPLICATION IN RELATION TO AIRPLANE CENTERLINE



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45° FLUID APPLICATION

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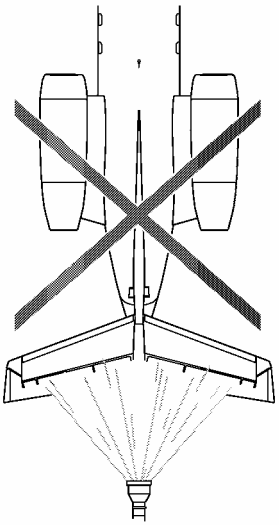

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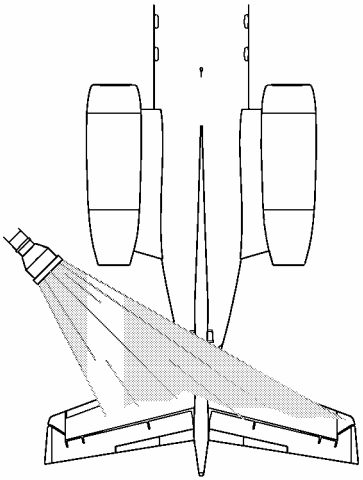
BACK SPRAYING



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CROSS SPRAYING APPLICATION

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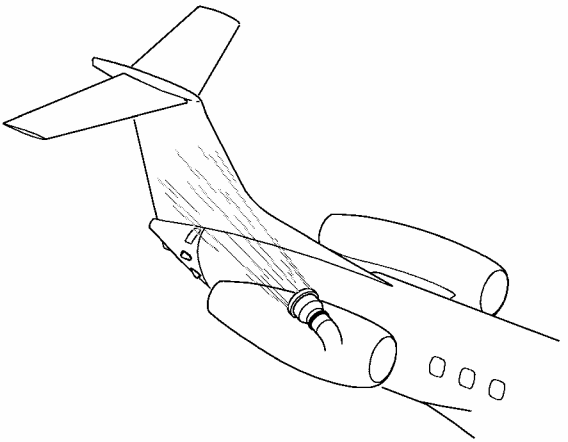
- Vertical Stabilizer and Rudder: Apply the fluid at a low, side angle (see figure), to prevent fluid spills into the APU. The rudder should be in the neutral position. Application on the rudder surface can also cause the fluid to be ingested by the APU. For the vertical surfaces the application should start at the top and then work down.



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SPRAYING ON THE VERTICAL STABILIZER AND RUDDER

– Fuselage – Remove all snow accumulated on the nose to avoid snow blowing back during takeoff and restricting pilot's visibility. Fluid should be sprayed along the top centerline of the fuselage and then outboard, letting the fluid cascade down and across the windows. Fluid must not be sprayed directly onto windows and window seals, doors and doors seals, air conditioning scoops or NACA air inlets. A thin layer of hoar frost on the fuselage is permitted, but only to the point you can still see the airplane markings. Check the APU air inlet and surrounding area to ensure that it is clear of ice or snow prior to APU starting. Fluid applied close to inlet area may be ingested and cause flameout and result in APU internal parts damage.

Landing gear and wheel bays – application of fluid in this area must be kept to a minimum. Do not allow water or fluid mixture spray on wheels and brakes to avoid damage to carbon brakes. For this part of the airplane, it is preferable to clear snow or slush using a brush.

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Engines – deposits of snow should be mechanically removed from engine intakes using either brooms, soft hand scrapers or rubber scrappers. Frozen deposits adhering to either the lower surface of the intake or to the fan blades should be removed by the applying hot air. To ensure the safety of ground personnel and passengers, this should be carefully coordinated with the flight crew.

It is also important to examine and remove all ice attached to the surface close to the pitot and static sensors, static ports, TAT probes, AOA sensors, and ice detectors. However, deicing or anti-icing fluid should not be applied directly to these devices. The fluids should be sprayed along the top of the sensors, allowing the fluid to cascade down across the sensor and de-ice it.

GROUND ANTI-ICING STRATEGY

Once the airplane has been fully deiced, then it is time to consider the prevention of any further ice contamination prior to takeoff by application of an anti-icing treatment. To prevent frozen contamination on airplane surfaces, the anti-icing operation requires that fluids be distributed uniformly over surfaces. In order to control uniformity, all horizontal surfaces must be visually checked during fluid application. The correct amount is indicated by fluid just beginning to drip off the leading edge. The following surfaces must be protected: wing upper surface and leading edge, horizontal stabilizer upper surface and leading edge, elevator upper surface, vertical stabilizer and rudder, fuselage upper surface.

On the wings, the best results are obtained by starting the spraying at the highest part of the wing section and proceeding towards the leading and trailing edges. On vertical surfaces, start at the top and work down.

A check for fluid coverage and residual ice is required immediately following application of the deicing/anti-icing fluids and should be accomplished by a qualified person. It is possible that fluid may not flow evenly over the protected surfaces. It is essential that the wings, horizontal and vertical stabilizer are properly coated with fluid. It is also important that the fluid be applied symmetrically to both wings so as to ensure that the aerodynamic effect of the fluid remaining is the same on both sides of the airplane.

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APPROVED DEICING/ANTI-ICING FLUIDS

Only Deicing/Anti-icing fluids certified under specifications below are approved to be used in the EMB-145 airplane models:

Deicing/Anti-icing Fluid	Specification
Type I	SAE AMS 1424
Types II, III and IV	SAE AMS 1428

Refer to the fluid manufacturer's recommendations for fluid mixture, if applicable, and holdover times.

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FORCED AIR DEICING

GENERAL

Forced air deicing is other alternative process to ground deicing only.

Forced air uses an air stream to remove accumulations of frozen contamination from the airplane with or without fluid. Forced air could provide the option of injecting heated or unheated fluid into the air stream for removal of heavier frozen contamination.

Apply forced air according to the following instructions, considering the use of the pressure supply unit:

- From a distance of 1.5 m to 6 m (5 ft to20 ft).
- With a maximum pressure of 34.5 kPa (5 psi).
- At the minimum angle of the surface.

Additionally, adopt the following precautions:

- Forced air cannot remove adhering contaminants and therefore does not eliminate the need for deicing processes.
- Do not direct forced air into engines, auxiliary intakes/exhausts or the Pitot/Static/AOA sensors, Static Port and TAT.
- Do not use forced air in areas that made of rubber, plastic, or other soft material, because it is possible to damage these areas.
- Do not use forced air near windscreen wipers, because it is possible to damage these areas.
- Be careful to avoid damage to landing gear and wheel bays components when removing ice.
- Prevent ice, snow, or slush from entering and accumulating in aerodynamically quiet areas such as control surface hinge areas or from entering engine inlets.
- To ensure the safety of ground personnel and passengers, coordinate the forced air application carefully with the flight crew.
- It is possible that forced air applications do not eliminate the need for deicing or anti-icing processes.
- A subsequent inspection of the critical surfaces is required after the use of forced air.

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FORCED AIR DEICING PROCEDURES

Application of deicing method must be done by trained and qualified personnel.

Airplane Configuration

- Doors and windows – CLOSED.
- THRUST LEVERS – IDLE.
- PARKING BRAKE – ON.
- FLAPS – UP.
- Pitch trim - full nose down to help in removing contaminants.
- Ailerons - neutral position.
- Rudder - neutral position.
- APU – is recommended to be OFF. If APU is required during the deicing procedure, do not apply hot air directly to or near the APU air inlet.
- APU Bleed - CLOSED.
- Engine Bleed – CLOSED.
- Air conditioning PACKS – OFF.

Wing and Horizontal Stabilizers – Apply the forced air from tip inboard to root, from the highest point of surface camber to the lowest. The hot air temperature must not be greater than 80°C (176°F) on these areas.

Vertical Stabilizer, Dorsal Fin, Rudder, and Winglet – Start at the top and then work down. The hot air temperature must not be greater than 80°C (176°F) on these areas.

Fuselage – Apply the hot air along the top centerline and then outboard, letting the melted ice cascade down and across the windows. The hot air temperature must not be greater than 80°C (176°F) on these areas.

Nose Radome Area, Windows, and Windshields – Do not apply hot air directly on cold windshields and windows. It is possible to damage the windows. The hot air temperature must not be greater than 80°C (176°F) on these areas.

Pitot/Static/AOA **Sensors, TAT probes, Pressurization Static Port, and Ice Detectors** – If ice cause blockage of the static port holes or Pitot/Static/AOA sensors, carefully apply hot air until the ice melts.

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Landing Gear and Wheel Bay Areas – Remove quantities of blown snow, applying hot air directly towards the wheels, wheel bays, brakes, or tires. Apply hot air also to remove the ice and to release the tires from the ground. The hot air temperature must not be greater than 85°C (194°F). The maximum airspeed must not be greater than 400 km/h (250 mph) on these areas.

Engine and APU – Do not direct forced air into engines and auxiliary intakes/exhausts, APU inlet/outlet, air/oil cooling intake, and rear fuselage door. Remove any frozen deposits that are bonded to either lower surface of the intake or the fan blades with the application of hot air. The hot air temperature must not be greater than 93°C (200°F) on these areas.

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FUEL SYSTEM SERVICING

PRESSURE REFUELING

Pressure refueling is done by accessing an adapter and a panel located on the right wing-to-fuselage fairing. The adapter is assembled with a valve operated by the opening movement of the fueling nozzle shut-off valve, which is manually controlled. Refer to the FUEL SYSTEM (Section 2-8) for detailed description of the system.

- Connect the ground cable to the airplane.
- Open refueling panel access door on the right side of the fuselage.
- Energize the airplane or set the Power Selection switch to BATTERY.
- Make sure that the refueling CLSD (closed) lights associated with LH and RH tanks are extinguished.
- Make sure that the DEFUELING light is extinguished.
- Make sure that the SELECTED fuel quantity indicator shows zero, select the desired fuel quantity for the airplane.
- Remove the protection cover from the pressure refueling adapter.
- Connect the refueling nozzle to the pressure refueling adapter.
- Pressurize the system (35 - 50 psig).
- Make sure that the refueling CLSD lights associated with LH and RH tanks illuminate and the refueling flow stops.
- Set the REFUELING switch to the OPEN position and make sure that the REFUELING lights associated with the LH and RH tanks extinguish.
- Make sure that the refueling CLSD lights related to LH and RH tanks illuminate, when the desired fuel level is reached.
- For airplanes with High Level Exceeding Indication System if the automatic refueling shutoff fails and the failed tank overfills, the “STOP RFL” red light will illuminate. Stop immediately the refueling operation and defuel the extra fuel of the affected tanks.
- Set the REFUELING switch to the CLOSED position.
- Disconnect the refueling nozzle from the pressure refueling adapter.
- Close the pressure refueling adapter with the protection cover.

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– Set the power selection switch to NORMAL position or deenergize the airplane.

NOTE: The power selection switch guard shall be manually closed.

– Disconnect the grounding cable.

WARNING: MAKE SURE THAT ALL THE SWITCH GUARDS ON THE REFUELING PANEL ARE IN THE CLOSED POSITION.

– Close access door.

GRAVITY REFUELING

Wing tanks gravity refueling is accomplished through the filler caps installed on the upper wing surface. Prior to refueling, the refueling nozzle must be grounded through the grounding point at each wing lower surface. The operation consists in opening the filler cap and inserting the refueling nozzle into the filler port. Fuel quantity may be checked through the EICAS indication or through the magnetic measuring sticks in case of failure of the normal indication system.

FUEL QUALITY CONTROL

Before accepting delivery from the fuel supplier, a check should be made with the purpose of ensuring that fuel intended for use in airplane is in a fit state for use. Fuel should be considered unsatisfactory for use if a sample shows:

– trace of sediments;
– globules of water;
– cloudiness; and
– positive reaction to water detector test.

A visual inspection to a sample should be accomplished to ensure that it does not contain excessive sediment. Generally, aviation turbine fuel is clean, and its color is appropriate to its grade (normally undyed and clear). Apart from cases where water is evidently present in the form of globules, only an appropriate check can be conclusive to indicate the presence of water in a fuel sample.

Both free and suspended water may be present in aviation jet fuel. The water finding paste or paper test method is used to show the presence of free water. The chemical water detector test method is designed to detect suspended water and should be used therefore in addition to the paste/paper method when checking fuels.

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PRESSURE DEFUELING

- Connect the ground cable to the airplane.
- Energize the airplane.
- Open refueling panel access door on the right side of the fuselage and connect the fuel nozzle to the pressure refueling adapter.
- Set the defueling switch to the OPEN position and make sure that the defueling OPEN light illuminates.
- Apply suction (4 psig MAX) to the nozzle or set the Electric Fuel Pumps switches to the ON position.

  NOTE: To defuel the LH tank, set the cross-feed switch to the LOW 2 position.

- When the selected fuel quantity is reached, set the defueling switch to the CLOSED position and make sure its light is extinguished.

CAUTION: DO NOT PERMIT THE FUEL PUMPS TO RUN DRY DURING DEFUELING TO PREVENT DAMAGE.

- Set the Electric Fuel Pumps and X-FEED switches to the OFF position.
- Disconnect the refueling nozzle from the pressure refueling adapter.
- Close the pressure refueling adapter with the protection cover.
- Deenergize the airplane if necessary.

  NOTE: If Power Selection switch has been used at the BATTERY position, set it back to the NORMAL position and close the switch guard.

- Disconnect the grounding cable from the airplane.

  WARNING: MAKE SURE ALL THE SWITCH GUARDS ARE AT THE CLOSED POSITION ON THE REFUELING PANEL.

- Close access door.

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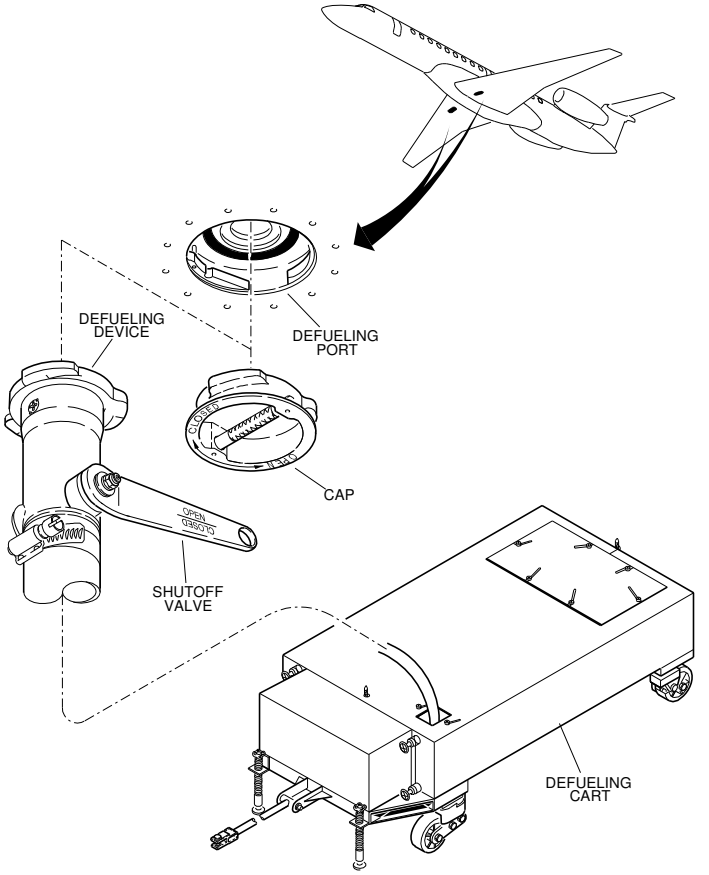
GRAVITY DEFUELING

Gravity defueling is accomplished through the defueling port installed on the wing lower surface, next to the wing root.



GRAVITY DEFUELING EQUIPMENT

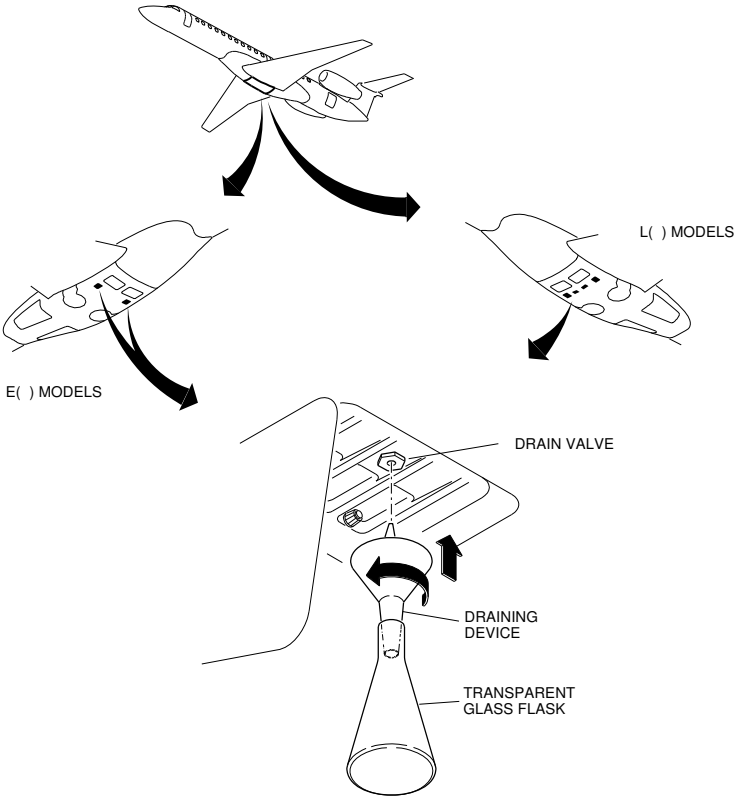
Gravity defueling is accomplished by installing the defueling valve to the defueling port and putting the other hose end into the defueling cart. The airplane must be previously grounded. Opening the shutoff valve will cause the defueling operation to initiate. When the selected remaining quantity is reached, closing the valve will stop defueling.

After the defueling operation is completed, the defueling valve must be removed from the defueling port, and the defueling cap must be closed.

FUEL TANK DRAINING

Fuel tanks must be drained periodically to remove free water and contaminants from the tank bottom, on intervals no longer than 100 FH or 7 calendar days, whichever occurs first.

To drain, place a flask below the draining device. To open the drain valve, insert the draining device in the valve and turn it one-quarter of turn. Close the access panels after the draining is completed.



FUEL DRAINING POINTS

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MEASURING STICK TABLES

To determine the fuel quantity, the airplane must be laterally leveled with roll angles between -1° to +1°and pitch angles between -2° to +2°. After refueling the airplane, start at the external measuring stick, closer to the wing tip. For airplanes without wing stub tank, between 1503 and 2131 liters (397 and 563 US gal), the external measuring stick provides a correct fuel level indication. Above 2131 liters (563 US gal), it is not possible to measure the fuel level through the measuring sticks. If the external measuring stick provides a zero indication, use the internal measuring stick to obtain the fuel level. It is also not possible to measure the fuel level through the measuring sticks, if it is below 448 liters (118 US gal).

For airplanes with wing stub tank, between 2163 and 2791 liters (571 and 737 US gal) the external measuring stick provides a correct fuel level indication. Above 2791 liters (737 US gal), it is not possible to measure the fuel level through the sticks. If the external measuring stick provides a zero indication, use the internal measuring stick to obtain the fuel level. Between 781 and 2168 liters (206 and 573 US gal) the internal measuring stick provides a correct fuel level indication. If the internal measuring stick provides a zero indication, use the wing stub stick to obtain the fuel level. It is also not possible to measure the fuel level through the measuring sticks, if it is below 7 liters (2 US gal).

Enter the measuring stick tables with the value read on the stick to obtain the fuel quantity (liters or US gal). To find the fuel mass in kg (lb) multiply the volume in liters (US gal) by the actual fuel density in kg/l (lb/US gal).

NOTE: - Do not add measuring sticks values.

- After the airplane refueling or after the fuel pumps are turned OFF, it is necessary to wait 10 minutes before reading the measuring sticks.

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STICK POSITION		AIRPLANES WITHOUT WING STUB TANK		AIRPLANES WITH WING STUB TANK	
		LITERS	*US GAL*	*LITERS*	*US GAL*
Wing Stub Tank	Min	--	--	7	2
	Max	--	--	783	207
Internal Point	Min	448	118	781	206
	Max	1553	410	2168	573
External Point	Min	1503	397	2163	571
	Max	2131	563	2791	737

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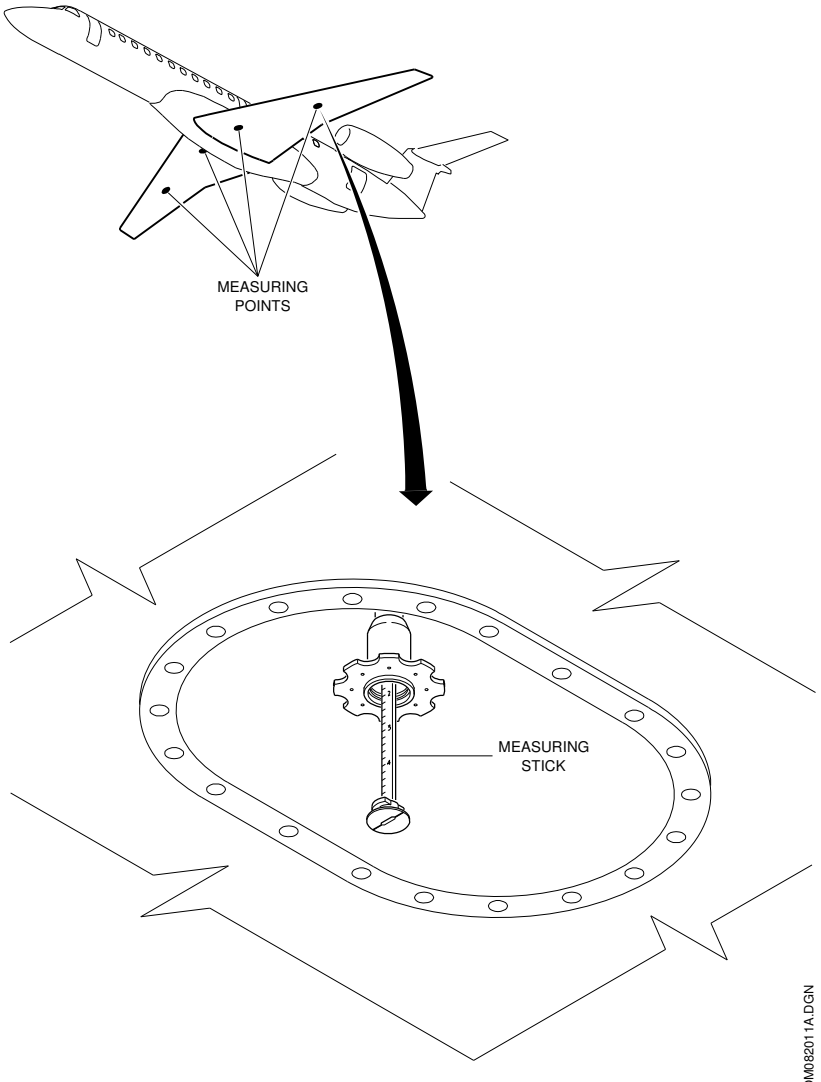

MEASURING STICK POINTS
(AIRPLANES WITHOUT WING STUB TANK)

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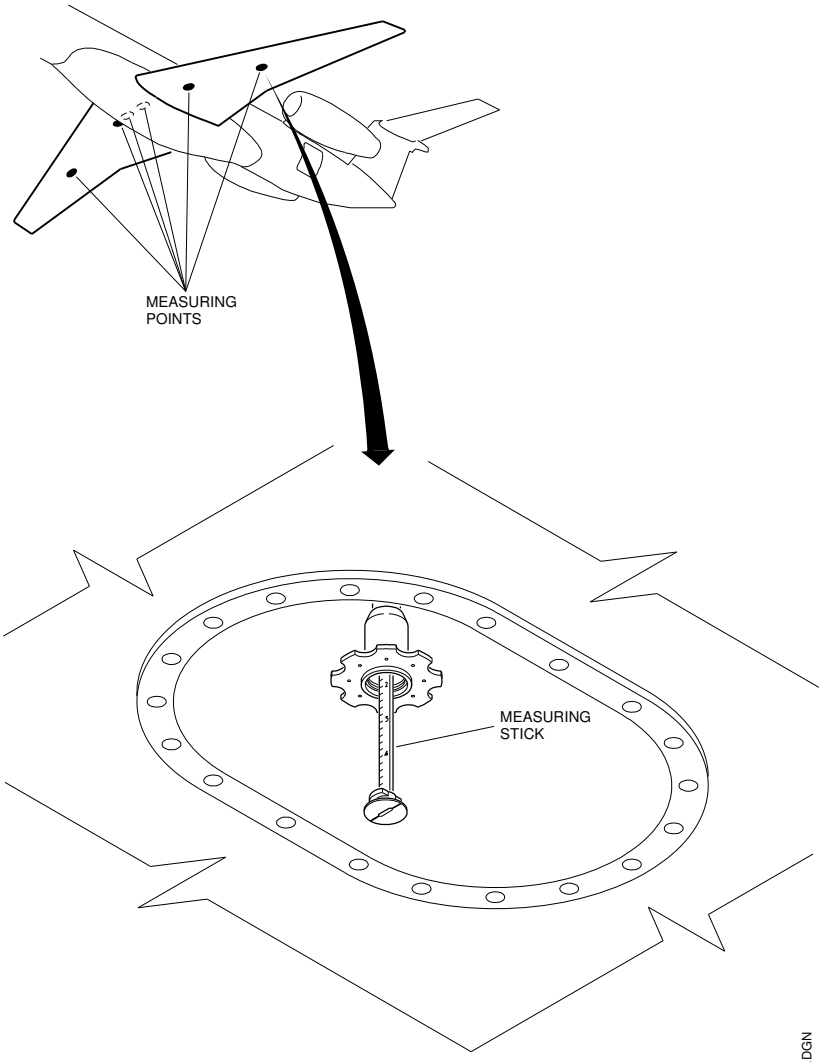

MEASURING STICK POINTS (AIRPLANES WITH WING STUB TANK)

STICK INDICATION	FUEL QUANTITY			
	INTERNAL STICK		EXTERNAL STICK	
	LITERS	*US GAL*	*LITERS*	*US GAL*
0.1	448	118	1503	397
0.2	455	120	1516	401
0.3	462	122	1530	404
0.4	469	124	1543	408
0.5	476	126	1556	411
0.6	483	128	1570	415
0.7	490	129	1583	418
0.8	497	131	1597	422
0.9	505	133	1610	425
1.0	512	135	1623	429
1.1	520	137	1637	432
1.2	527	139	1645	435
1.3	535	141	1663	439
1.4	543	143	1677	443
1.5	550	145	1690	447
1.6	558	148	1703	450
1.7	566	150	1717	454
1.8	574	152	1730	457
1.9	582	154	1744	461
2.0	591	156	1757	464
2.1	599	158	1770	468
2.2	607	160	1784	471
2.3	615	163	1797	475
2.4	624	165	1810	478
2.5	632	167	1824	482
2.6	641	169	1837	485
2.7	650	172	1851	489
2.8	658	174	1864	492

MEASURING STICK TABLES (SHEET 1 OF 4)
(AIRPLANES WITHOUT WING STUB TANK)

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STICK INDICATION	FUEL QUANTITY			
	INTERNAL STICK		EXTERNAL STICK	
	LITERS	*US GAL*	*LITERS*	*US GAL*
2.9	667	176	1877	496
3.0	676	179	1891	499
3.1	685	181	1904	503
3.2	694	183	1917	507
3.3	703	186	1931	510
3.4	712	188	1944	514
3.5	721	191	1957	517
3.6	730	193	1971	521
3.7	740	195	1984	524
3.8	749	198	1998	528
3.9	759	200	2011	531
4.0	768	203	2024	535
4.1	778	205	2037	538
4.2	787	208	2051	542
4.3	797	211	2064	545
4.4	807	213	2078	549
4.5	817	216	2091	552
4.6	827	218	2104	556
4.7	837	221	2118	560
4.8	847	224	2131	563
4.9	857	226	-	-
5.0	868	229	-	-
5.1	878	232	-	-
5.2	888	235	-	-
5.3	899	237	-	-
5.4	909	240	-	-

MEASURING STICK TABLES (SHEET 2 OF 4)
(AIRPLANES WITHOUT WING STUB TANK)

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STICK INDICATION	FUEL QUANTITY	
	INTERNAL STICK	
	LITERS	*US GAL*
5.5	920	243
5.6	930	246
5.7	941	249
5.8	952	252
5.9	963	254
6.0	974	257
6.1	985	260
6.2	996	263
6.3	1007	266
6.4	1018	269
6.5	1030	272
6.6	1041	275
6.7	1052	278
6.8	1064	281
6.9	1076	284
7.0	1087	287
7.1	1099	290
7.2	1111	293
7.3	1123	297
7.4	1134	300
7.5	1146	303
7.6	1159	306
7.7	1171	309
7.8	1183	312
7.9	1195	316
8.0	1208	319
8.1	1220	322
8.2	1232	326

MEASURING STICK TABLES (SHEET 3 OF 4)
(AIRPLANES WITHOUT WING STUB TANK)

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STICK INDICATION	FUEL QUANTITY	
	INTERNAL STICK	
	LITERS	*US GAL*
8.3	1245	329
8.4	1258	332
8.5	1270	336
8.6	1283	339
8.7	1296	342
8.8	1309	346
8.9	1322	349
9.0	1335	353
9.1	1348	356
9.2	1361	360
9.3	1374	363
9.4	1388	367
9.5	1401	370
9.6	1415	374
9.7	1428	377
9.8	1442	381
9.9	1455	385
10.0	1469	388
10.1	1483	392
10.2	1497	395
10.3	1511	399
10.4	1525	403
10.5	1539	407
10.6	1553	410

MEASURING STICK TABLES (SHEET 4 OF 4)
(AIRPLANES WITHOUT WING STUB TANK)

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STICK IND	FUEL QUANTITY					
	INTERNAL STICK		EXTERNAL STICK		WING STUB STICK	
	LITERS	*US GAL*	*LITERS*	*US GAL*	*LITERS*	*US GAL*
0.1	781	206	2163	571	7	2
0.2	794	210	2184	577	14	4
0.3	805	213	2203	582	22	6
0.4	817	216	2220	586	29	8
0.5	827	219	2235	590	36	10
0.6	838	221	2249	594	43	11
0.7	848	224	2263	598	50	13
0.8	858	227	2276	601	56	15
0.9	868	229	2288	605	63	17
1.0	878	232	2301	608	69	18
1.1	888	235	2314	611	74	20
1.2	898	237	2327	615	80	21
1.3	907	240	2340	618	85	23
1.4	917	242	2354	622	90	24
1.5	927	245	2368	626	95	25
1.6	937	248	2383	630	100	26
1.7	947	250	2398	633	104	28
1.8	957	253	2413	638	109	29
1.9	968	256	2429	642	113	30
2.0	978	258	2445	646	116	31
2.1	989	261	2461	650	120	32
2.2	1000	264	2477	654	123	33
2.3	1011	267	2493	659	129	34
2.4	1022	270	2508	663	136	36
2.5	1034	273	2524	667	140	37
2.6	1045	276	2539	671	144	38
2.7	1057	279	2553	674	148	39

MEASURING STICK TABLES (SHEET 1 OF 4)
(AIRPLANES WITH WING STUB TANK)

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STICK IND	FUEL QUANTITY					
	INTERNAL STICK		EXTERNAL STICK		WING STUB STICK	
	LITERS	*US GAL*	*LITERS*	*US GAL*	*LITERS*	*US GAL*
2.8	1069	282	2567	678	155	41
2.9	1081	286	2580	682	164	43
3.0	1093	289	2593	685	173	46
3.1	1105	292	2604	688	181	48
3.2	1118	295	2615	691	188	50
3.3	1130	299	2625	693	195	51
3.4	1143	302	2634	696	201	53
3.5	1156	305	2643	698	207	55
3.6	1169	309	2651	700	213	56
3.7	1182	312	2658	702	218	58
3.8	1194	316	2666	704	224	59
3.9	1208	319	2673	706	229	60
4.0	1221	322	2680	708	234	62
4.1	1234	326	2687	710	239	63
4.2	1247	329	2696	712	244	64
4.3	1260	333	2706	715	249	66
4.4	1273	336	2717	718	254	67
4.5	1286	340	2731	721	259	68
4.6	1300	343	2747	726	265	70
4.7	1313	347	2767	731	270	71
4.8	1326	350	2791	737	276	73

MEASURING STICK TABLES (SHEET 2 OF 4)
(AIRPLANES WITH WING STUB TANK)

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STICK INDICATION	FUEL QUANTITY			
	INTERNAL STICK		WING STUB STICK	
	LITERS	*US GAL*	*LITERS*	*US GAL*
4.9	1339	354	281	74
5.0	1352	357	287	76
5.1	1365	361	293	78
5.2	1378	364	300	79
5.3	1391	368	306	81
5.4	1404	371	313	83
5.5	1418	374	320	85
5.6	1431	378	327	86
5.7	1444	381	334	88
5.8	1457	385	342	90
5.9	1470	388	350	92
6.0	1483	392	357	94
6.1	1496	395	365	97
6.2	1509	399	374	99
6.3	1522	402	382	101
6.4	1535	405	390	103
6.5	1548	409	399	105
6.6	1561	412	408	108
6.7	1574	416	416	110
6.8	1588	419	425	112
6.9	1601	423	434	115
7.0	1615	427	443	117
7.1	1629	430	452	119
7.2	1642	434	461	122
7.3	1656	438	470	124
7.4	1670	441	479	126
7.5	1685	445	488	129
7.6	1699	449	497	131

MEASURING STICK TABLES (SHEET 3 OF 4)
(AIRPLANES WITH WING STUB TANK)

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STICK INDICATION	FUEL QUANTITY			
	INTERNAL STICK		WING STUB STICK	
	LITERS	*US GAL*	*LITERS*	*US GAL*
7.7	1714	453	505	134
7.8	1729	457	514	136
7.9	1744	461	523	138
8.0	1759	465	532	141
8.1	1774	469	541	143
8.2	1790	473	550	145
8.3	1806	477	558	147
8.4	1822	481	567	150
8.5	1838	486	576	152
8.6	1855	490	585	154
8.7	1872	494	593	157
8.8	1889	499	602	159
8.9	1906	503	611	161
9.0	1923	508	620	164
9.1	1941	513	629	166
9.2	1958	517	639	169
9.3	1976	522	648	171
9.4	1994	527	658	174
9.5	2012	531	668	176
9.6	2030	536	679	179
9.7	2048	541	689	182
9.8	2065	546	701	185
9.9	2083	550	713	188
10.0	2101	555	725	192
10.1	2118	560	738	195
10.2	2135	564	752	199
10.3	2152	568	767	203
10.4	2168	573	783	207

MEASURING STICK TABLES (SHEET 4 OF 4)
(AIRPLANES WITH WING STUB TANK)

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REFUELING WITH AN ENGINE RUNNING

Refueling the airplane with an engine running is not recommended. Apart from the risk of fire, there is the risk posed for the maintenance and other personnel who are required to move around the airplane.

There may be circumstances in which an Airport Authority agrees with a detailed procedure that offers an acceptable level of safety to all parts involved. This would, however, be a matter between the Airport Authority and the individual operator. Therefore, contact the Airport Authority prior to performing this operation and/or obtain the necessary approval from the operations inspector.

To refuel the airplane with an engine running, proceed as follows:

- Have the passengers disembarked (refer to the “Deplaning or Boarding with One Engine Running” procedure ahead).
- The airplane must be parked in an area designated by the Airport Authority, with free access to fire fighting equipment and personnel.
- Keep the main door open and the stairs deployed.
- Shut down the right engine.
- Set the left engine to idle power.
- At least one pilot must remain in the cockpit during the refueling. This pilot is responsible for informing all flight and ground crew that the airplane is being refueled and the engine is running.
- During the refueling procedure, do not turn on switches, except those required to operate the fuel system. Set all airplane systems before initiating refueling, in order to avoid moving controls during refueling. Sparks of any kind must be avoided. The use of mobile phones must not be allowed.
- Smoking is prohibited during the refueling, both inside and outside the cabin.
- Only pressure refueling is recommended and, to avoid the possibility of fuel spillage, fueling should be limited to 90% of the tank capacity.
- In the case of fuel spillage, shut down the operating engine.

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DEPLANING OR BOARDING WITH ONE ENGINE RUNNING

The following precautions are recommended:

- At least one pilot must remain in the cockpit.
- Turn the left engine off.
- Set the right engine to idle power.
- Provide safety precautions for passengers on the ground. Isolate the right side of the airplane so that no passenger can get access to this area.

REFUELING WITH PASSENGERS ON BOARD OR EMBARKING/DISEMBARKING

The following precautions are recommended:

- At least one pilot must remain in the cockpit during the refueling procedure. This pilot is responsible for informing all the flight and ground crew that the airplane is being refueled with passengers on board or embarking/disembarking.
- Engines must be off.
- Crew, staff, and passengers must be warned that refueling will take place;
- “Fasten Seat Belts” signs must be off;
- “No Smoking” signs must be on together with interior lights to enable the emergency exits to be noticed;
- Passengers must be instructed to unfasten their seat belts and refrain from smoking;
- Sufficient qualified personnel must be on board and be prepared for an immediate emergency evacuation;
- If the presence of fuel vapors is detected inside the airplane, or any other hazard arises during refueling, fueling must be interrupted immediately;
- Aisles and emergency doors must be kept unobstructed, as well as the ground area beneath the exits.

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RECOMMENDATIONS FOR APU START AND OPERATION WHILE REFUELING

If the APU is operating during refueling:

- Respect APU limitations.
- APU start is allowed during refueling if the start is an initial start or a restart after a normal shutdown.
- APU shutdown is allowed during the refueling operations.

If the APU fails to start during refueling:

- Complete refueling prior to another start attempt.
- Do not attempt to start the APU before disconnection of the fuel hose.

In case of an APU fire:

- Stop the refueling operation
- Accomplish the APU FIRE procedure.

In case of fuel spillage:

- Stop the refueling operation.
- Shut down the APU.
- Do not start the APU until the spillage is removed.

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ENGINE OIL SERVICING

The engine oil tank features an oil level sight gage and an oil level/low level warning sensor. To check oil level in the engine, open its access door and observe the sight glass. It must never exceed the FULL mark.

The engine oil consumption rate is considered high when it increases above the typical consumption rate for the engine, or is equal to or more than 10.1 ounces per hour (0.32 quarts per hour or 300cc per hour). Engine oil consumption rates may increase as engine hours/cycles increase.

High oil consumption indicates something is not functioning properly or possibly a leak which should be addressed by maintenance personnel when convenient. In the absence of other problems associated with the high oil consumption rate there is no mandatory action. Engine oil consumption rates can increase as engine hours/cycles increase.

To fill the tank with oil, proceed as follows:

– Remove the filler cap from the engine oil tank.
– There is an O-ring on the filler cap that must be checked for dents, cracks or breakage. Remove and visually inspect this O-ring.
– Replace the O-ring, if necessary.
– Prior to the first engine run of the day, pour oil through the filler neck observing that the one quart mark on the sight gauge is not exceeded.
– Prior to other flights of the day, if the quantity is below the three quart mark on the sight gauge, fill the oil tank until the oil reaches the two quart mark on the sight gauge.

NOTE: Servicing the oil tank to levels other than above could cause an indication of a high oil pressure condition during takeoff.

– After filling the tank, put the O-ring and the filler cap back in place and make sure that it is properly installed and tightened.

NOTE: Assure an adequate oil quantity to avoid low oil level indication in flight (8 quarts recommended).

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APPROVED ENGINE OIL TYPES

SPECIFICATION	COMMERCIAL PRODUCT	SUPPLIER
MIL-PRF 23699D STD	Aeroshell/Royco Turbine Oil 500	Shell/Royal Lubricants
	BPTO 2380	Air BP Lubricants
	Mobil Jet II	Mobil
MIL-PRF-23669 HTS	Mobil Jet Oil 254	
	BPTO 2197	Air BP Lubricants
MIL-PRF-7808	Mobil RM 284A	Mobil

CAUTION:

- IF MIXED WITH OTHER OILS, MOBIL JET OIL 254 CAN CAUSE WASHING OR SHEDDING OR CARBON DEPOSITS LEFT BY THOSE OILS. THIS CLEANING PROCESS CAN LEAD TO OIL SYSTEM PROBLEMS, SUCH AS BLOCKED PASSAGEWAYS AND SCREENS. CHANGING FROM BPTO 2380, MIL JET II OR AEROSHELL/ROYCO 500, TO MOBIL JET 254 SHOULD ONLY BE DONE WHEN THE ENGINE IS NEW OR OVERHAULED.
- USE OF NON-APPROVED OIL COULD RESULT IN DAMAGE AND PREMATURE ENGINE FAILURE.
- IF OIL BRANDS ARE CHANGED, IT SHOULD BE ACCOMPLISHED GRADUALLY USING THE “TOP OFF” METHOD.
- DO NOT MIX MIL-PRF-23669D STD AND MIL-PRF-7808.
- USE OF MIL-PRF-7808 TYPE OIL SHOULD BE LIMITED TO ONLY THOSE TIMES WHEN OPERATING IN EXTREME COLD WITHOUT PREHEAT CAPABILITY (-40°F TO -65°F) OR WHEN MIL-PRF-7808 IS THE ONLY TYPE OF OIL AVAILABLE.

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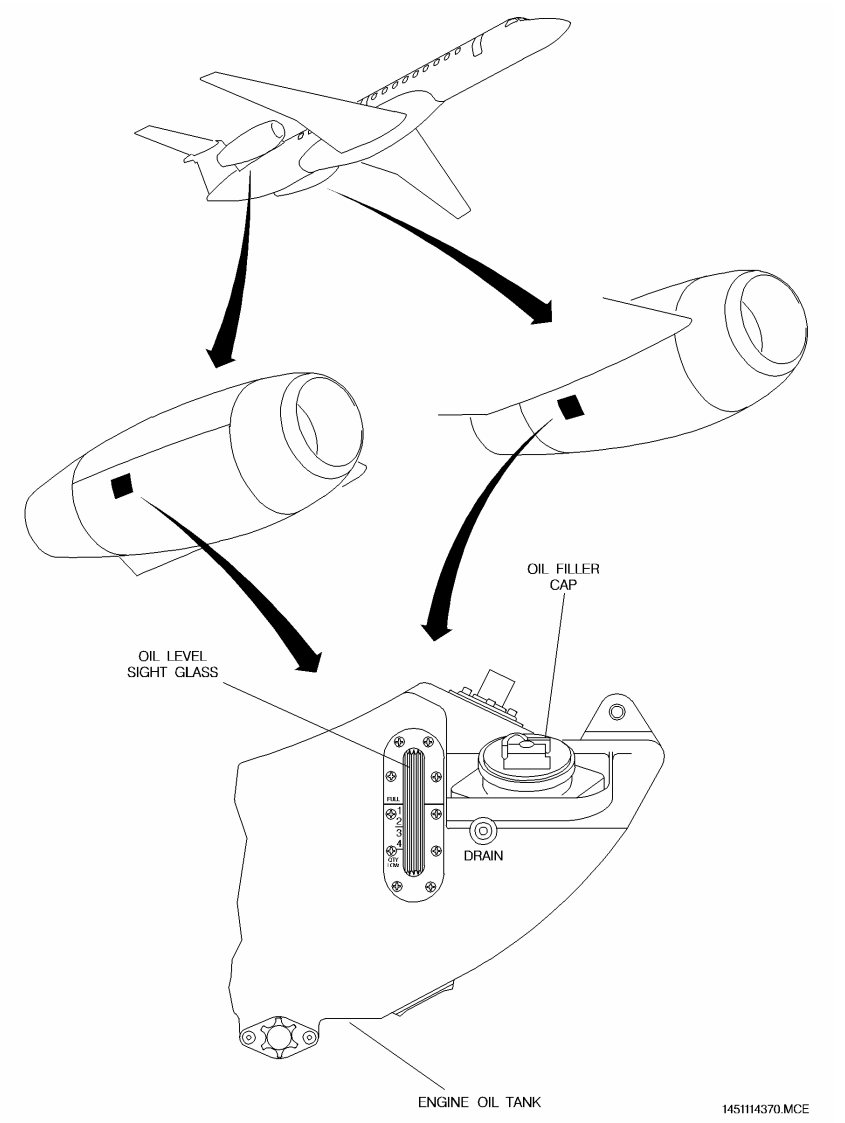

ENGINE OIL FILLING AND OIL LEVEL CHECK

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APU OIL SERVICING

APU oil tank servicing is done through the access at the airplane tail cone which, when open, provides access to a sight glass and an oil filler cap. The sight glass has a FULL indication which must never be exceeded.

APPROVED APU OIL TYPES

SPECIFICATION	COMMERCIAL PRODUCT	SUPPLIER
MIL-PRF-7808	Aeroshell Turbine Oil 390	Shell
	BPTO 2389	Local supplier
	Castrol 325	Castrol
	Mobil Avrex S Turbo 256	Local supplier
MIL-PRF-23699	Castrol 5000	Castrol
	Castrol 5050	Castrol
	Calstex Sato 5S	Local supplier
	BPTO 2197	Air BP Lubricants
	BPTO 2380	
	Hatcol 3211	Local supplier
	Mobil Jet Oil II	Mobil
	Mobil Jet Oil 254	Mobil
	Aeroshell/Royco Turbine Oil 500	Royal Lubricants Shell Aeropia Aero Hardware
	Aeroshell/Royco Turbine Oil 560	Local supplier
	Total Aero Turbine Oil 535	Local supplier
	Turbonycoil 525-2A	Nyco
	Turbonycoil TN 600	Nyco

CAUTION:
- DO NOT FILL THE APU OIL TANK WITH AN OIL OF A DIFFERENT BRAND FROM THAT WHICH IS IN THE TANK, EVEN IF THE SPECIFICATION IS THE SAME (REFER TO THE PLACARD ATTACHED TO THE ACCESS DOOR).
- DO NOT ALLOW THE OIL LEVEL TO EXCEED THE "FULL" MARK ON THE SIGHT PLUG. AN OVERFILLED TANK WILL RESULT IN OIL FOAMING, HIGH TEMPERATURE, AND LOW OIL PRESSURE.

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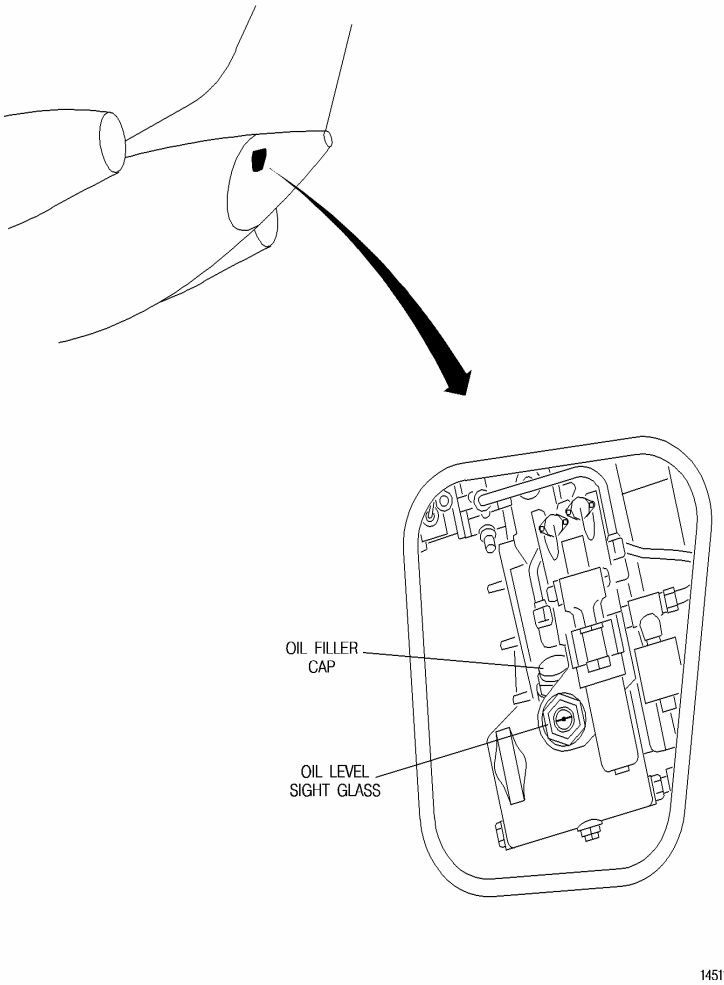


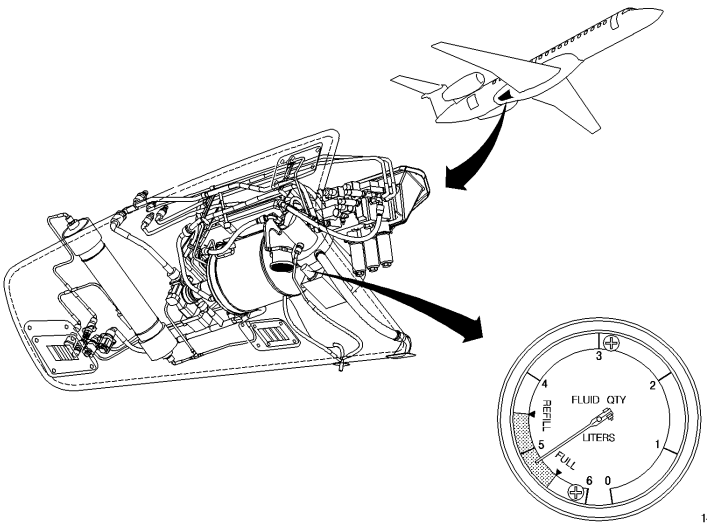
APU OIL FILLING AND OIL LEVEL CHECK

HYDRAULIC SYSTEM SERVICING

HYDRAULIC FLUID LEVEL CHECK

Gain access through the panel located aft of the wing fairing (on both sides of the aircraft). On the hydraulic fluid level indicator, make sure the needle pointer is between the 4.5 and 5.5 liter marks (normal range). The shaded region is the dispatchability range. If the pointer is below the refill mark, fill the reservoir until you have the correct full level mark. Low oil level in the reservoir can be a sign that there is a leak in the system. After servicing the hydraulic system, close the related hydraulic fluid reservoir access panel.
If level indicator is inoperative, it is still possible to check fluid level, but a maintenance technician is required to do the job.

CAUTION: USE ADEQUATE GOGGLES AND RUBBER GLOVES WHILE SERVICING HYDRAULIC SYSTEM. IN CASE HYDRAULIC FLUID COMES IN CONTACT WITH THE SKIN, FLUSH THE AFFECTED AREA WITH WATER. IN CASE HYDRAULIC FLUID COMES IN CONTACT WITH THE EYES, FLUSH THEM WITH WATER AND SEEK MEDICAL ATTENTION.



CHECK OF HYDRAULIC FLUID LEVEL

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LANDING GEAR SERVICING

MAIN AND NOSE LANDING GEAR SHOCK ABSORBER PRESSURE

The main and nose landing gear shock absorber sometimes need nitrogen to be filled. Nitrogen is filled through a charging valve installed at the landing gear. Filling pressure is a function of the piston height, as checked in the charts below (there are separate charts for nose and main landing gears).

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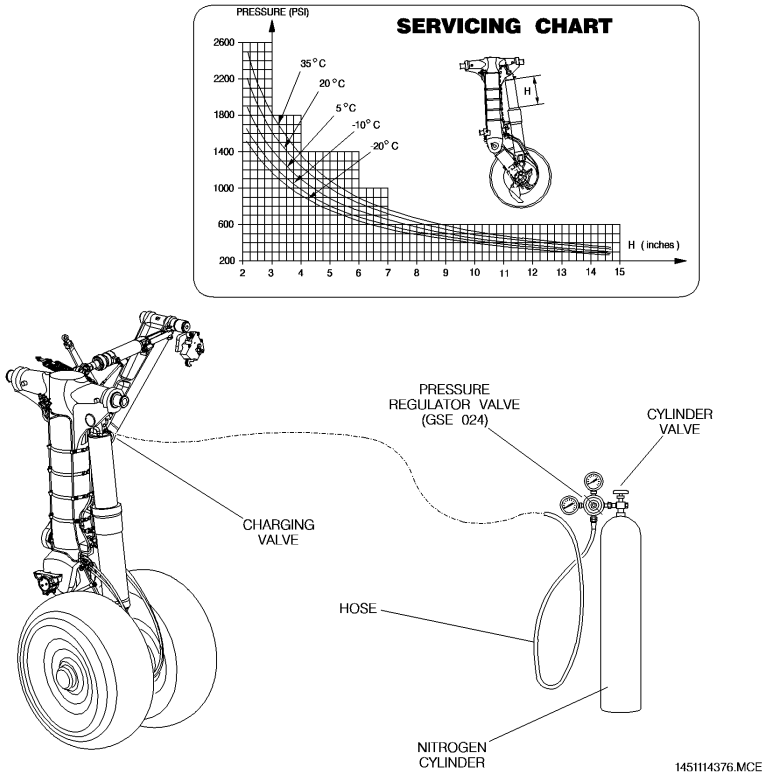
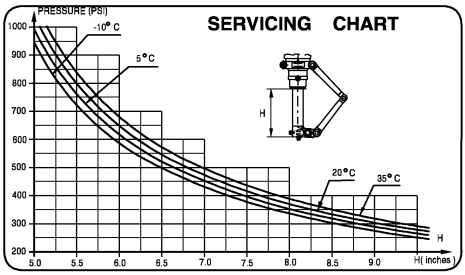


MAIN LANDING GEAR SERVICING



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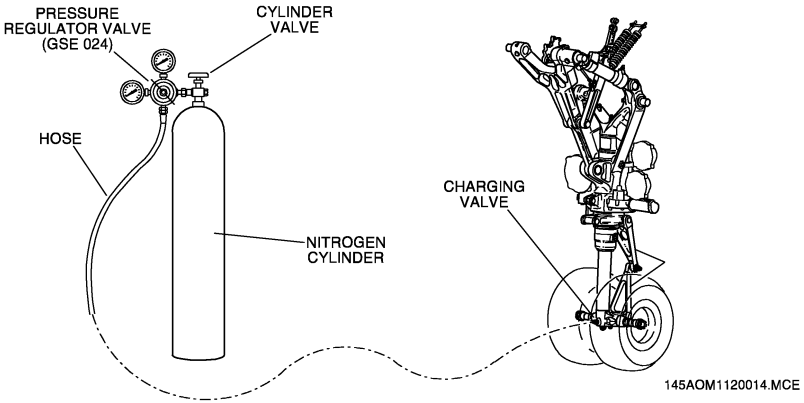

NOSE LANDING GEAR SERVICING

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TIRE PRESSURE

AIRPLANE VERSION	NOSE TIRE PRESSURE (PSI) (Loaded)	MAIN TIRE PRESSURE (PSI) (Loaded)
EMB-145 ER	82 +4/-0	145 +5/-0
EMB-145 EU	82 +4/-0	145 +5/-0
EMB-145 EP	82 +4/-0	148 +5/-0
EMB-145 MP/MK	84 +2/-2	150 +3/-3
EMB-145 LR/LU	84 +2/-2	160 +4/-4
EMB-135 ER	84 +2/-2	134 +3/-3
EMB-135 LR	84 +2/-2	148 +3/-3
ERJ-140 ER (EMB-135 KE)	84 +2/-2	145 +3/-3
ERJ-140 LR (EMB-135 KL)	84 +2/-2	153 +3/-3 (*) 148 +3/-3 (**)
EMB-145 XR	84 +2/-2	175 +4/-4

(*) Airplanes equipped with main tire dimension H30x9.5-16 16PR

(**) Airplanes equipped with main tire dimension 30x9.5-14 16PR

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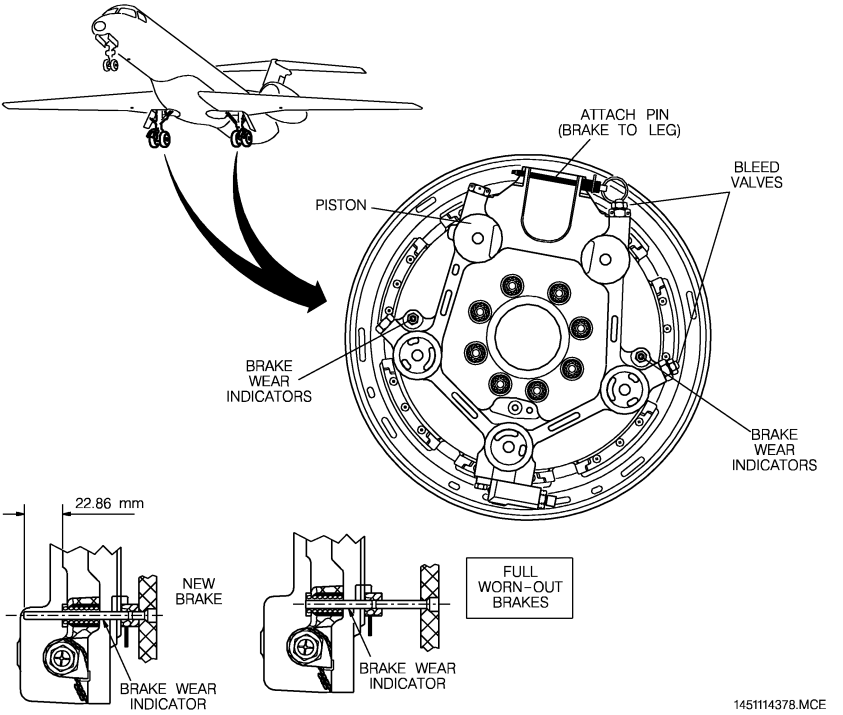
BRAKE WEAR INDICATOR

Checking the brake wear indicators is required during walk-arounds, as prescribed in the approved Airplane Flight Manual, according to the following procedure:



- Operate the emergency/parking brake handle and visually verify all pistons (2) of the brake assembly for operation.
  Brake wear indicator positions must be inspected with brake pressurized (brake applied).
- Inspect the brake wear indicators for visible cracks.
- Inspect the brake wear indicators length. The length of the brake wear indicator for a new brake is 22.86 mm (0.90 in). When the indicator rod is flat with the hexagonal insert, the brakes are full worn out and should be replaced.
- If one or more of the brake wear indicators does not come out of the piston housing, the brake assembly must be replaced.

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CREW OXYGEN MASK STOWAGE

EROS OXYGEN MASK

Stowage box ..... OPEN

Supply hose ..... WIND AND PUT IN BOX

Before winding the supply hose, make sure it is not twisted.

Pneumatic Harness ..... FOLD INTO THE MASK

Crew Mask ..... PUT IN BOX

Make sure the pneumatic harness does not interfere with the retainers.

Make sure that the tabs in the front of the crew oxygen mask is on the top of the plastic stop in the stowage box assembly and the supply hose is at the center of the stowage box.

Left lid of the stowage box ..... CLOSE

Test/shut-off button ..... PUSH

OXY ON flag ..... CHECK

Make sure that the "OXY ON" flag cannot be seen.

Hole of the red plate ..... CONNECT TO DOOR PIN

Connect the hole of the red plate to the door pin in the stowage box assembly .

Right lid of the stowage box ..... CLOSE

Test/shut-off sliding control lever ..... PUSH

Push the lever in the indicated direction. A white band becomes visible beneath the lever. The oxygen is supplied to the mask regulator.

Blinker ..... CHECK

A yellow blinker is displayed for a short time indicating that there is no leak in the mask regulator assembly.

Test/shut-off sliding control lever ..... RELEASE

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PURITAN OXYGEN MASK

Stowage box ..... OPEN

Supply hose ..... WIND AND PUT IN BOX

Before winding the supply hose, make sure it is not twisted.

Pneumatic Harness..... FOLD INTO THE MASK

Crew Mask ..... PUT IN BOX

Make sure the pneumatic harness does not interfere with the retainers. Make sure that the mask regulator is at the center of the stowage box.

Lids of the stowage box ..... CLOSE

OXY ON flag ..... CHECK

If the OXY ON flag is visible:

Test/reset button ..... PUSH

Test/reset button ..... PUSH

OXY ON flag ..... CHECK

The oxygen is supplied to the mask regulator.

Blinker ..... CHECK

A yellow blinker is displayed for a short time indicating that there is no leak in the mask regulator assembly.

Test/reset button ..... RELEASE

The OXY ON flag goes out of view.

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OXYGEN SERVICING

A 50-cu.ft oxygen cylinder is installed on the right side of the cockpit/passenger cabin partition. This cylinder is designated for pilot, copilot and observer use during emergencies. Its pressure can be checked on the EICAS, inside the cockpit, and through an access panel located on the right side of the aiplane nose. Minimum pressure for dispatch of the main cylinder is:

- Crew made up of pilot and copilot: 1100 psi
- Crew made up of pilot, copilot and observer: 1500 psi

Portable oxygen cylinders are distributed along the cabin for passenger and flight attendant emergencies. For airplane dispatchability, the minimum pressure shown on the gauge of the portable oxygen cylinder must be in accordance with the minimum guideline set either for the airline or regulator authority.

Dispatching pressures were calculated for an ambient temperature of 21°C (70°F). For other temperatures, a correction chart is available at the Operations Manual.

WARNING: HIGH-PRESSURE OXYGEN CAN CAUSE SUDDEN COMBUSTION BY CONTACT WITH OIL, GREASE, SOLVENTS, HYDROCARBONS IN GENERAL, CLOTH FIBERS, METAL CHIPS, ETC. QUALIFIED PERSONNEL ONLY MUST HANDLE AND SERVICE THE OXYGEN EQUIPMENT.

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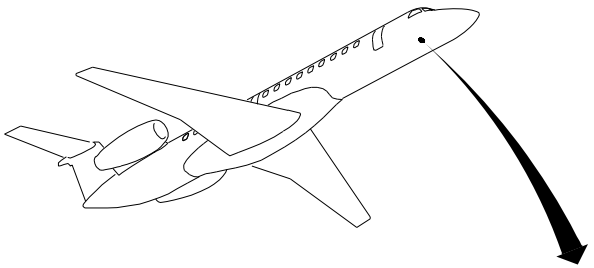

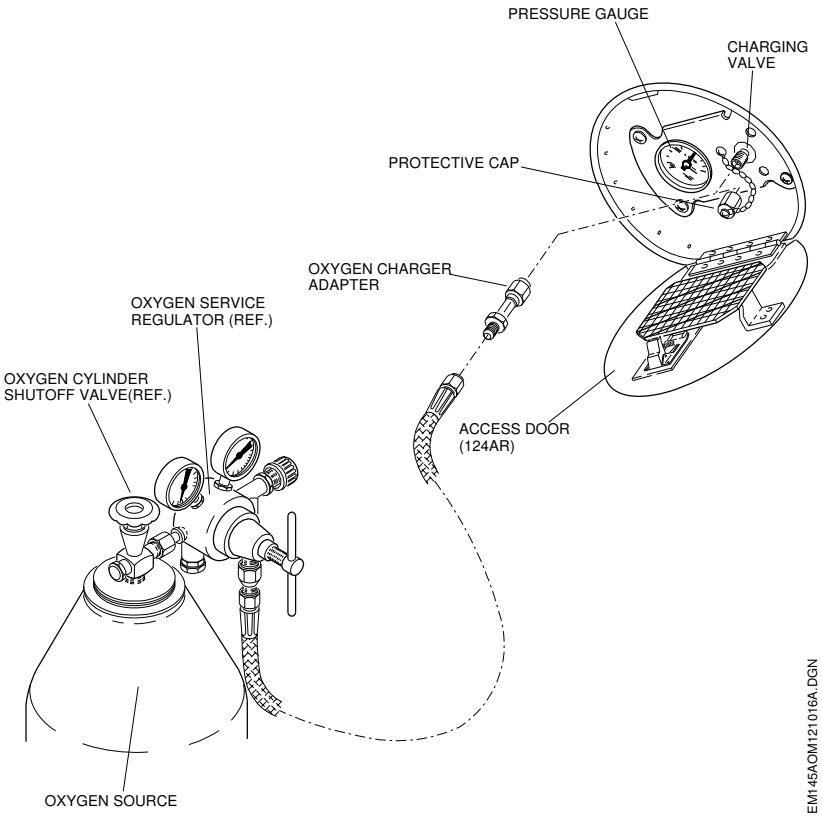

OXYGEN SERVICING

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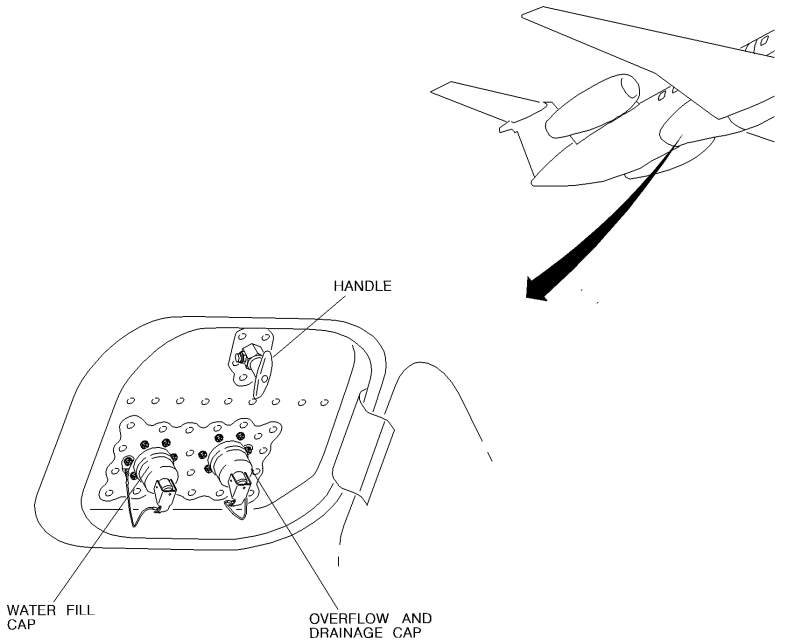
WATER TANK SERVICING

Filling and draining of the water tank is done through a panel installed on the lower right side of the fuselage aft section.

The tank is drained through the water drain installed on the servicing panel, near its control handle. To drain the water tank, remove the cap and pull the handle.

Draining is recommended when freezing or icing conditions are forecast after the last flight and parking overnight.

To fill the tank (20 liters - 5.3 US gallons) of water, caps from the water filling connection and from the tank overflow must be removed. The tanks is full when water starts to flow through the overflow.



WATER TANK DRAINING AND FILLING

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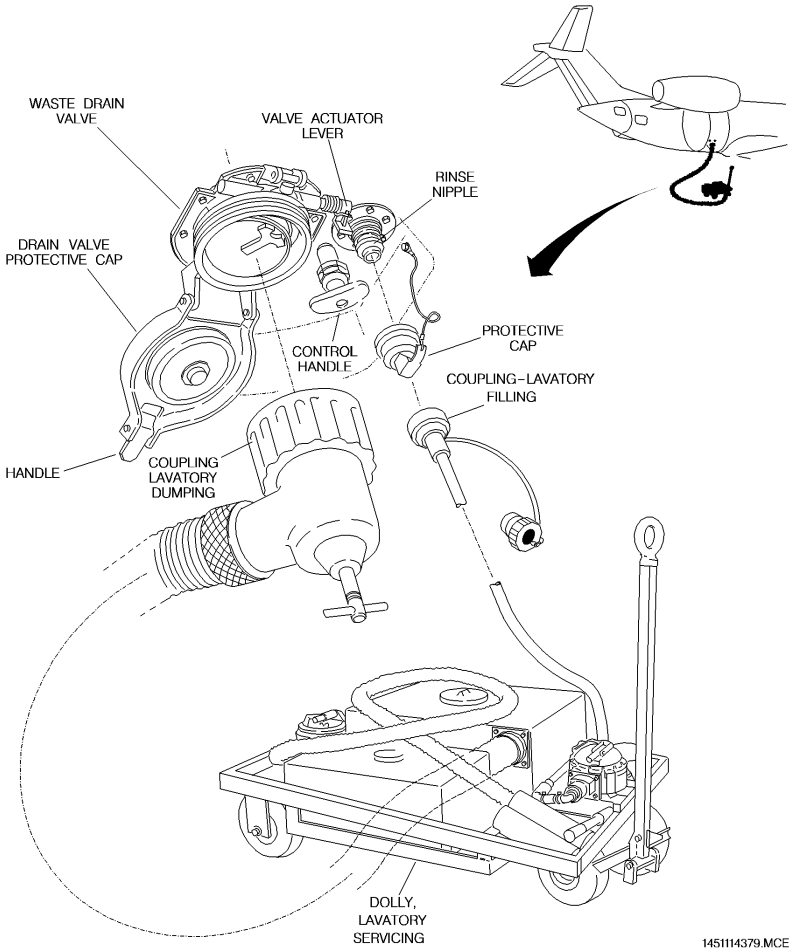
TOILET SERVICING

Toilet waste disposal servicing is accomplished by accessing a panel at the rear right side of the fuselage. A sanitary service unit must be connected to the aircraft service panel.



TOILET SERVICING

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Servicing the toilet waste tank is accomplished as follows:

NOTE: Commercial deodorants and disinfectants can be added to the waste tank, but the tank definitive volume must not contain such material.

- Open waste-service-panel door.
- Remove the protective cap from the toilet rinse nipple.
- Release the handle and open the cap of the waste drain valve.
- Connect the lavatory dumping coupling of the lavatory servicing dolly to the waste drain valve.
- Connect the lavatory filling coupling to the rinse nipple.
- Push the lever of the waste drain-valve actuator to open its internal flapper valve. Do not operate the coupling handle; its operation is not necessary.
- Pull and lock the drain control handle to open the holding-tank drain valve.
- Continue the tank drainage until the waste flow stops.
- Flush with water through the rinse nipple for approximately 3 minutes.
- Release the control cable.
- Fill the waste holding tank with 15 liters (4 gal) of water.
- Pull and lock the drain control handle to open the holding-tank drain valve.
- Release the drain control handle after all liquid is drained.
- Fill the waste holding tank with a maximum of 7.5 liters (2 gal) of water and then add:
  - 57 grams (2 oz.) of Monogram MC-2000 germicidal deodorant, or;
  - 170 grams (6 oz.) of Mirabowl "Q" germicidal deodorant.
- Disconnect the lavatory dumping and filling couplings.
- Close the cap and latch the handle of the waste drain valve. The flapper valve will close automatically when the cap is closed.
- Install the cap on the toilet rinse nipple.

  NOTE: The access door will close only if the waste drain valve is correctly closed.

- Close waste-service-panel door.

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GROUND RESETS

The purpose of this chapter is to provide flight crew with information and procedures to clear nuisance EICAS messages and miscellaneous nuisance faults.

This chapter does not cover all messages or faults that may be detected on the airplane. Any message or fault not covered by this document must be reported to the maintenance personnel.

Standard procedures must be established to instruct the flight crew how to proceed when a nuisance message or fault is presented before starting to follow this chapter after dispatch. These procedures may vary for different airports.

This chapter is organized in a four-column table, as follows:

- ATA column: gives the ATA number for the related message or fault.
- MESSAGE or CONDITION column: provides the messages or fault condition, alphabetically ordered. Messages are referred in capital letters and conditions are referred in plain text.
- LOCATION column: indicates the location of the fault or annunciation.
- PROCEDURES column: provides the proper procedures required to clear the nuisance EICAS message or fault. It may also provide the effectivity of the procedure or Fault Condition in which the procedure applies.

NOTE: This chapter does not constitute an operational approval. If Local Regulatory Authority approval is required, it should be obtained by the operator.

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LIMITATIONS

This chapter shall be used under the following condition:

- Airplane on the ground with parking brake set.
- Each procedure may be performed only once per flight leg. If the nuisance EICAS message or fault is not cleared, maintenance personnel must be notified to clear the condition.
- Effectivity and Fault Condition must be observed. Ground Resets Procedures should be accomplished only if the applicable effectivity and fault conditions are satisfied. Applicable effectivity and fault conditions are listed preceding the procedures. Those procedures that do not have effectivity and fault conditions listed preceding the procedures can be accomplished to every model and conditions, observing the preceding items.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	Absence of ADF 1 bearing information on the RMU and on the PFD and MFD (Transitory condition of Integrated Navigation Unit 1)	ADF	(1) Set the cursor of RMU 1 to the ADF 1 window. (2) Do the test of the frequency selection: (a) Put the cursor on the selected frequency code. (b) Turn the dual concentric knobs. A frequency code can be set. (3) Do the self-test: (a) Set the RMU 1 to the ADF 1 window. (b) Push and hold the RMU TST function key. On the RMU, the ADF 1 window shows: – TEST and ADF TEST (amber). – TEST (amber) and ADF PASS (green), at the end of the test cycle. **NOTE:** An ADF ERR (red) is the indication that the selected ADF is defective.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	Absence of ADF 2 bearing information on the RMU and on the PFD and MDF (Transitory condition of Integrated Navigation Unit 2)	ADF	(1) Set the cursor of RMU 2 to the ADF 2 window. (2) Do the test of the frequency selection: (a) Put the cursor on the selected frequency code. (b) Turn the dual concentric knobs. A frequency code can be set. (3) Do the self-test: (a) Set the RMU to the ADF 2 window. (b) Push and hold the RMU TST function key. On the RMU, the ADF 2 window shows: – TEST and ADF TEST (amber). – TEST (amber) and ADF PASS (green), at the end of the test cycle. **NOTE:** An ADF ERR (red) is the indication that the selected ADF is defective.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	Absence of DME 1 distance information on the RMU and on the PFD and MFD (Transitory condition of Integrated Navigation Unit 1)	DME	(1) On RMU 1, push the DME function key. (2) Move the cursor of RMU 1 to the DME 1 window. (3) Do the test of frequency selection: (a) Put the cursor on the selected frequency code. (b) Turn the dual concentric knobs. A frequency code can be set. (4) Do the self-test: (a) Set the RMU 1 to the DME 1 window. (b) Push and hold the RMU TST function key. On the RMU, the DME 1 window shows: – TEST and DME TEST (amber). – TEST (amber) and DME PASS (green), at the end of the test cycle. **NOTE:** A DME ERR (red) is the indication that the selected DME is defective.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	Absence of DME 2 distance information on the RMU and on the PFD and MFD (Transitory condition of Integrated Navigation Unit 2)	DME	(1) On RMU 2, push the DME function key. (2) Move the cursor of RMU 2 to the DME 2 window. (3) Do the test of frequency selection: (a) Put the cursor on the selected frequency code. (b) Turn the dual concentric knobs. A frequency code can be set. (4) Do the self-test: (a) Set the RMU 2 to the DME 2 window. (b) Push and hold the RMU TST function key. On the RMU, the DME 2 window shows: – TEST and DME TEST (amber). – TEST (amber) and DME PASS (green), at the end of the test cycle. **NOTE:** A DME ERR (red) is the indication that the selected DME is defective.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
24	Absence of electrical power at some buses (Transitory condition of the electrical circuit)	GPU	(1) Energize airplane with external DC power supply. (2) Check that output voltage of external power is 28 ± 0.5 V DC. (3) Check that BATT 1-2 switches, BUS TIE switch, and ESSENTIAL POWER pushbutton (pushbutton released), on the electrical panel, on the overhead panel, are set at the AUTO position. (4) Check that GPU pushbutton, on the electrical panel, on the overhead panel, is set at ON (GPU pushbutton pushed). (5) Set the ELEC PWR switch, on the maintenance panel, to RESET.
23	ACARS/ DMU failure message on FMS (Transitory condition of the CMU)	ACARS	Make sure the CMU ground service is active and ready to use. Make sure the CMU is correctly installed. Check if the fault occurred during the airplane power-up. **NOTE:** The CMU takes approximately 1 minute or 2 minutes to restart. During this time, the CDU displays ACARS DMU FAILED.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
27	Aileron – No roll control through the switch (Transitory condition of the roll trim electrical circuit)	AILERON	Make sure that the ROLL TRIM circuit breaker is closed. Energize the airplane with hydraulic pressure. Do a roll trim test through the roll trim switch: (1) Push the roll trim switch to the LWD position for approximately 3 seconds. The roll trim system is automatically deactivated in 3 seconds. (2) Push the roll trim switch to the RWD position for approximately 3 seconds. The roll trim system is automatically deactivated in 3 seconds.
34	ALT Flag on the ISIS (SMITHS and THALES)	ISIS	(1) On the circuit breaker panel, open and close the INTEG STBY circuit breaker. **NOTE:** Before turning on the ISIS, make sure that there is no dynamic pressure applied to Pitot/Static 3. It must be equivalent to an airspeed equal to or greater than 60 knots. The airplane must be maintained stationary during the ISIS initialization. (2) The display shows an initialization page for 70 seconds (ISIS SMITHS) or for 90 seconds (ISIS THALES). (3) Wait until the ISIS completes its initialization.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	ATT Flag on the ISIS (SMITHS and THALES)	ISIS	(1) On the circuit breaker panel, open and close the INTEG STBY circuit breaker. **NOTE:** Before turning on the ISIS, make sure that there is no dynamic pressure applied to Pitot/Static 3. It must be equivalent to an airspeed equal to or greater than 60 knots. The airplane must be maintained stationary during the ISIS initialization. (2) The display shows an initialization page for 70 seconds (ISIS SMITHS) or for 90 seconds (ISIS THALES). (3) Wait until the ISIS completes its initialization.
34	CAGE Flag on the ISIS (THALES)	ISIS	(1) Push the CAGE button to cage the Integrated Standby Instrument System (ISIS) and do not move the ISIS during this phase. **NOTE:** The "ATT 10s" indication replaces the ATT CAGE flag to show that the ISIS is in the attitude reset (caging) phase. In flight, the pilot must maintain the airplane in straight and level flight and at constant speed before pushing the CAGE button during this phase. (2) Make sure that the attitude function has been set to the true value in stabilized condition.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
31	CAS Message displayed on the PFD	IC-600	On the copilot's reversionary panel, set the MFD selector to the EICAS position. To check which the discrepant message is, compare the messages on the copilot's MFD with the ones presented on the EICAS. In a discrepant message on the EICAS: – Open the IC-600 1 circuit breaker, wait a few seconds, and close it back. Wait for the IC system initialization. Do the comparison again.
27	Directional Trim Locked (Rudder trim switch has to be pressed 3 times before the surface responds and the system operates at the fourth try) (Transitory condition of yaw trim electrical circuit)	Rudder Trim	Pressurize the hydraulic system. Do the operational check of the yaw trim: – Move the YAW TRIM switch to the LEFT position. On the EICAS display, the arrow of the YAW TRIM indication moves to the left. **NOTE:** The system cycle is limited in 3 seconds, after this time you must to release the switch and move it again to get another cycle. – Release the YAW TRIM switch, it goes to neutral position by itself. On the EICAS display, the arrow of the YAW TRIM indication remains at last position. – Move the YAW TRIM switch to the RIGHT position. On the EICAS display, the arrow of the YAW TRIM indication goes from LEFT to RIGHT position.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
27	Directional Trim Locked (Yaw trim surface is locked at the RH position) (Transitory condition of the Yaw Trim electrical circuit)	Yaw Trim	Pressurize the hydraulic system. Do the operational check of the yaw trim: – Move the YAW TRIM switch to the LEFT position. On the EICAS display, the arrow of the YAW TRIM indication moves to the left. **NOTE:** The system cycle is limited in 3 seconds, after this time you must to release the switch and move it again to get another cycle. – Release the YAW TRIM switch, it goes to neutral position by itself. On the EICAS display, the arrow of the YAW TRIM indication remains at last position. – Move the YAW TRIM switch to the RIGHT position. On the EICAS display, the arrow of the YAW TRIM indication goes from LEFT to RIGHT position.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
28	FCU L (R) ARINC 429 message appears on the repeater indicator panel	FCU	Do the electrical fuel quantity indication check. On the repeater indicator panel, set the toggle switch to the TEST position and clear the fault message. If passes the electrical fuel quantity indication check, reset is ok.
28	FCU L (R) FAIL message on the repeater indicator panel	FCU	Do the electrical fuel quantity indication check. On the repeater indicator panel, set the toggle switch to the TEST position and clear the fault message. If passes the electrical fuel quantity indication check, reset is ok.
34	HDG Flag on the ISIS (SMITHS and THALES)	ISIS	(1) On the circuit breaker panel, open and close the INTEG STBY circuit breaker. **NOTE:** Before turning on the ISIS, make sure that there is no dynamic pressure applied to Pitot/Static 3. It must be equivalent to an airspeed equal to or greater than 60 knots. The airplane must be maintained stationary during the ISIS initialization. (2) The display shows an initialization page for 70 seconds (ISIS SMITHS) or for 90 seconds (ISIS THALES). (3) Wait until the ISIS completes its initialization.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	M Flag on the ISIS	ISIS	(1) On the circuit breaker panel, open and close the INTEG STBY circuit breaker. **NOTE:** Before turning on the ISIS, make sure that there is no dynamic pressure applied to Pitot/Static 3. It must be equivalent to an airspeed equal to or greater than 60 knots. The airplane must be maintained stationary during the ISIS initialization. (2) The display shows an initialization page for 90 seconds. (3) Wait until the ISIS completes its initialization.
34	MAINT Indication on the ISIS	ISIS	(1) On the circuit breaker panel, open and close the INTEG STBY circuit breaker. **NOTE:** Before turning on the ISIS, make sure that there is no dynamic pressure applied to Pitot/Static 3. It must be equivalent to an airspeed equal to or greater than 60 knots. The airplane must be maintained stationary during the ISIS initialization. (2) The display shows an initialization page for 90 seconds. (3) Wait until the ISIS completes its initialization.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
28	MFD shows dashes instead of wing fuel quantity	FCU	Get access to the maintenance panel. Set the fuel page on the MFD. Move the "FUEL QTY IND" toggle switch on the maintenance panel. (1) The EICAS display shows these messages and indications: – FUEL 1-2 LO LEVEL (WARNING). – TANK 1-2 shows 1130 kg ± 10 kg (2500 lb). (2) The MFD shows these indications: – TANK 1 – 1130 kg ± 10 kg (2500 lb). – TANK 2 – 1130 kg ± 10 kg (2500 lb). – TOTAL – 2260 kg (5000 lb). (3) The warning lights flash. (4) The aural warning operates (bell). **NOTE:** After 10 seconds, the preceding indications go back to the normal condition. Press one of the master warning lights to stop the lights. If passes the electrical fuel quantity indication check, reset is ok.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	SPD Flag on the ISIS	ISIS	(1) On the circuit breaker panel, open and close the INTEG STBY circuit breaker. **NOTE:** Before turning on the ISIS, make sure that there is no dynamic pressure applied to Pitot/Static 3. It must be equivalent to an airspeed equal to or greater than 60 knots. The airplane must be maintained stationary during the ISIS initialization. (2) The display shows an initialization page for 90 seconds. (3) Wait until the ISIS completes its initialization.
34	SSEC Annunciation on the ISIS	ISIS	(1) On the circuit breaker panel, open and close the INTEG STBY circuit breaker. **NOTE:** Before turning on the ISIS, make sure that there is no dynamic pressure applied to Pitot/Static 3. It must be equivalent to an airspeed equal to or greater than 60 knots. The airplane must be maintained stationary during the ISIS initialization. (2) The display shows an initialization page for 90 seconds. (3) Wait until the ISIS completes its initialization.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
22	The rudder servo motor does not actuate (Transitory condition of Integrated Computer)	IC-600	(1) Energize the airplane with the External DC Power supply. (2) Pressurize the hydraulic system. Operational check of the Yaw trim: (a) Move the YAW TRIM switch to the LEFT position. On the EICAS display, the arrow of the YAW TRIM indication moves to the left. **NOTE:** The system cycle time is limited in 3 seconds, after this time you must to release the switch and move it again to get another cycle. (b) Release the YAW TRIM switch, it goes to neutral position by itself. On the EICAS display, the arrow of the YAW TRIM indication remains at last position. (c) Move the YAW TRIM switch to the RIGHT position. On the EICAS display, the arrow of the YAW TRIM indication goes from LEFT to RIGHT position. (3) Release the pressure of the hydraulic system.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	VMO/MMO Flag on the ISIS	ISIS	(1) On the circuit breaker panel, open and close the INTEG STBY circuit breaker. **NOTE:** Before turning on the ISIS, make sure that there is no dynamic pressure applied to Pitot/Static 3. It must be equivalent to an airspeed equal to or greater than 60 knots. The airplane must be maintained stationary during the ISIS initialization. (2) The display shows an initialization page for 90 seconds. (3) Wait until the ISIS completes its initialization.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	AHRS 1 ATT MODE	EICAS	(1) After the airplane is brought to a stop at the ramp or hangar, power off the AHRS 1. Open the circuit breaker AHRS 1. (2) Reapply power and try to align the AHRS in a normal fashion.
34	AHRS 2 ATT MODE	EICAS	(1) After the airplane is brought to a stop at the ramp or hangar, power off the AHRS 2. Open the circuit breaker AHRS 2. (2) Reapply power and try to align the AHRS in a normal fashion.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	AHRS 1 FAIL	EICAS	(1) Enter the correct present position. For airplanes with single or dual Honeywell FMS: **NOTE:** Operator can use either the FMS CDU or the bezel pushbuttons of the pilot's MFD to enter the present position. (a) FMS CDU: Push the NAV mode key and the NEXT function key (NAV INDEX 2/2 page comes into view). Push the POS INIT (3L) left line select key (POS INIT 1/1 page comes into view). Push the LOAD (2R) right line select key to update the FMS position with the last saved position (FMS CDU shows the LOADED POSITION coordinates). Bezel Pushbuttons: Make sure that the airplane is in the ground configuration. On main menu of the pilot's MFD, use the bezel pushbuttons to select the PPOS INIT option (pilot's MFD shows the present position initialization menu). **NOTE:** From this menu operator can: – Confirm that the EFIS stored present position (PPOS) is correct, and push the ENT pushbutton, or (continued)

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	AHRS 1 FAIL (continued)	EICAS	(continued) – Operator can change the present position coordinates via the bezel pushbuttons and the data set knob. (b) After the present coordinates are set, push the ENT pushbutton to send the coordinates to the AH-900 computer. For airplanes with single or dual Universal FMS: **NOTE:** Operator can use either the FMS CDU or the bezel pushbuttons of the pilot's MFD to enter the present position. (a) FMS CDU: On the FMS CDU, on the INIT 1/1 page, push the ACCEPT line select key to update the FMS position. Bezel pushbuttons: Make sure that the airplane is in the ground configuration. On main menu of the pilot's MFD, use the bezel pushbuttons to select the PPOS INIT option (pilot's MFD shows the present position initialization menu). **NOTE:** From this menu operator can: – Confirm that the EFIS stored present position (PPOS) is correct, and push the ENT pushbutton, or (continued)

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	AHRS 1 FAIL (continued)	EICAS	(continued) – Operator can change the present position coordinates via the bezel pushbuttons and the data set knob. (b) After the present coordinates are set, push the ENT pushbutton to send the coordinates to the AH-900 computer. **NOTE:** At the end of the alignment, the AHRU conducts an alignment-performance test on the entered latitude. If the entered does not pass the alignment-performance test, the AHRS 1 ALN FAULT message shows on the EICAS display. If a subsequent entry of the same latitude does not pass the alignment-performance test, the AHRS 1 FAIL message shows on the EICAS display. Under the preceding conditions, the AHRU still accepts latitude entries. If an entry passes the alignment-performance test: – AHRS 1 FAIL message goes out of view, and – AHRU clears the bits that were set to indicate the failure. (2) Wait until the alignment is completed.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	AHRS 2 FAIL	EICAS	(1) Enter the correct present position. For airplanes with single or dual Honeywell FMS: **NOTE:** Operator can use either the FMS CDU or the bezel pushbuttons of the pilot's MFD to enter the present position. (a) FMS CDU: Push the NAV mode key and the NEXT function key (NAV INDEX 2/2 page comes into view). Push the POS INIT (3L) left line select key (POS INIT 1/1 page comes into view). Push the LOAD (2R) right line select key to update the FMS position with the last saved position (FMS CDU shows the LOADED POSITION coordinates). (b) Bezel Pushbuttons: Make sure that the airplane is in the ground configuration. On main menu of the pilot's MFD, use the bezel pushbuttons to select the PPOS INIT option (pilot's MFD shows the present position initialization menu). **NOTE:** From this menu operator can: – Confirm that the EFIS stored present position (PPOS) is correct, and push the ENT pushbutton, or (continued)

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	AHRS 2 FAIL (continued)	EICAS	(continued) – Operator can change the present position coordinates via the bezel pushbuttons and the data set knob. (c) After the present coordinates are set, push the ENT pushbutton to send the coordinates to the AH-900 computer. For airplanes with single or dual Universal FMS: **NOTE:** Operator can use either the FMS CDU or the bezel pushbuttons of the pilot's MFD to enter the present position. (a) FMS CDU: On the FMS CDU, on the INIT 1/1 page, push the ACCEPT line select key to update the FMS position. (b) Bezel pushbuttons: Make sure that the airplane is in the ground configuration. On main menu of the pilot's MFD, use the bezel pushbuttons to select the PPOS INIT option (pilot's MFD shows the present position initialization menu). **NOTE:** From this menu operator can: – Confirm that the EFIS stored present position (PPOS) is correct, and push the ENT pushbutton, or (continued)

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	AHRS 2 FAIL (continued)	EICAS	(continued) – Operator can change the present position coordinates via the bezel pushbuttons and the data set knob. (c) After the present coordinates are set, push the ENT pushbutton to send the coordinates to the AH-900 computer. **NOTE:** At the end of the alignment, the AHRU conducts an alignment-performance test on the entered latitude. If the entered does not pass the alignment-performance test, the AHRS 1 ALN FAULT message shows on the EICAS display. If a subsequent entry of the same latitude does not pass the alignment-performance test, the AHRS 1 FAIL message shows on the EICAS display. Under the preceding conditions, the AHRU still accepts latitude entries. If an entry passes the alignment-performance test: – AHRS 1 FAIL message goes out of view, and – AHRU clears the bits that were set to indicate the failure. (2) Wait until the alignment is completed.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
32	BRAKE DEGRADED	EICAS	(1) On the circuit breaker panel, open the BRAKES OUTBD and BRAKES INBD circuit breakers. (2) Close the BRAKES OUTBD and BRAKES INBD circuit breakers on the circuit breaker panel. (3) Press both brake pedals and verify that the message remains extinguished.
31	CHECK IC 2 SW	EICAS	On the circuit breaker panel, open the IC 2 circuit breaker and close it after a few seconds.
31	DAU 1A FAIL (Transitory condition of IC)	EICAS	Check that EICAS DAU 1A and 1B, MFD 1, EICAS DISPLAY, DISPLAY CONTROL 1, IC 1 and IC 2 circuit breakers are closed. Check the SG pushbutton on the pilot Reversionary Panel. Is the SG pushbutton pressed when the DAU 1A FAIL message appears? **YES** –Open, and then, close the IC 2 circuit breaker on the overhead circuit breakers panel.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
31	DAU 1B FAIL (Transitory condition of IC)	EICAS	Check that EICAS DAU 1A and 1B, MFD 1, EICAS DISPLAY, DISPLAY CONTROL 1, IC 1 and IC 2 circuit breakers are closed. Check the SG pushbutton on the pilot Reversionary Panel. Is the SG pushbutton pressed when the DAU 1B FAIL message appears? **YES** –Open, and then, close the IC 2 circuit breaker on the overhead circuit breakers panel.
31	DAU 2A FAIL (Transitory condition of IC)	EICAS	Check that EICAS DAU 2A and 2B, MFD 2, EICAS DISPLAY, DISPLAY CONTROL 2, IC 1 and IC 2 circuit breakers are closed. Check the SG pushbutton on the pilot Reversionary Panel. Is the SG pushbutton pressed when the DAU 2A FAIL message appears? **YES** –Open, and then, close the IC 2 circuit breaker on the overhead circuit breakers panel.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
31	DAU 2B FAIL (Transitory condition of IC)	EICAS	Check that EICAS DAU 2A and 2B, MFD 2, EICAS DISPLAY, DISPLAY CONTROL 2, IC 1 and IC 2 circuit breakers are closed. Check the SG pushbutton on the pilot Reversionary Panel. Is the SG pushbutton pressed when the DAU 2B FAIL message appears? **YES** –Open, and then, close the IC 2 circuit breaker on the overhead circuit breakers panel.
31	DAU 1 WRN MISCOMP (Transitory condition of IC)	EICAS	Check that EICAS DAU 1A and 1B, MFD 1, EICAS DISPLAY, DISPLAY CONTROL 1, IC 1 and IC 2 circuit breakers are closed. Check the SG pushbutton on the pilot Reversionary Panel. Is the SG pushbutton pressed when the DAU 1 WRN MISCOMP message appears? **YES** –Open, and then, close the IC 2 circuit breaker on the overhead circuit breakers panel.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
31	DAU 2 WRN MISCOMP (Transitory condition of IC)	EICAS	Check that EICAS DAU 2A and 2B, MFD 2, EICAS DISPLAY, DISPLAY CONTROL 2, IC 1 and IC 2 circuit breakers are closed. Check the SG pushbutton on the pilot Reversionary Panel. Is the SG pushbutton pressed when the DAU 2 WRN MISCOMP message appears? **YES** –Open, and then, close the IC 2 circuit breaker on the overhead circuit breakers panel.
34	DU 1 FAN FAIL	EICAS	On the circuit breaker panel, open and close PFD 1 circuit breaker (D13).
34	DU 2 FAN FAIL	EICAS	On the circuit breaker panel, open and close MFD 1 circuit breaker (D23).
34	DU 3 FAN FAIL	EICAS	On the circuit breaker panel, open and close EICAS/DISPLAY circuit breaker (C9).
34	DU 4 FAN FAIL	EICAS	On the circuit breaker panel, open and close MFD 2 circuit breaker (D12).
34	DU 5 FAN FAIL	EICAS	On the circuit breaker panel, open and close PFD 2 circuit breaker (D22).
34	DU 1 OVHT	EICAS	Check if the DU 1 OVHT message appears for approximately 4 seconds on the EICAS and then disappears.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	DU 2 OVHT	EICAS	Check if the DU 2 OVHT message appears for approximately 4 seconds on the EICAS and then disappears.
34	DU 3 OVHT	EICAS	(1) On the pilot reversionary panel, rotate the MFD switch to the EICAS position. The EICAS screen shows on the MFD 1 display (DU 2). (2) Check if the DU 3 OVHT message appears for approximately 4 seconds on the EICAS (DU 2) and then disappears. If yes, on the pilot reversionary panel, rotate the MFD switch to the normal position. The EICAS screen shows on the EICAS display (DU 3).
34	DU 4 OVHT	EICAS	Check if the DU 4 OVHT message appears for approximately 4 seconds on the EICAS and then disappears.
34	DU 5 OVHT	EICAS	Check if the DU 5 OVHT message appears for approximately 4 seconds on the EICAS and then disappears.
34	HGS FAIL	EICAS	Open the following circuit breakers and, after approximately 5 seconds, close them: – HCP (Location Tip: DC BUS 1/CAT III/HCP) CB H8 – HGC (Location Tip: DC BUS 1/CAT III/HCG) CB H6 – OHU (Location Tip: DC BUS 1/CAT III/OHU). CB H7
34	IRS 1 ATT MODE	EICAS	(1) After the airplane is brought to a stop at the ramp or hangar, power off IRS 1. (2) Reapply power and try to align IRS 1 in a normal fashion.

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	IRS 2 ATT MODE	EICAS	(1) After the airplane is brought to a stop at the ramp or hangar, power off IRS 2. (2) Reapply power and try to align IRS 2 in a normal fashion.
34	IRS 1 FAIL	EICAS	(1) Set the MSU 1 rotary switch to ALIGN. (2) Enter the correct present position. **NOTE:** The airplane must be maintained stationary during the IRS 1 alignment. (3) Wait until the alignment is complete. In case of IRS 1 FAIL message does not disappear: (a) Set the MSU 1 rotary switch to OFF. (b) On the overhead electrical panel, push the BACKUP pushbutton (the stripped bar illuminates). (c) On the overhead circuit breaker panel, open IRS 1 CB. (d) On the overhead circuit breaker panel, open the following CBs: For single FMS installed: CDU, CMPTR, GPS. For dual FMS installed: CDU 1, CDU 2, FMC 1, FMC 2, GPS 1, and GPS 2. (e) Wait at least 3 seconds. (f) On the overhead electrical panel, push the BACKUP pushbutton again (the stripped bar extinguishes). (continued)

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	IRS 1 FAIL (continued)	EICAS	(continued) (g) On the overhead circuit breaker panel, close IRS 1 CB. (h) On the overhead circuit breaker panel, close the following CBs: For single FMS installed: CDU, CMPTR, GPS. For dual FMS installed: CDU 1, CDU 2, FMC 1, FMC 2, GPS 1, and GPS 2. (i) Set the MSU 1 rotary switch to ALIGN. (j) Enter the correct present position. **NOTE:** The airplane must be kept stationary during the IRS 1 alignment. (k) Wait until the alignment is complete.
34	IRS 2 FAIL	EICAS	(1) Set the MSU 2 rotary switch to ALIGN. (2) Enter the correct present position. **NOTE:** The airplane must be maintained stationary during the IRS 2 alignment. (3) Wait until the alignment is complete. In case of IRS 2 FAIL message does not disappear: (a) Set the MSU 2 rotary switch to OFF. (b) On the overhead electrical panel, push the BACKUP pushbutton (the stripped bar illuminates). (continued)

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ATA	EICAS MESSAGE or CONDITION	LOCATION	PROCEDURE
34	IRS 2 FAIL (continued)	EICAS	(continued) (c) On the overhead circuit breaker panel, open IRS 2 CB. (d) On the overhead circuit breaker panel, open the following CBs: For single FMS installed: CDU, CMPTR, GPS. For dual FMS installed: CDU 1, CDU 2, FMC 1, FMC 2, GPS 1 and GPS 2. (e) Wait at least 3 seconds. (f) On the overhead electrical panel, push the BACKUP pushbutton again (the stripped bar extinguishes). (g) On the overhead circuit breaker panel, close IRS 2 CB. (h) On the overhead circuit breaker panel, close the following CBs: For single FMS installed: CDU, CMPTR, GPS. For dual FMS installed: CDU 1, CDU 2, FMC 1, FMC 2, GPS 1 and GPS 2. (i) Set the MSU 2 rotary switch to ALIGN. (j) Enter the correct present position. **NOTE:** The airplane must be kept stationary during the IRS 2 alignment. (k) Wait until the alignment is complete.
27	RUD STOP DISAGREE	EICAS	Energize the airplane with the hydraulic power.

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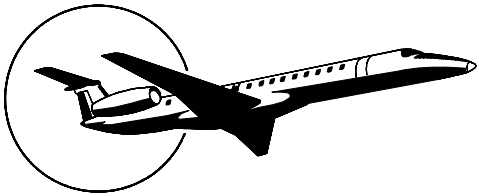

AIRPLANE OPERATIONS MANUAL
VOLUME 2

EMBRAER S.A.

THIS PUBLICATION IS INCOMPLETE WITHOUT AIRPLANE OPERATIONS MANUAL AOM–145/1114 VOLUME 1

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AOM–145/1114

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Section/Page/Code: _____ Date of Page: _____ Revision: ____

Name: _____
Position: _____
Company: _____
Fax Number: _____ Phone Number: _____
E-Mail: _____

Comment/Suggestion: _____

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Person in Charge: _____	
Action to be taken: _____	
_____	
_____	
Proposed date for implementation: _____	Implemented: _____

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

LIST OF EFFECTIVE PAGES

(VOLUME 2)

ORIGINAL	0	OCT 31, 1996
REVISION	1	FEB 14, 1997
REVISION	2	MAR 10, 1997
REVISION	3	APR 15, 1997
REVISION	4	MAY 08, 1997
REVISION	5	JUL 10, 1997
REVISION	6	SEP 19, 1997
REVISION	7	NOV 28, 1997
REVISION	8	FEB 02, 1998
REVISION	9	APR 03, 1998
REVISION	10	AUG 31, 1998
REVISION	11	JAN 12, 1999
REVISION	12	JUN 01, 1999
REVISION	13	SEP 20, 1999
REVISION	14	DEC 15, 1999
REVISION	15	APR 28, 2000
REVISION	16	SEP 29, 2000
REVISION	17	MAR 30, 2001
REVISION	18	JUN 29, 2001
REVISION	19	AUG 24, 2001
REVISION	20	OCT 02, 2001
REVISION	21	JAN 21, 2002
REVISION	22	MAR 28, 2002
REVISION	23	JUN 28, 2002
REVISION	24	DEC 20, 2002
REVISION	25	JUN 30, 2003
REVISION	26	DEC 30, 2003
REVISION	27	JUN 30, 2004
REVISION	28	NOV 30, 2004
REVISION	29	JUN 30, 2005
REVISION	30	NOV 30, 2005
REVISION	31	JUN 30, 2006
REVISION	32	NOV 30, 2006
REVISION	33	JUN 29, 2007
REVISION	34	NOV 30, 2007
REVISION	35	JUN 30, 2008
REVISION	36	DEC 19, 2008
REVISION	37	OCT 30, 2009
REVISION	38	AUG 15, 2011
REVISION	39	OCT 22, 2012

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REVISION.....40 ..... NOV 14, 2013
REVISION.....41 ..... MAR 06, 2015
REVISION.....42 .....APR 05, 2017
REVISION.....43 .....APR 26, 2019
REVISION.....44 ..... AUG 14, 2020
REVISION.....45 ..... NOV 30, 2022
REVISION.....46 ..... OCT 28, 2024

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
2-LEP	**title**	106	*	REVISION 46	AOM-145/1114-106
2-LEP	1	106	*	REVISION 46	
2-LEP	2	106	*	REVISION 46	
2-LEP	3	106	*	REVISION 46	
2-LEP	4	106	*	REVISION 46	
2-LEP	5	106	*	REVISION 46	
2-LEP	6	106	*	REVISION 46	
2-LEP	7	106	*	REVISION 46	
2-LEP	8	106	*	REVISION 46	
2-LEP	9	106	*	REVISION 46	
2-LEP	10	106	*	REVISION 46	
2-LEP	11	106	*	REVISION 46	
2-LEP	12	106	*	REVISION 46	
2-LEP	13	106	*	REVISION 46	
2-LEP	14	106	*	REVISION 46	
2-LEP	15	106	*	REVISION 46	
2-LEP	16	106	*	REVISION 46	
2-LEP	17	106	*	REVISION 46	
2-LEP	18	106	*	REVISION 46	
2-LEP	19	106	*	REVISION 46	
2-LEP	20	106	*	REVISION 46	
2-LEP	21	106	*	REVISION 46	
2-LEP	22	106	*	REVISION 46	
2-LEP	23	106	*	REVISION 46	
2-LEP	24	106	*	REVISION 46	
2-LEP	25	106	*	REVISION 46	
2-LEP	26	106	*	REVISION 46	
2-LEP	27	106	*	REVISION 46	
2-LEP	28	106	*	REVISION 46	

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
2-LEP	29	106	*	REVISION 46	
2-LEP	30	106	*	REVISION 46	
2-LEP	31	106	*	REVISION 46	
2-LEP	32	106	*	REVISION 46	
2-LEP	33	106	*	REVISION 46	
2-LEP	34	106	*	REVISION 46	
2-LEP	35	106	*	REVISION 46	
2-LEP	36	106	*	REVISION 46	
2-LEP	37	106	*	REVISION 46	
2-LEP	38	106	*	REVISION 46	
2-LEP	39	106	*	REVISION 46	
2-LEP	40	106	*	REVISION 46	
2-LEP	41	106	*	REVISION 46	
2-LEP	42	106	*	REVISION 46	
2-LEP	43	106	*	REVISION 46	
2-LEP	44	106	*	REVISION 46	
2-LEP	45	106	*	REVISION 46	
2-LEP	46	106	*	REVISION 46	
2-LEP	47	106	*	REVISION 46	
2-LEP	48	106	*	REVISION 46	
2-LEP	49	106	*	REVISION 46	
2-LEP	50	106	*	REVISION 46	
2-TOC	1	01		JUN 28, 2002	ALL
2-TOC	2	01		JUN 28, 2002	
2-01-00	1	01		SEP 29, 2000	ALL
2-01-00	2	01		DEC 20, 2002	
2-01-00	3	01		DEC 20, 2002	
2-01-00	4	01		JUN 28, 2002	
2-01-00	4A	01		DEC 20, 2002	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-01-00	4B	01	DEC 20, 2002	
2-01-00	5	01	JUN 28, 2002	
2-01-00	6	01	JUN 28, 2002	
2-01-00	7	01	JUN 28, 2002	
2-01-00	8	01	JUN 28, 2002	
2-01-05	1	01	SEP 29, 2000	Panel Typical
2-01-05	2	01	SEP 29, 2000	
2-01-05	3	01	SEP 29, 2000	
2-01-05	4	01	JUN 28, 2002	
2-01-10	1	01	SEP 29, 2000	ALL except XR
2-01-10	2	01	SEP 29, 2000	
2-01-15	1	01	SEP 29, 2000	ALL
2-01-15	2	01	SEP 29, 2000	
2-02-00	1	01	REVISION 45	ALL
2-02-00	2	01	REVISION 45	
2-02-05	1	01	OCT 02, 2001	Cockpit
2-02-05	2	01	OCT 02, 2001	
2-02-05	3	01	OCT 02, 2001	
2-02-05	4	01	OCT 02, 2001	
2-02-05	5	01	OCT 02, 2001	
2-02-05	6	01	OCT 02, 2001	
2-02-05	7	01	OCT 02, 2001	
2-02-05	8	01	OCT 02, 2001	
2-02-10	1	01	OCT 02, 2001	Attendant stations
2-02-10	2	01	OCT 02, 2001	
2-02-15	1	01	OCT 02, 2001	Attendant's panel
2-02-15	2	01	OCT 02, 2001	
2-02-15	3	01	OCT 02, 2001	
2-02-15	4	01	OCT 02, 2001	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-02-15	5	01	OCT 02, 2001	
2-02-15	6	01	OCT 02, 2001	
2-02-15	7	01	OCT 02, 2001	
2-02-15	8	01	OCT 02, 2001	
2-02-15	9	01	OCT 02, 2001	
2-02-15	10	01	OCT 02, 2001	
2-02-20	1	01	OCT 02, 2001	Galley
2-02-20	2	01	OCT 02, 2001	
2-02-20	3	01	OCT 02, 2001	
2-02-20	4	01	OCT 02, 2001	
2-02-25	1	01	OCT 02, 2001	PSU
2-02-25	2	01	OCT 02, 2001	
2-02-25	3	01	OCT 02, 2001	
2-02-25	4	01	OCT 02, 2001	
2-02-27	1	01	REVISION 38	Cockpit Door
2-02-27	2	01	REVISION 38	
2-02-30	1	01	REVISION 27	Water and Waste
2-02-30	2	01	REVISION 27	
2-02-30	3	01	OCT 02, 2001	
2-02-30	4	01	OCT 02, 2001	
2-02-35	1	01	REVISION 38	Airstair main door
2-02-35	2	01	REVISION 38	
2-02-35	3	01	REVISION 38	
2-02-35	4	01	REVISION 38	
2-02-35	5	01	REVISION 38	
2-02-35	6	01	REVISION 38	
2-02-35	7	01	REVISION 38	
2-02-35	8	01	REVISION 38	
2-02-35	1	02	REVISION 32	Jetway main door

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-02-35	2	02	REVISION 32	
2-02-35	3	02	REVISION 20	
2-02-35	4	02	REVISION 26	
2-02-35	5	02	REVISION 26	
2-02-35	6	02	REVISION 26	
2-02-40	1	01	REVISION 37	Access doors and hatches
2-02-40	2	01	REVISION 37	
2-02-40	3	01	REVISION 37	
2-02-40	4	01	REVISION 37	
2-02-40	5	01	REVISION 37	
2-02-40	6	01	REVISION 37	
2-02-40	7	01	REVISION 37	
2-02-40	8	01	REVISION 37	
2-02-40	9	01	REVISION 37	
2-02-40	10	01	REVISION 37	
2-02-40	11	01	REVISION 37	
2-02-40	12	01	REVISION 37	
2-02-50	1	01	REVISION 38	PC power system
2-02-50	2	01	REVISION 38	
2-02-55	1	01	REVISION 38	In-flight entertainment system
2-02-55	2	01	REVISION 38	
2-02-55	3	01	REVISION 38	
2-02-55	4	01	REVISION 38	
2-02-55	5	01	REVISION 38	
2-02-55	6	01	REVISION 38	
2-02-55	7	01	REVISION 38	
2-02-55	8	01	REVISION 38	
2-02-60	1	01	REVISION 25	AIR CEL
2-02-60	2	01	REVISION 20	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-02-60	3	01	OCT 02, 2001	
2-02-60	4	01	OCT 02, 2001	
2-02-60	5	01	OCT 02, 2001	
2-02-60	6	01	OCT 02, 2001	
2-02-60	1	02	REVISION 25	MAGNASTAR
2-02-60	2	02	REVISION 25	
2-02-65	1	01	REVISION 25	Cockpit Security Door
2-02-65	2	01	REVISION 27	
2-02-65	3	01	REVISION 25	
2-02-65	4	01	REVISION 25	
2-02-65	5	01	REVISION 25	
2-02-65	6	01	REVISION 25	
2-02-67	1	01	REVISION 33	Video Surveillance System
2-02-67	2	01	REVISION 33	
2-02-67	3	01	REVISION 33	
2-02-67	4	01	REVISION 33	
2-02-70	1	01	REVISION 31	ALL
2-02-70	2	01	REVISION 31	
2-02-70	3	01	REVISION 31	
2-02-70	4	01	REVISION 31	
2-02-70	5	01	REVISION 31	
2-02-70	6	01	REVISION 31	
2-03-00	1	01	DEC 20, 2002	ALL
2-03-00	2	01	DEC 20, 2002	
2-04-00	1	01	REVISION 45	ALL
2-04-00	2	01	REVISION 45	
2-04-05	1	01	JUN 28, 2002	ALL
2-04-05	2	01	JUN 28, 2002	
2-04-05	3	01	REVISION 23	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-04-05	4	01	REVISION 30	
2-04-05	5	01	JUN 28, 2002	
2-04-05	6	01	JUN 28, 2002	
2-04-05	7	01	JUN 28, 2002	
2-04-05	8	01	JUN 28, 2002	
2-04-05	9	01	JUN 28, 2002	
2-04-05	10	01	JUN 28, 2002	
2-04-05	11	01	JUN 28, 2002	
2-04-05	12	01	JUN 28, 2002	
2-04-05	13	01	JUN 28, 2002	
2-04-05	14	01	JUN 28, 2002	
2-04-05	15	01	JUN 28, 2002	
2-04-05	16	01	JUN 28, 2002	
2-04-05	17	01	JUN 28, 2002	
2-04-05	18	01	DEC 20, 2002	
2-04-05	19	01	JUN 28, 2002	
2-04-05	20	01	JUN 28, 2002	
2-04-05	21	01	JUN 28, 2002	
2-04-05	22	01	DEC 20, 2002	
2-04-05	23	01	JUN 28, 2002	
2-04-05	24	01	JUN 28, 2002	
2-04-05	25	01	JUN 28, 2002	
2-04-05	26	01	JUN 28, 2002	
2-04-05	27	01	JUN 28, 2002	
2-04-05	28	01	JUN 28, 2002	
2-04-05	29	01	JUN 28, 2002	
2-04-05	30	01	JUN 28, 2002	
2-04-05	31	01	JUN 28, 2002	
2-04-05	32	01	JUN 28, 2002	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-04-05	33	01	JUN 28, 2002	
2-04-05	34	01	JUN 28, 2002	
2-04-05	35	01	JUN 28, 2002	
2-04-05	36	01	JUN 28, 2002	
2-04-10	1	01	REVISION 45	ALL
2-04-10	2	01	REVISION 45	
2-04-10	3	01	REVISION 45	
2-04-10	4	01	REVISION 45	
2-04-10	5	01	REVISION 45	
2-04-10	6	01	REVISION 45	
2-04-10	7	01	REVISION 45	
2-04-10	8	01	REVISION 45	
2-04-10	9	01	REVISION 45	
2-04-10	10	01	REVISION 45	
2-04-10	11	01	REVISION 45	
2-04-10	12	01	REVISION 45	
2-04-10	13	01	REVISION 45	
2-04-10	14	01	REVISION 45	
2-04-10	15	01	REVISION 45	
2-04-10	16	01	REVISION 45	
2-04-13	1	01	REVISION 44	ALL
2-04-13	2	01	REVISION 44	
2-04-13	3	01	REVISION 44	
2-04-13	4	01	REVISION 45	
2-04-13	5	01	REVISION 45	
2-04-13	6	01	REVISION 44	
2-04-13	7	01	REVISION 44	
2-04-13	8	01	REVISION 44	
2-04-13	9	01	REVISION 44	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-04-13	10	01	REVISION 44	
2-04-13	11	01	REVISION 44	
2-04-13	12	01	REVISION 44	
2-04-13	13	01	REVISION 44	
2-04-13	14	01	REVISION 44	
2-04-13	15	01	REVISION 44	
2-04-13	16	01	REVISION 44	
2-04-13	17	01	REVISION 44	
2-04-13	18	01	REVISION 44	
2-04-13	19	01	REVISION 44	
2-04-13	20	01	REVISION 44	
2-04-13	21	01	REVISION 44	
2-04-13	22	01	REVISION 45	
2-04-13	23	01	REVISION 45	
2-04-13	24	01	REVISION 45	
2-04-15	1	01	REVISION 37	ALL
2-04-15	2	01	REVISION 37	
2-04-15	3	01	REVISION 38	
2-04-15	4	01	REVISION 37	
2-04-15	5	01	REVISION 39	
2-04-15	6	01	REVISION 39	
2-04-20	1	01	REVISION 30	ALL
2-04-20	2	01	REVISION 23	
2-04-25	1	01	REVISION 43	ALL
2-04-25	2	01	REVISION 43	
2-04-25	3	01	REVISION 43	
2-04-25	4	01	REVISION 43	
2-04-25	5	01	REVISION 43	
2-04-25	6	01	REVISION 43	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-04-25	7	01	REVISION 43	
2-04-25	8	01	REVISION 43	
2-04-30	1	01	REVISION 42	EGPWS + Steep Approach
2-04-30	2	01	REVISION 42	
2-04-30	3	01	REVISION 42	
2-04-30	4	01	REVISION 42	
2-04-30	5	01	REVISION 42	
2-04-30	6	01	REVISION 42	
2-04-30	7	01	REVISION 42	
2-04-30	8	01	REVISION 42	
2-04-30	9	01	REVISION 42	
2-04-30	10	01	REVISION 42	
2-04-30	11	01	REVISION 42	
2-04-30	12	01	REVISION 42	
2-04-30	13	01	REVISION 42	
2-04-30	14	01	REVISION 42	
2-04-30	15	01	REVISION 42	
2-04-30	16	01	REVISION 42	
2-04-30	17	01	REVISION 42	
2-04-30	18	01	REVISION 42	
2-04-30	19	01	REVISION 42	
2-04-30	20	01	REVISION 42	
2-04-30	21	01	REVISION 42	
2-04-30	22	01	REVISION 42	
2-04-30	23	01	REVISION 42	
2-04-30	24	01	REVISION 42	
2-04-30	25	01	REVISION 42	
2-04-30	26	01	REVISION 42	
2-04-30	27	01	REVISION 42	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-04-30	28	01	REVISION 42	
2-04-30	29	01	REVISION 42	
2-04-30	30	01	REVISION 42	
2-04-30	31	01	REVISION 42	
2-04-30	32	01	REVISION 42	
2-04-30	33	01	REVISION 42	
2-04-30	34	01	REVISION 42	
2-04-30	35	01	REVISION 42	
2-04-30	36	01	REVISION 42	
2-04-30	37	01	REVISION 42	
2-04-30	38	01	REVISION 42	
2-04-30	39	01	REVISION 42	
2-04-30	40	01	REVISION 42	
2-04-30	41	01	REVISION 42	
2-04-30	42	01	REVISION 42	
2-04-30	43	01	REVISION 42	
2-04-30	44	01	REVISION 42	
2-04-30	45	01	REVISION 42	
2-04-30	46	01	REVISION 42	
2-04-35	1	01	REVISION 39	ALL
2-04-35	2	01	REVISION 39	
2-04-35	3	01	REVISION 39	
2-04-35	4	01	REVISION 39	
2-04-35	5	01	REVISION 39	
2-04-35	6	01	REVISION 39	
2-04-35	7	01	REVISION 39	
2-04-35	8	01	REVISION 39	
2-04-35	9	01	REVISION 39	
2-04-35	10	01	REVISION 39	

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Page Block	Page	Code		Change	Applicability (model, engine, certification, other)
2-04-35	11	01		REVISION 39	
2-04-35	12	01		REVISION 39	
2-04-40	1	01		REVISION 42	ALL
2-04-40	2	01		REVISION 42	
2-04-40	3	01		REVISION 42	
2-04-40	4	01		REVISION 42	
2-04-40	5	01		REVISION 42	
2-04-40	6	01		REVISION 42	
2-04-40	7	01		REVISION 42	
2-04-40	8	01	*	REVISION 46	
2-04-40	9	01		REVISION 42	
2-04-40	10	01		REVISION 42	
2-04-40	11	01		REVISION 42	
2-04-40	12	01		REVISION 42	
2-04-40	13	01		REVISION 42	
2-04-40	14	01		REVISION 42	
2-04-40	15	01		REVISION 42	
2-04-40	16	01		REVISION 42	
2-04-40	17	01		REVISION 42	
2-04-40	18	01		REVISION 45	
2-04-40	19	01		REVISION 42	
2-04-40	20	01		REVISION 42	
2-05-00	1	01		MAR 28, 2002	ALL
2-05-00	2	01		MAR 28, 2002	
2-05-05	1	01		REVISION 36	ALL
2-05-05	2	01		REVISION 36	
2-05-05	3	01		REVISION 36	
2-05-05	4	01		REVISION 36	
2-05-05	5	01		REVISION 36	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-05-05	6	01	REVISION 36	
2-05-05	7	01	REVISION 36	
2-05-05	8	01	REVISION 36	
2-05-05	9	01	REVISION 36	
2-05-05	10	01	REVISION 36	
2-05-05	11	01	REVISION 36	
2-05-05	12	01	REVISION 36	
2-05-05	13	01	REVISION 36	
2-05-05	14	01	REVISION 36	
2-05-10	1	01	REVISION 22	ALL
2-05-10	2	01	REVISION 29	
2-05-10	3	01	MAR 28, 2002	
2-05-10	4	01	MAR 28, 2002	
2-05-10	5	01	REVISION 22	
2-05-10	6	01	REVISION 26	
2-05-10	6A	01	JUN 28, 2002	
2-05-10	6B	01	JUN 28, 2002	
2-05-10	6C	01	REVISION 23	
2-05-10	6D	01	REVISION 26	
2-05-10	7	01	REVISION 26	
2-05-10	8	01	REVISION 22	
2-05-10	9	01	MAR 28, 2002	
2-05-10	10	01	JUN 28, 2002	
2-05-10	11	01	MAR 28, 2002	
2-05-10	12	01	MAR 28, 2002	
2-05-10	13	01	MAR 28, 2002	
2-05-10	14	01	MAR 28, 2002	
2-05-10	15	01	REVISION 22	
2-05-10	16	01	REVISION 29	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-05-10	17	01	REVISION 29	
2-05-10	18	01	REVISION 22	
2-05-10	19	01	MAR 28, 2002	
2-05-10	20	01	MAR 28, 2002	
2-05-10	21	01	REVISION 29	
2-05-10	22	01	REVISION 22	
2-05-10	23	01	REVISION 22	
2-05-10	24	01	REVISION 26	
2-05-10	25	01	REVISION 22	
2-05-10	26	01	REVISION 29	
2-05-10	27	01	REVISION 29	
2-05-10	28	01	REVISION 29	
2-05-15	1	01	MAR 28, 2002	ALL
2-05-15	2	01	MAR 28, 2002	
2-05-15	3	01	MAR 28, 2002	
2-05-15	4	01	MAR 28, 2002	
2-05-15	5	01	MAR 28, 2002	
2-05-15	6	01	MAR 28, 2002	
2-05-15	7	01	REVISION 29	
2-05-15	8	01	REVISION 22	
2-05-20	1	01	REVISION 41	ALL
2-05-20	2	01	REVISION 41	
2-05-20	3	01	REVISION 41	
2-05-20	4	01	REVISION 41	
2-05-20	5	01	REVISION 41	
2-05-20	6	01	REVISION 41	
2-06-00	1	01	JAN 21, 2002	ALL
2-06-00	2	01	JAN 21, 2002	
2-06-05	1	01	JAN 21, 2002	Cockpit lighting

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-06-05	2	01	JAN 21, 2002	
2-06-05	3	01	JAN 21, 2002	
2-06-05	4	01	JAN 21, 2002	
2-06-05	5	01	JAN 21, 2002	
2-06-05	6	01	JAN 21, 2002	
2-06-05	7	01	JAN 21, 2002	
2-06-05	8	01	JAN 21, 2002	
2-06-10	1	01	REVISION 44	Pax cab lighting
2-06-10	2	01	REVISION 44	
2-06-10	3	01	REVISION 44	
2-06-10	4	01	REVISION 44	
2-06-10	5	01	REVISION 44	
2-06-10	6	01	REVISION 44	
2-06-10	7	01	REVISION 44	
2-06-10	8	01	REVISION 44	
2-06-15	1	01	DEC 20, 2002	External lighting
2-06-15	2	01	DEC 20, 2002	
2-06-15	3	01	DEC 20, 2002	
2-06-15	4	01	DEC 20, 2002	
2-06-15	5	01	JAN 21, 2002	
2-06-15	6	01	JAN 21, 2002	
2-06-15	7	01	JAN 21, 2002	
2-06-15	8	01	JAN 21, 2002	
2-06-20	1	01	REVISION 24	Emergency lighting
2-06-20	2	01	REVISION 25	
2-06-20	3	01	JAN 21, 2002	
2-06-20	4	01	JAN 21, 2002	
2-06-20	5	01	JAN 21, 2002	
2-06-20	6	01	JAN 21, 2002	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-07-00	1	01	JAN 21, 2002	ALL
2-07-00	2	01	JAN 21, 2002	
2-07-05	1	01	JAN 21, 2002	General
2-07-05	2	01	JAN 21, 2002	
2-07-10	1	01	JAN 21, 2002	Engine and APU fire protection
2-07-10	2	01	JAN 21, 2002	
2-07-10	3	01	JAN 21, 2002	
2-07-10	4	01	JAN 21, 2002	
2-07-10	5	01	JAN 21, 2002	
2-07-10	6	01	JAN 21, 2002	
2-07-10	7	01	REVISION 30	
2-07-10	8	01	REVISION 30	
2-07-10	9	01	JAN 21, 2002	
2-07-10	10	01	JAN 21, 2002	
2-07-15	1	01	JAN 21, 2002	Lavatory fire protection
2-07-15	2	01	JAN 21, 2002	
2-07-15	3	01	JAN 21, 2002	
2-07-15	4	01	JAN 21, 2002	
2-07-15	1	02	REVISION 44	145 ALL
2-07-15	2	02	REVISION 44	
2-07-15	3	02	REVISION 44	
2-07-15	4	02	REVISION 44	
2-07-15	5	02	REVISION 44	
2-07-15	6	02	REVISION 44	
2-07-20	1	01	REVISION 44	Baggage compart protection
2-07-20	2	01	REVISION 44	
2-07-20	3	01	REVISION 44	
2-07-20	4	01	REVISION 44	
2-07-20	5	01	REVISION 44	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-07-20	6	01	REVISION 44	
2-07-20	7	01	REVISION 44	
2-07-20	8	01	REVISION 44	
2-08-00	1	01	REVISION 31	ALL except XR
2-08-00	2	01	REVISION 17	
2-08-05	1	01	REVISION 39	ALL except XR
2-08-05	2	01	REVISION 39	
2-08-05	3	01	REVISION 39	
2-08-05	4	01	REVISION 39	
2-08-05	5	01	REVISION 39	
2-08-05	6	01	REVISION 39	
2-08-05	7	01	REVISION 39	
2-08-05	8	01	REVISION 39	
2-08-05	9	01	REVISION 39	
2-08-05	10	01	REVISION 39	
2-08-05	11	01	REVISION 39	
2-08-05	12	01	REVISION 39	
2-08-05	13	01	REVISION 39	
2-08-05	14	01	REVISION 39	
2-08-10	1	01	REVISION 38	ALL except XR
2-08-10	2	01	REVISION 38	
2-08-10	3	01	REVISION 38	
2-08-10	4	01	REVISION 38	
2-08-10	5	01	REVISION 38	
2-08-10	6	01	REVISION 38	
2-08-15	1	01	REVISION 31	ALL
2-08-15	2	01	REVISION 31	
2-08-15	3	01	REVISION 31	
2-08-15	4	01	REVISION 31	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-09-00	1	01	JAN 21, 2002	ALL
2-09-00	2	01	JAN 21, 2002	
2-09-05	1	01	REVISION 37	General
2-09-05	2	01	REVISION 37	
2-09-05	3	01	REVISION 37	
2-09-05	4	01	REVISION 37	
2-09-05	5	01	REVISION 37	
2-09-05	6	01	REVISION 37	
2-09-05	7	01	REVISION 37	
2-09-05	8	01	REVISION 37	
2-09-05	9	01	REVISION 37	
2-09-05	10	01	REVISION 37	
2-09-05	11	01	REVISION 37	
2-09-05	12	01	REVISION 37	
2-10-00	1	01	REVISION 41	All except China Eastern
2-10-00	2	01	REVISION 41	
2-10-00	3	01	REVISION 41	
2-10-00	4	01	REVISION 41	
2-10-05	1	01	DEC 20, 2002	ALL
2-10-05	2	01	DEC 20, 2002	
2-10-05	3	01	DEC 20, 2002	
2-10-05	4	01	DEC 20, 2002	
2-10-10	1	01	DEC 20, 2002	ALL
2-10-10	2	01	DEC 20, 2002	
2-10-10	3	01	JUN 28, 2002	
2-10-10	4	01	JUN 28, 2002	
2-10-15	1	01	REVISION 30	ALL
2-10-15	2	01	REVISION 24	
2-10-15	3	01	DEC 20, 2002	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-10-15	4	01	DEC 20, 2002	
2-10-20	1	01	DEC 20, 2002	ALL
2-10-20	2	01	JUN 28, 2002	
2-10-25	1	01	DEC 20, 2002	ALL
2-10-25	2	01	JUN 28, 2002	
2-10-30	1	01	REVISION 37	ALL
2-10-30	2	01	REVISION 37	
2-10-30	3	01	REVISION 37	
2-10-30	4	01	REVISION 37	
2-10-30	5	01	REVISION 37	
2-10-30	6	01	REVISION 37	
2-10-35	1	01	REVISION 30	ALL
2-10-35	2	01	REVISION 23	
2-10-40	1	01	REVISION 41	ALL
2-10-40	2	01	REVISION 42	
2-10-40	3	01	REVISION 42	
2-10-40	4	01	REVISION 42	
2-10-40	5	01	REVISION 42	
2-10-40	6	01	REVISION 42	
2-10-40	7	01	REVISION 42	
2-10-40	8	01	REVISION 42	
2-10-40	9	01	REVISION 42	
2-10-40	10	01	REVISION 42	
2-10-50	1	01	REVISION 41	ALL
2-10-50	2	01	REVISION 41	
2-10-50	3	01	REVISION 41	
2-10-50	4	01	REVISION 41	
2-10-50	5	01	REVISION 41	
2-10-50	6	01	REVISION 41	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-10-50	7	01	REVISION 41	
2-10-50	8	01	REVISION 41	
2-10-50	9	01	REVISION 41	
2-10-50	10	01	REVISION 41	
2-10-50	11	01	REVISION 41	
2-10-50	12	01	REVISION 41	
2-10-50	13	01	REVISION 41	
2-10-50	14	01	REVISION 41	
2-10-50	15	01	REVISION 41	
2-10-50	16	01	REVISION 41	
2-10-50	17	01	REVISION 42	
2-10-50	18	01	REVISION 41	
2-10-50	19	01	REVISION 41	
2-10-50	20	01	REVISION 41	
2-10-50	21	01	REVISION 41	
2-10-50	22	01	REVISION 41	
2-10-60	1	01	REVISION 39	ALL
2-10-60	2	01	REVISION 39	
2-10-60	3	01	REVISION 39	
2-10-60	4	01	REVISION 40	
2-10-60	5	01	REVISION 39	
2-10-60	6	01	REVISION 39	
2-10-60	7	01	REVISION 39	
2-10-60	8	01	REVISION 39	
2-10-60	9	01	REVISION 39	
2-10-60	10	01	REVISION 39	
2-10-60	11	01	REVISION 39	
2-10-60	12	01	REVISION 39	
2-10-70	1	01	JUN 28, 2002	ALL

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-10-70	2	01	JUN 28, 2002	
2-10-70	3	01	JUN 28, 2002	
2-10-70	4	01	JUN 28, 2002	
2-10-70	5	01	JUN 28, 2002	
2-10-70	6	01	JUN 28, 2002	
2-11-00	1	01	JAN 21, 2002	ALL
2-11-00	2	01	JAN 21, 2002	
2-11-05	1	01	JAN 21, 2002	General
2-11-05	2	01	JAN 21, 2002	
2-11-05	3	01	JAN 21, 2002	
2-11-05	4	01	JAN 21, 2002	
2-11-05	5	01	REVISION 30	
2-11-05	6	01	REVISION 21	
2-11-05	7	01	JAN 21, 2002	
2-11-05	8	01	JAN 21, 2002	
2-12-00	1	01	REVISION 38	All except China Eastern
2-12-00	2	01	REVISION 38	
2-12-05	1	01	REVISION 45	ALL
2-12-05	2	01	REVISION 45	
2-12-05	3	01	REVISION 45	
2-12-05	4	01	REVISION 45	
2-12-05	5	01	REVISION 45	
2-12-05	6	01	REVISION 45	
2-12-05	7	01	REVISION 45	
2-12-05	8	01	REVISION 45	
2-12-05	9	01	REVISION 45	
2-12-05	10	01	REVISION 45	
2-12-05	11	01	REVISION 45	
2-12-05	12	01	REVISION 45	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-12-05	13	01	REVISION 45	
2-12-05	14	01	REVISION 45	
2-12-05	15	01	REVISION 45	
2-12-05	16	01	REVISION 45	
2-12-10	1	01	REVISION 40	ALL
2-12-10	2	01	REVISION 40	
2-12-10	3	01	REVISION 40	
2-12-10	4	01	REVISION 40	
2-12-10	5	01	REVISION 40	
2-12-10	6	01	REVISION 40	
2-12-10	7	01	REVISION 40	
2-12-10	8	01	REVISION 40	
2-12-10	9	01	REVISION 40	
2-12-10	10	01	REVISION 40	
2-12-10	11	01	REVISION 40	
2-12-10	12	01	REVISION 40	
2-12-15	1	01	REVISION 40	ALL
2-12-15	2	01	REVISION 40	
2-12-15	3	01	REVISION 40	
2-12-15	4	01	REVISION 40	
2-12-15	5	01	REVISION 40	
2-12-15	6	01	REVISION 40	
2-12-15	7	01	REVISION 40	
2-12-15	8	01	REVISION 40	
2-12-15	9	01	REVISION 40	
2-12-15	10	01	REVISION 40	
2-12-15	11	01	REVISION 40	
2-12-15	12	01	REVISION 40	
2-13-00	1	01	REVISION 38	ALL except XR

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-13-00	2	01	REVISION 38	
2-13-05	1	01	JUN 29, 2001	ALL
2-13-05	2	01	JUN 29, 2001	
2-13-05	3	01	JUN 29, 2001	
2-13-05	4	01	JUN 29, 2001	
2-13-10	1	01	REVISION 38	ALL except XR
2-13-10	2	01	REVISION 38	
2-13-10	3	01	REVISION 38	
2-13-10	4	01	REVISION 38	
2-13-10	5	01	REVISION 38	
2-13-10	6	01	REVISION 38	
2-13-10	7	01	REVISION 38	
2-13-10	8	01	REVISION 38	
2-13-10	9	01	REVISION 38	
2-13-10	10	01	REVISION 38	
2-13-10	11	01	REVISION 38	
2-13-10	12	01	REVISION 38	
2-13-10	13	01	REVISION 38	
2-13-10	14	01	REVISION 38	
2-13-10	15	01	REVISION 38	
2-13-10	16	01	REVISION 38	
2-13-10	17	01	REVISION 38	
2-13-10	18	01	REVISION 38	
2-13-15	1	01	JUN 29, 2001	ALL
2-13-15	2	01	JUN 29, 2001	
2-13-15	3	01	JUN 29, 2001	
2-13-15	4	01	JUN 29, 2001	
2-13-15	5	01	JUN 29, 2001	
2-13-15	6	01	JUN 28, 2002	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-13-15	7	01	JUN 29, 2001	
2-13-15	8	01	JUN 29, 2001	
2-13-15	9	01	AUG 24, 2001	
2-13-15	10	01	JUN 29, 2001	
2-13-20	1	02	REVISION 42	ANAC/FAA
2-13-20	2	02	REVISION 42	
2-13-20	3	02	REVISION 42	
2-13-20	4	02	REVISION 42	
2-13-20	5	02	REVISION 42	
2-13-20	6	02	REVISION 42	
2-13-20	7	02	REVISION 42	
2-13-20	8	02	REVISION 42	
2-13-20	9	02	REVISION 42	
2-13-20	10	02	REVISION 42	
2-13-20	11	02	REVISION 42	
2-13-20	12	02	REVISION 42	
2-13-25	1	01	REVISION 41	ALL
2-13-25	2	01	REVISION 42	
2-13-25	3	01	REVISION 41	
2-13-25	4	01	REVISION 41	
2-13-25	5	01	REVISION 41	
2-13-25	6	01	REVISION 41	
2-13-25	7	01	REVISION 41	
2-13-25	8	01	REVISION 41	
2-13-30	1	01	JUN 29, 2001	ALL
2-13-30	2	01	JUN 29, 2001	
2-13-30	3	01	REVISION 18	
2-13-30	4	01	REVISION 32	
2-13-30	5	01	JUN 29, 2001	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-13-30	6	01	AUG 24, 2001	
2-13-35	1	01	REVISION 18	ALL
2-13-35	2	01	REVISION 27	
2-13-35	3	01	REVISION 18	
2-13-35	4	01	REVISION 30	
2-13-35	5	01	JUN 29, 2001	
2-13-35	6	01	AUG 24, 2001	
2-14-00	1	01	REVISION 29	ALL except XR
2-14-00	2	01	REVISION 18	
2-14-05	1	01	REVISION 18	ALL
2-14-05	2	01	REVISION 29	
2-14-05	2A	01	REVISION 29	
2-14-05	2B	01	REVISION 29	
2-14-05	3	01	REVISION 23	
2-14-05	4	01	REVISION 32	
2-14-05	5	01	JUN 28, 2002	
2-14-05	6	01	DEC 20, 2002	
2-14-05	6A	01	REVISION 29	
2-14-05	6B	01	REVISION 29	
2-14-05	7	01	JUN 28, 2002	
2-14-05	8	01	JUN 28, 2002	
2-14-10	1	01	REVISION 43	ALL
2-14-10	2	01	REVISION 43	
2-14-10	3	01	REVISION 43	
2-14-10	4	01	REVISION 43	
2-14-10	5	01	REVISION 43	
2-14-10	6	01	REVISION 43	
2-14-10	7	01	REVISION 43	
2-14-10	8	01	REVISION 43	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-14-10	9	01	REVISION 43	
2-14-10	10	01	REVISION 43	
2-14-10	11	01	REVISION 43	
2-14-10	12	01	REVISION 43	
2-14-10	13	01	REVISION 43	
2-14-10	14	01	REVISION 43	
2-14-10	15	01	REVISION 43	
2-14-10	16	01	REVISION 43	
2-14-10	17	01	REVISION 43	
2-14-10	18	01	REVISION 43	
2-14-15	1	01	JAN 21, 2002	ALL except High Alt
2-14-15	2	01	JUN 29, 2001	
2-14-15	3	01	REVISION 19	
2-14-15	4	01	REVISION 29	
2-14-15	5	01	REVISION 19	
2-14-15	6	01	REVISION 29	
2-14-15	7	01	JUN 29, 2001	
2-14-15	8	01	JUN 29, 2001	
2-14-15	9	01	JAN 21, 2002	
2-14-15	10	01	OCT 02, 2001	
2-14-15	1	02	REVISION 41	High Alt
2-14-15	2	02	REVISION 41	
2-14-15	3	02	REVISION 41	
2-14-15	4	02	REVISION 41	
2-14-15	5	02	REVISION 41	
2-14-15	6	02	REVISION 41	
2-14-15	7	02	REVISION 41	
2-14-15	8	02	REVISION 41	
2-14-15	9	02	REVISION 41	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-14-15	10	02	REVISION 41	
2-14-15	11	02	REVISION 41	
2-14-15	12	02	REVISION 41	
2-14-15	13	02	REVISION 41	
2-14-15	14	02	REVISION 41	
2-14-15	15	02	REVISION 41	
2-14-15	16	02	REVISION 41	
2-14-20	1	01	JUN 29, 2001	ALL
2-14-20	2	01	JUN 29, 2001	
2-14-20	3	01	JUN 29, 2001	
2-14-20	4	01	JUN 29, 2001	
2-14-25	1	01	REVISION 29	ALL
2-14-25	2	01	REVISION 18	
2-15-00	1	01	REVISION 41	ALL except XR
2-15-00	2	01	REVISION 41	
2-15-05	1	01	REVISION 41	ALL
2-15-05	2	01	REVISION 41	
2-15-10	1	01	REVISION 43	ALL
2-15-10	2	01	REVISION 43	
2-15-10	3	01	REVISION 43	
2-15-10	4	01	REVISION 43	
2-15-10	5	01	REVISION 43	
2-15-10	6	01	REVISION 43	
2-15-10	7	01	REVISION 43	
2-15-10	8	01	REVISION 43	
2-15-10	9	01	REVISION 43	
2-15-10	10	01	REVISION 43	
2-15-10	11	01	REVISION 43	
2-15-10	12	01	REVISION 43	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-15-10	13	01	REVISION 43	
2-15-10	14	01	REVISION 43	
2-15-10	15	01	REVISION 43	
2-15-10	16	01	REVISION 43	
2-15-10	17	01	REVISION 43	
2-15-10	18	01	REVISION 43	
2-15-15	1	01	REVISION 42	ALL except XR
2-15-15	2	01	REVISION 41	
2-15-15	3	01	REVISION 42	
2-15-15	4	01	REVISION 41	
2-16-00	1	01	OCT 02, 2001	ALL except shuttle 135
2-16-00	2	01	OCT 02, 2001	
2-16-05	1	01	REVISION 44	ALL except Shuttle 135
2-16-05	2	01	REVISION 44	
2-16-10	1	01	REVISION 26	ALL except shuttle 135
2-16-10	2	01	REVISION 20	
2-16-10	3	01	OCT 02, 2001	
2-16-10	4	01	OCT 02, 2001	
2-16-10	5	01	OCT 02, 2001	
2-16-10	6	01	OCT 02, 2001	
2-16-10	7	01	OCT 02, 2001	
2-16-10	8	01	OCT 02, 2001	
2-16-10	9	01	OCT 02, 2001	
2-16-10	10	01	OCT 02, 2001	
2-16-10	11	01	OCT 02, 2001	
2-16-10	12	01	OCT 02, 2001	
2-16-15	1	01	REVISION 41	ALL except Shuttle 135
2-16-15	2	01	REVISION 41	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-16-15	3	01	REVISION 41	
2-16-15	4	01	REVISION 41	
2-16-15	5	01	REVISION 41	
2-16-15	6	01	REVISION 41	
2-16-20	1	01	REVISION 31	ALL
2-16-20	2	01	REVISION 20	
2-16-25	1	01	OCT 02, 2001	ALL
2-16-25	2	01	OCT 02, 2001	
2-16-25	3	01	OCT 02, 2001	
2-16-25	4	01	OCT 02, 2001	
2-16-25	5	01	OCT 02, 2001	
2-16-25	6	01	OCT 02, 2001	
2-16-30	1	01	REVISION 38	ALL except Shuttle 135
2-16-30	2	01	REVISION 36	
2-16-30	3	01	REVISION 36	
2-16-30	4	01	REVISION 36	
2-16-30	5	01	REVISION 36	
2-16-30	6	01	REVISION 36	
2-17-00	1	01	JUN 29, 2001	ALL
2-17-00	2	01	JUN 29, 2001	
2-17-05	1	01	JUN 29, 2001	ALL
2-17-05	2	01	JUN 29, 2001	
2-17-10	1	01	REVISION 28	ALL
2-17-10	2	01	REVISION 18	
2-17-10	3	01	REVISION 28	
2-17-10	4	01	REVISION 18	
2-17-10	5	01	JUN 29, 2001	
2-17-10	6	01	JUN 29, 2001	
2-17-10	7	01	JUN 29, 2001	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-17-10	8	01	JUN 29, 2001	
2-17-15	1	01	REVISION 39	ALL
2-17-15	2	01	REVISION 39	
2-17-15	3	01	REVISION 39	
2-17-15	4	01	REVISION 39	
2-17-15	5	01	REVISION 39	
2-17-15	6	01	REVISION 39	
2-17-15	7	01	REVISION 39	
2-17-15	8	01	REVISION 39	
2-17-15	9	01	REVISION 39	
2-17-15	10	01	REVISION 39	
2-17-15	11	01	REVISION 39	
2-17-15	12	01	REVISION 39	
2-17-20	1	01	REVISION 43	ISIS THALES
2-17-20	2	01	REVISION 43	
2-17-20	3	01	REVISION 43	
2-17-20	4	01	REVISION 43	
2-17-20	5	01	REVISION 43	
2-17-20	6	01	REVISION 43	
2-17-20	7	01	REVISION 43	
2-17-20	8	01	REVISION 43	
2-17-20	9	01	REVISION 43	
2-17-20	10	01	REVISION 43	
2-17-20	11	01	REVISION 43	
2-17-20	12	01	REVISION 43	
2-17-20	13	01	REVISION 43	
2-17-20	14	01	REVISION 43	
2-17-20	15	01	REVISION 43	
2-17-20	16	01	REVISION 43	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-17-25	1	01	REVISION 37	ALL
2-17-25	2	01	REVISION 38	
2-17-25	3	01	REVISION 38	
2-17-25	4	01	REVISION 39	
2-17-25	5	01	REVISION 39	
2-17-25	6	01	REVISION 37	
2-17-25	7	01	REVISION 37	
2-17-25	8	01	REVISION 37	
2-17-30	1	01	REVISION 38	ALL
2-17-30	2	01	REVISION 38	
2-17-30	3	01	REVISION 38	
2-17-30	4	01	REVISION 38	
2-17-30	5	01	REVISION 38	
2-17-30	6	01	REVISION 38	
2-17-35	1	01	REVISION 33	ALL but MFDAU
2-17-35	2	01	REVISION 22	
2-17-35	3	01	REVISION 33	
2-17-35	4	01	REVISION 33	
2-18-00	1	01	REVISION 45	ALL
2-18-00	2	01	REVISION 45	
2-18-00	3	01	REVISION 45	
2-18-00	4	01	REVISION 45	
2-18-00	5	01	REVISION 45	
2-18-00	6	01	REVISION 45	
2-18-01	1	01	MAR 30, 2001	ALL
2-18-01	2	01	MAR 30, 2001	
2-18-05	1	01	MAR 30, 2001	RMS
2-18-05	2	01	AUG 24, 2001	
2-18-07	1	01	REVISION 29	Integrated Com. Unit

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-07	2	01	REVISION 17	
2-18-09	1	01	MAR 30, 2001	Integrated Nav. Unit
2-18-09	2	01	MAR 30, 2001	
2-18-11	1	01	REVISION 43	ALL RMU
2-18-11	2	01	REVISION 43	
2-18-11	3	01	REVISION 43	
2-18-11	4	01	REVISION 43	
2-18-11	5	01	REVISION 43	
2-18-11	6	01	REVISION 43	
2-18-11	7	01	REVISION 43	
2-18-11	8	01	REVISION 43	
2-18-11	9	01	REVISION 43	
2-18-11	10	01	REVISION 43	
2-18-11	11	01	REVISION 43	
2-18-11	12	01	REVISION 43	
2-18-11	13	01	REVISION 43	
2-18-11	14	01	REVISION 43	
2-18-11	15	01	REVISION 43	
2-18-11	16	01	REVISION 43	
2-18-11	17	01	REVISION 43	
2-18-11	18	01	REVISION 43	
2-18-11	19	01	REVISION 43	
2-18-11	20	01	REVISION 43	
2-18-11	21	01	REVISION 43	
2-18-11	22	01	REVISION 43	
2-18-11	23	01	REVISION 43	
2-18-11	24	01	REVISION 43	
2-18-11	25	01	REVISION 43	
2-18-11	26	01	REVISION 43	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-11	27	01	REVISION 43	
2-18-11	28	01	REVISION 43	
2-18-11	29	01	REVISION 43	
2-18-11	30	01	REVISION 43	
2-18-11	31	01	REVISION 43	
2-18-11	32	01	REVISION 43	
2-18-11	33	01	REVISION 43	
2-18-11	34	01	REVISION 43	
2-18-11	35	01	REVISION 43	
2-18-11	36	01	REVISION 43	
2-18-11	37	01	REVISION 43	
2-18-11	38	01	REVISION 43	
2-18-11	39	01	REVISION 43	
2-18-11	40	01	REVISION 43	
2-18-11	41	01	REVISION 43	
2-18-11	42	01	REVISION 43	
2-18-11	43	01	REVISION 43	
2-18-11	44	01	REVISION 43	
2-18-11	45	01	REVISION 43	
2-18-11	46	01	REVISION 43	
2-18-11	47	01	REVISION 43	
2-18-11	48	01	REVISION 43	
2-18-11	49	01	REVISION 43	
2-18-11	50	01	REVISION 43	
2-18-11	51	01	REVISION 43	
2-18-11	52	01	REVISION 43	
2-18-11	53	01	REVISION 43	
2-18-11	54	01	REVISION 43	
2-18-11	55	01	REVISION 43	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-11	56	01	REVISION 43	
2-18-13	1	01	MAR 30, 2001	Tuning Backup Control
2-18-13	2	01	MAR 30, 2001	
2-18-13	3	01	MAR 30, 2001	
2-18-13	4	01	MAR 30, 2001	
2-18-13	5	01	AUG 24, 2001	
2-18-13	6	01	MAR 30, 2001	
2-18-15	1	01	REVISION 36	Digital Audio Panel
2-18-15	2	01	REVISION 36	
2-18-15	3	01	REVISION 36	
2-18-15	4	01	REVISION 36	
2-18-15	5	01	REVISION 36	
2-18-15	6	01	REVISION 36	
2-18-19	1	01	REVISION 45	EICAS messages
2-18-19	2	01	REVISION 45	
2-18-20	1	01	REVISION 27	Communication Control
2-18-20	2	01	REVISION 19	
2-18-20	3	01	AUG 24, 2001	
2-18-20	4	01	JUN 28, 2002	
2-18-20	5	01	JUN 28, 2002	
2-18-20	6	01	JUN 28, 2002	
2-18-20	7	01	JUN 28, 2002	
2-18-20	8	01	MAR 30, 2001	
2-18-20	9	01	MAR 30, 2001	
2-18-20	10	01	MAR 30, 2001	
2-18-21	1	01	JUN 29, 2001	HF-230
2-18-21	2	01	MAR 30, 2001	
2-18-21	3	01	MAR 30, 2001	
2-18-21	4	01	MAR 30, 2001	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-21	5	01	MAR 30, 2001	
2-18-21	6	01	MAR 30, 2001	
2-18-21	7	01	MAR 30, 2001	
2-18-21	8	01	MAR 30, 2001	
2-18-21	9	01	MAR 30, 2001	
2-18-21	10	01	MAR 30, 2001	
2-18-21	11	01	MAR 30, 2001	
2-18-21	12	01	MAR 30, 2001	
2-18-21	13	01	MAR 30, 2001	
2-18-21	14	01	MAR 30, 2001	
2-18-21	15	01	MAR 30, 2001	
2-18-21	16	01	MAR 30, 2001	
2-18-21	1	02	REVISION 31	KHF-950 and ref. to KHF-1050
2-18-21	2	02	REVISION 18	
2-18-21	3	02	JUN 29, 2001	
2-18-21	4	02	JUN 29, 2001	
2-18-21	5	02	JUN 29, 2001	
2-18-21	6	02	JUN 29, 2001	
2-18-21	7	02	JUN 29, 2001	
2-18-21	8	02	JUN 29, 2001	
2-18-21	9	02	JUN 29, 2001	
2-18-21	10	02	JUN 29, 2001	
2-18-21	11	02	JUN 29, 2001	
2-18-21	12	02	JUN 29, 2001	
2-18-21	1	03	REVISION 33	KHF-1050
2-18-21	2	03	REVISION 33	
2-18-22	1	01	MAR 30, 2001	3rd VHF COM
2-18-22	2	01	MAR 30, 2001	
2-18-22	3	01	MAR 30, 2001	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-22	4	01	MAR 30, 2001	
2-18-22	5	01	AUG 24, 2001	
2-18-22	6	01	MAR 30, 2001	
2-18-22	1	02	MAR 30, 2001	3rd VHF NAV/COM
2-18-22	2	02	MAR 30, 2001	
2-18-22	3	02	MAR 30, 2001	
2-18-22	4	02	MAR 30, 2001	
2-18-22	1	03	MAR 30, 2001	3rd VHF NAV
2-18-22	2	03	MAR 30, 2001	
2-18-22	3	03	MAR 30, 2001	
2-18-22	4	03	MAR 30, 2001	
2-18-22	5	03	MAR 30, 2001	
2-18-22	6	03	MAR 30, 2001	
2-18-22	1	04	JUN 28, 2002	3rd VHF COM/CMU
2-18-22	2	04	MAR 28, 2002	
2-18-22	3	04	MAR 28, 2002	
2-18-22	4	04	MAR 28, 2002	
2-18-22	5	04	MAR 28, 2002	
2-18-22	6	04	MAR 28, 2002	
2-18-23	1	01	REVISION 17	SELCAL
2-18-23	2	01	REVISION 33	
2-18-24	1	01	MAR 30, 2001	ACARS
2-18-24	2	01	MAR 30, 2001	
2-18-24	3	01	MAR 30, 2001	
2-18-24	4	01	MAR 30, 2001	
2-18-24	5	01	MAR 30, 2001	
2-18-24	6	01	MAR 30, 2001	
2-18-24	7	01	AUG 24, 2001	
2-18-24	8	01	MAR 30, 2001	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-24	9	01	MAR 28, 2002	
2-18-24	10	01	MAR 30, 2001	
2-18-24	1	02	OCT 02, 2001	CMU mark III
2-18-24	2	02	JAN 21, 2002	
2-18-24	3	02	OCT 02, 2001	
2-18-24	4	02	OCT 02, 2001	
2-18-24	5	02	OCT 02, 2001	
2-18-24	6	02	OCT 02, 2001	
2-18-24	7	02	OCT 02, 2001	
2-18-24	8	02	OCT 02, 2001	
2-18-24	9	02	MAR 28, 2002	
2-18-24	10	02	OCT 02, 2001	
2-18-25	1	01	REVISION 29	CVR
2-18-25	2	01	REVISION 29	
2-18-25	3	01	REVISION 29	
2-18-25	4	01	REVISION 29	
2-18-27	1	01	REVISION 17	Passenger Address
2-18-27	2	01	REVISION 31	
2-18-27	3	01	MAR 30, 2001	
2-18-27	4	01	MAR 30, 2001	
2-18-27	5	01	AUG 24, 2001	
2-18-27	6	01	MAR 30, 2001	
2-18-27	7	01	REVISION 31	
2-18-27	8	01	REVISION 17	
2-18-28	1	01	JUN 29, 2001	satcom system
2-18-28	2	01	JUN 29, 2001	
2-18-28	3	01	JUN 29, 2001	
2-18-28	4	01	JUN 29, 2001	
2-18-28	5	01	JUN 29, 2001	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-28	6	01	JUN 29, 2001	
2-18-28	7	01	JUN 29, 2001	
2-18-28	8	01	JUN 29, 2001	
2-18-28	9	01	JUN 29, 2001	
2-18-28	10	01	JUN 29, 2001	
2-18-28	11	01	JUN 29, 2001	
2-18-28	12	01	JUN 29, 2001	
2-18-28	13	01	JUN 29, 2001	
2-18-28	14	01	JUN 29, 2001	
2-18-30	1	01	MAR 30, 2001	AHRS
2-18-30	2	01	MAR 30, 2001	
2-18-30	3	01	MAR 30, 2001	
2-18-30	4	01	DEC 20, 2002	
2-18-30	5	01	MAR 30, 2001	
2-18-30	6	01	MAR 30, 2001	
2-18-30	7	01	MAR 30, 2001	
2-18-30	8	01	MAR 30, 2001	
2-18-30	9	01	REVISION 17	
2-18-30	10	01	REVISION 25	
2-18-30	11	01	REVISION 25	
2-18-30	12	01	REVISION 25	
2-18-30	13	01	MAR 28, 2002	
2-18-30	14	01	MAR 28, 2002	
2-18-30	15	01	MAR 30, 2001	
2-18-30	16	01	MAR 30, 2001	
2-18-30	17	01	AUG 24, 2001	
2-18-30	18	01	MAR 30, 2001	
2-18-30	19	01	MAR 30, 2001	
2-18-30	20	01	MAR 30, 2001	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-30	21	01	MAR 30, 2001	
2-18-30	22	01	MAR 30, 2001	
2-18-30	23	01	MAR 30, 2001	
2-18-30	24	01	MAR 30, 2001	
2-18-30	25	01	AUG 24, 2001	
2-18-30	26	01	MAR 30, 2001	
2-18-30	1	02	JUN 28, 2002	IRS
2-18-30	2	02	MAR 30, 2001	
2-18-30	3	02	MAR 30, 2001	
2-18-30	4	02	DEC 20, 2002	
2-18-30	5	02	JUN 28, 2002	
2-18-30	6	02	MAR 30, 2001	
2-18-30	7	02	MAR 30, 2001	
2-18-30	8	02	MAR 30, 2001	
2-18-30	9	02	MAR 30, 2001	
2-18-30	10	02	MAR 30, 2001	
2-18-30	11	02	MAR 30, 2001	
2-18-30	12	02	DEC 20, 2002	
2-18-30	13	02	MAR 30, 2001	
2-18-30	14	02	MAR 30, 2001	
2-18-30	15	02	AUG 24, 2001	
2-18-30	16	02	MAR 30, 2001	
2-18-30	17	02	AUG 24, 2001	
2-18-30	18	02	MAR 30, 2001	
2-18-30	19	02	MAR 30, 2001	
2-18-30	20	02	MAR 30, 2001	
2-18-30	21	02	MAR 30, 2001	
2-18-30	22	02	MAR 30, 2001	
2-18-30	23	02	MAR 30, 2001	

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Page Block	Page	Code			Change	Applicability (model, engine, certification, other)
2-18-30	24	02			MAR 30, 2001	
2-18-30	25	02			AUG 24, 2001	
2-18-30	26	02			MAR 30, 2001	
2-18-35	1	01	*		REVISION 46	FMZ 2000 FMS
2-18-35	2	01	*		REVISION 46	
2-18-35	3	01	*		REVISION 46	
2-18-35	4	01	*		REVISION 46	
2-18-35	5	01	*		REVISION 46	
2-18-35	6	01	*		REVISION 46	
2-18-35	7	01	*		REVISION 46	
2-18-35	8	01	*		REVISION 46	
2-18-35	9	01	*		REVISION 46	
2-18-35	10	01	*		REVISION 46	
2-18-35	11	01	*		REVISION 46	
2-18-35	12	01	*		REVISION 46	
2-18-35	13	01	*		REVISION 46	
2-18-35	14	01	*		REVISION 46	
2-18-35	15	01	*		REVISION 46	
2-18-35	16	01	*		REVISION 46	
2-18-35	17	01	*	new	REVISION 46	
2-18-35	18	01	*	new	REVISION 46	
2-18-35	1	02			REVISION 26	UNS 1K FMS
2-18-35	2	02			REVISION 17	
2-18-35	3	02			REVISION 18	
2-18-35	4	02			REVISION 35	
2-18-35	4A	02			REVISION 35	
2-18-35	4B	02			REVISION 35	
2-18-35	4C	02			REVISION 35	
2-18-35	4D	02			REVISION 35	

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User: fnhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-35	5	02	REVISION 34	
2-18-35	6	02	REVISION 17	
2-18-35	7	02	MAR 30, 2001	
2-18-35	8	02	MAR 30, 2001	
2-18-35	9	02	AUG 24, 2001	
2-18-35	10	02	JUN 28, 2002	
2-18-35	11	02	REVISION 19	
2-18-35	12	02	REVISION 27	
2-18-35	13	02	REVISION 29	
2-18-35	14	02	REVISION 23	
2-18-35	1	04	REVISION 45	ANAC/FAA FMZ 2010 FMS (NZ 6.1.1)
2-18-35	2	04	REVISION 45	
2-18-35	3	04	REVISION 45	
2-18-35	4	04	REVISION 45	
2-18-35	5	04	REVISION 45	
2-18-35	6	04	REVISION 45	
2-18-35	7	04	REVISION 45	
2-18-35	8	04	REVISION 45	
2-18-35	9	04	REVISION 45	
2-18-35	10	04	REVISION 45	
2-18-35	11	04	REVISION 45	
2-18-35	12	04	REVISION 45	
2-18-35	13	04	REVISION 45	
2-18-35	14	04	REVISION 45	
2-18-35	15	04	REVISION 45	
2-18-35	16	04	REVISION 45	
2-18-35	17	04	REVISION 45	
2-18-35	18	04	REVISION 45	
2-18-35	19	04	REVISION 45	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-35	20	04	REVISION 45	
2-18-35	21	04	REVISION 45	
2-18-35	22	04	REVISION 45	
2-18-35	23	04	REVISION 45	
2-18-35	24	04	REVISION 45	
2-18-40	1	01	MAR 30, 2001	Navigation Display
2-18-40	2	01	MAR 30, 2001	
2-18-40	3	01	MAR 30, 2001	
2-18-40	4	01	MAR 30, 2001	
2-18-40	5	01	AUG 24, 2001	
2-18-40	6	01	MAR 30, 2001	
2-18-40	7	01	MAR 30, 2001	
2-18-40	8	01	MAR 30, 2001	
2-18-40	9	01	MAR 30, 2001	
2-18-40	10	01	MAR 30, 2001	
2-18-40	11	01	MAR 30, 2001	
2-18-40	12	01	MAR 30, 2001	
2-18-40	13	01	MAR 30, 2001	
2-18-40	14	01	MAR 30, 2001	
2-18-40	15	01	MAR 30, 2001	
2-18-40	16	01	MAR 30, 2001	
2-18-40	17	01	MAR 30, 2001	
2-18-40	18	01	MAR 30, 2001	
2-18-40	19	01	AUG 24, 2001	
2-18-40	20	01	MAR 30, 2001	
2-18-40	21	01	MAR 30, 2001	
2-18-40	22	01	MAR 30, 2001	
2-18-40	23	01	AUG 24, 2001	
2-18-40	24	01	MAR 30, 2001	

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User: fhherna0f - Printed By myTechCare - Nov 21/24 - 00:36:37

Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-45	1	01	REVISION 38	Weather Radar
2-18-45	2	01	REVISION 38	
2-18-45	3	01	REVISION 38	
2-18-45	4	01	REVISION 38	
2-18-45	5	01	REVISION 38	
2-18-45	6	01	REVISION 38	
2-18-45	7	01	REVISION 38	
2-18-45	8	01	REVISION 38	
2-18-45	9	01	REVISION 38	
2-18-45	10	01	REVISION 38	
2-18-45	11	01	REVISION 38	
2-18-45	12	01	REVISION 38	
2-18-45	13	01	REVISION 38	
2-18-45	14	01	REVISION 38	
2-18-45	15	01	REVISION 38	
2-18-45	16	01	REVISION 38	
2-18-45	17	01	REVISION 38	
2-18-45	18	01	REVISION 38	
2-18-45	19	01	REVISION 38	
2-18-45	20	01	REVISION 38	
2-18-45	21	01	REVISION 38	
2-18-45	22	01	REVISION 38	
2-18-45	23	01	REVISION 38	
2-18-45	24	01	REVISION 38	
2-18-45	25	01	REVISION 38	
2-18-45	26	01	REVISION 38	
2-18-45	27	01	REVISION 38	
2-18-45	28	01	REVISION 38	
2-18-45	29	01	REVISION 38	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-45	30	01	REVISION 38	
2-18-50	1	01	AUG 24, 2001	Lightning Sensor
2-18-50	2	01	MAR 30, 2001	
2-18-50	3	01	MAR 30, 2001	
2-18-50	4	01	MAR 30, 2001	
2-18-50	5	01	MAR 30, 2001	
2-18-50	6	01	MAR 30, 2001	
2-18-50	7	01	MAR 30, 2001	
2-18-50	8	01	MAR 30, 2001	
2-18-60	1	02	REVISION 45	ANAC/FAA FMZ 2010 BARO-VNAV (FMS 6.1.1)
2-18-60	2	02	REVISION 45	
2-18-60	3	02	REVISION 45	
2-18-60	4	02	REVISION 45	
2-18-60	5	02	REVISION 45	
2-18-60	6	02	REVISION 45	
2-18-60	7	02	REVISION 45	
2-18-60	8	02	REVISION 45	
2-18-60	9	02	REVISION 45	
2-18-60	10	02	REVISION 45	
2-18-60	11	02	REVISION 45	
2-18-60	12	02	REVISION 45	
2-18-60	13	02	REVISION 45	
2-18-60	14	02	REVISION 45	
2-18-60	15	02	REVISION 45	
2-18-60	16	02	REVISION 45	
2-18-60	17	02	REVISION 45	
2-18-60	18	02	REVISION 45	
2-18-60	19	02	REVISION 45	
2-18-60	20	02	REVISION 45	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-60	21	02	REVISION 45	
2-18-60	22	02	REVISION 45	
2-18-60	23	02	REVISION 45	
2-18-60	24	02	REVISION 45	
2-18-60	25	02	REVISION 45	
2-18-60	26	02	REVISION 45	
2-18-65	1	02	REVISION 45	ANAC/FAA FMZ 2010 RNP (FMS 6.1.1)
2-18-65	2	02	REVISION 45	
2-18-65	3	02	REVISION 45	
2-18-65	4	02	REVISION 45	
2-18-65	5	02	REVISION 45	
2-18-65	6	02	REVISION 45	
2-18-65	7	02	REVISION 45	
2-18-65	8	02	REVISION 45	
2-18-70	1	02	REVISION 45	FMZ 2010 LPV (FMS 6.1.1)
2-18-70	2	02	REVISION 45	
2-18-70	3	02	REVISION 45	
2-18-70	4	02	REVISION 45	
2-18-70	5	02	REVISION 45	
2-18-70	6	02	REVISION 45	
2-18-70	7	02	REVISION 45	
2-18-70	8	02	REVISION 45	
2-18-70	9	02	REVISION 45	
2-18-70	10	02	REVISION 45	
2-18-75	1	01	REVISION 39	HGS
2-18-75	2	01	REVISION 39	
2-18-75	3	01	REVISION 39	
2-18-75	4	01	REVISION 39	
2-18-75	5	01	REVISION 39	

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-75	6	01	REVISION 39	
2-18-75	7	01	REVISION 39	
2-18-75	8	01	REVISION 39	
2-18-75	9	01	REVISION 39	
2-18-75	10	01	REVISION 39	
2-18-75	11	01	REVISION 39	
2-18-75	12	01	REVISION 39	
2-18-75	13	01	REVISION 39	
2-18-75	14	01	REVISION 39	
2-18-75	15	01	REVISION 39	
2-18-75	16	01	REVISION 39	
2-18-75	17	01	REVISION 39	
2-18-75	18	01	REVISION 39	
2-18-75	19	01	REVISION 39	
2-18-75	20	01	REVISION 39	
2-18-80	1	01	REVISION 38	IFF
2-18-80	2	01	REVISION 38	
2-18-80	3	01	REVISION 38	
2-18-80	4	01	REVISION 38	
2-18-80	5	01	REVISION 38	
2-18-80	6	01	REVISION 38	
2-18-80	7	01	REVISION 38	
2-18-80	8	01	REVISION 38	
2-18-80	9	01	REVISION 38	
2-18-80	10	01	REVISION 38	
2-18-95	1	01	REVISION 45	ALL
2-18-95	2	01	REVISION 43	
2-18-95	3	01	REVISION 43	
2-18-95	4	01	REVISION 43	

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-18-95	5	01	REVISION 43	
2-18-95	6	01	REVISION 43	
2-19-00	1	01	REVISION 40	ALL
2-19-00	2	01	REVISION 36	
2-19-05	1	01	JUN 28, 2002	ALL
2-19-05	2	01	JUN 28, 2002	
2-19-05	3	01	REVISION 29	
2-19-05	4	01	REVISION 23	
2-19-05	5	01	JUN 28, 2002	
2-19-05	6	01	JUN 28, 2002	
2-19-10	1	01	REVISION 43	ALL
2-19-10	2	01	REVISION 43	
2-19-10	3	01	REVISION 43	
2-19-10	4	01	REVISION 43	
2-19-10	5	01	REVISION 43	
2-19-10	6	01	REVISION 43	
2-19-10	7	01	REVISION 43	
2-19-10	8	01	REVISION 43	
2-19-10	9	01	REVISION 43	
2-19-10	10	01	REVISION 43	
2-19-10	11	01	REVISION 43	
2-19-10	12	01	REVISION 43	
2-19-10	13	01	REVISION 43	
2-19-10	14	01	REVISION 43	
2-19-10	15	01	REVISION 43	
2-19-10	16	01	REVISION 43	
2-19-15	1	01	REVISION 36	ALL
2-19-15	2	01	REVISION 36	
2-19-15	3	01	REVISION 36	

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* Asterisk indicates pages revised, added or deleted by the current revision.

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Page Block	Page	Code	Change	Applicability (model, engine, certification, other)
2-19-15	4	01	REVISION 36	
2-19-15	5	01	REVISION 36	
2-19-15	6	01	REVISION 36	
2-19-15	7	01	REVISION 36	
2-19-15	8	01	REVISION 36	
2-19-15	9	01	REVISION 36	
2-19-15	10	01	REVISION 36	
2-19-15	11	01	REVISION 36	
2-19-15	12	01	REVISION 36	
2-19-15	13	01	REVISION 36	
2-19-15	14	01	REVISION 36	
2-19-15	15	01	REVISION 36	
2-19-15	16	01	REVISION 36	
2-19-15	17	01	REVISION 36	
2-19-15	18	01	REVISION 36	
2-19-15	19	01	REVISION 36	
2-19-15	20	01	REVISION 36	
2-19-20	1	01	REVISION 40	ANAC/FAA
2-19-20	2	01	REVISION 40	
2-19-20	3	01	REVISION 40	
2-19-20	4	01	REVISION 40	

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TABLE OF CONTENTS

AOM - VOLUME 2 - SYSTEMS DESCRIPTION

2-1 - AIRPLANE DESCRIPTION

2-2 - EQUIPMENT AND FURNISHINGS

2-3 - EMERGENCY EQUIPMENT (DELETED)

2-4 - CREW AWARENESS

2-5 - ELECTRICAL

2-6 - LIGHTING

2-7 - FIRE PROTECTION

2-8 - FUEL

2-9 - AUXILIARY POWER UNIT

2-10 - POWERPLANT

2-11 - HYDRAULIC

2-12 - LANDING GEAR AND BRAKES

2-13 - FLIGHT CONTROLS

2-14 - PNEUMATICS, AIR CONDITIONING AND PRESSURIZATION

2-15 - ICE AND RAIN PROTECTION

2-16 - OXYGEN

2-17 - FLIGHT INSTRUMENTS

2-18 - NAVIGATION AND COMMUNICATION

2-19 - AUTOPILOT

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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SECTION 2-01

AIRPLANE DESCRIPTION

TABLE OF CONTENTS

Page Block

Introduction 2-01-00
Airplane Description 2-01-00
Cockpit Arrangement 2-01-00
Interior Arrangement 2-01-00
Main/Glareshield Panels 2-01-05
Control Pedestal 2-01-05
Overhead Panel 2-01-10
Cockpit Partition 2-01-15

User: fhherna0f - Printed By myTechCare - Nov 21/24 - 00:36:37

INTRODUCTION

This Section is intended to present a general overview of the airplane, thus initiating the reader to the EMB-145, which may, then, go through the Sections searching more detailed information on each system.

AIRPLANE DESCRIPTION

The EMB-145 and EMB-135 models are a low wing, T-tail pressurized airplanes, powered by two high by-pass ratio rear mounted turbofan engines. The tricycle landing gear is all retractable, with twin tires in each leg.

A glass cockpit panel has been developed with highly integrated on-board avionics, thus allowing pilots to better monitor airplane general operation.

The typical passenger configuration consists of three seats abreast, with front galley and rear toilet, permitting to carry up to 50 passengers for the EMB-145 model, up to 44 passengers for the ERJ 140 model and up to 37 passengers for the EMB-135 model. Convenient accommodation is provided for the flight crew.

For detailed information on each system, refer to the appropriate Section in this manual.

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The airplane is presented in the following models:

Model	MTOW kg (lb)	MLW kg (lb)	MZFW kg (lb)	FUEL (wing) (*) kg (lb)	FUEL (ventral) (*) kg (lb)
135ER	19000 (41888)	18500 (40785)	15600 (34392)	4174 (9200)	-
135LR	20000 (44092)	18500 (40785)	16000 (35274)	5187 (11435)	-
140ER	20100 (44313)	18700 (41226)	17100 (37698)	4173 (9200)	-
140LR	21100 (46517)	18700 (41226)	17100 (37698)	5187 (11435)	-
145STD	19200 (42328)	18700 (41226)	17100 (37698)	4174 (9200)	-
145EU	19990 (44070)	18700 (41226)	17100 (37698)	4174 (9200)	-
145ER	20600 (45414)	18700 (41226)	17100 (37698)	4174 (9200)	-
145EP	20990 (46275)	18700 (41226)	17100 (37698)	4174 (9200)	-
145LR	22000 (48501)	19300 (42549)	17900 (39462)	5187 (11435)	-
145LU	21990 (48479)	19300 (42549)	17900 (39462)	5187 (11435)	-
145MK	19990 (44070)	18700 (41226)	17700 (39021)	4174 (9200)	-
145MP	20990 (46275)	19300 (42549)	17900 (39462)	4174 (9200)	-
145XR	24100 (53131)	20000 (44092)	18500 (40785)	5187 (11435)	845 (1863)

NOTE: (*) The values for fuel capacity above have been determined for an adopted fuel density of 0.811 kg/l (6.767 lb/US Gal).

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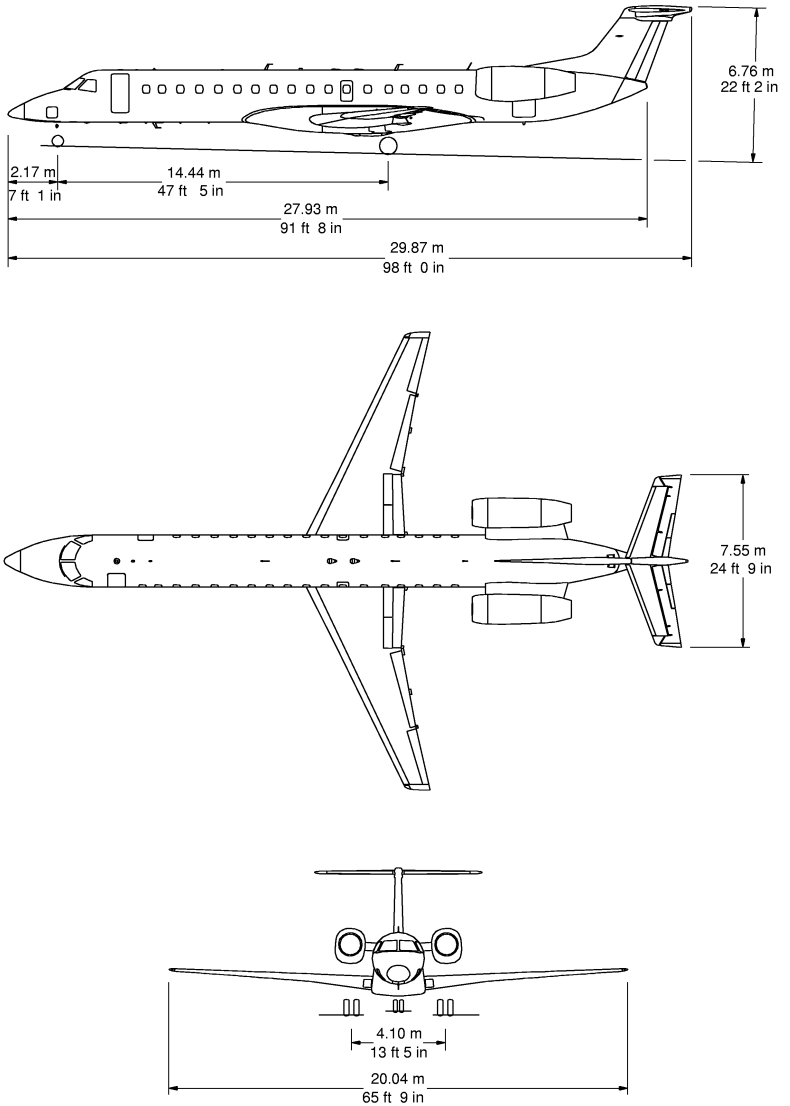
THREE VIEW DRAWING (EMB-145 MODELS)



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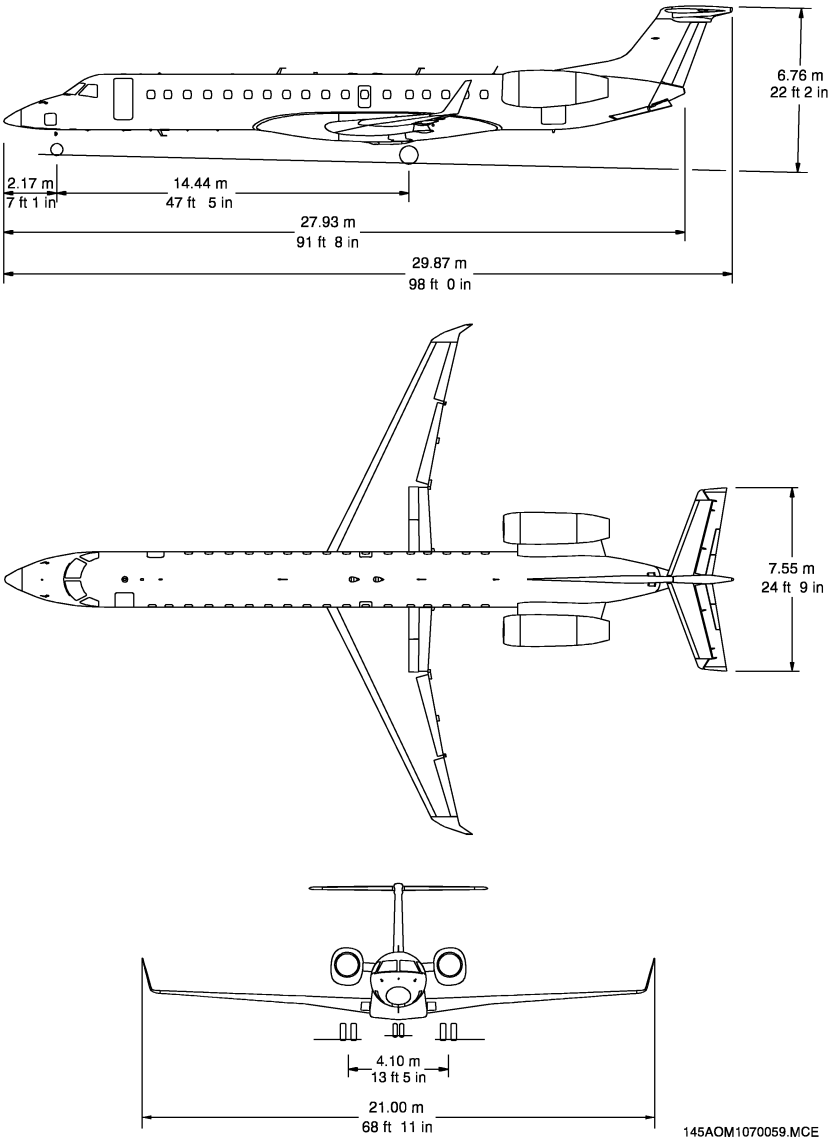

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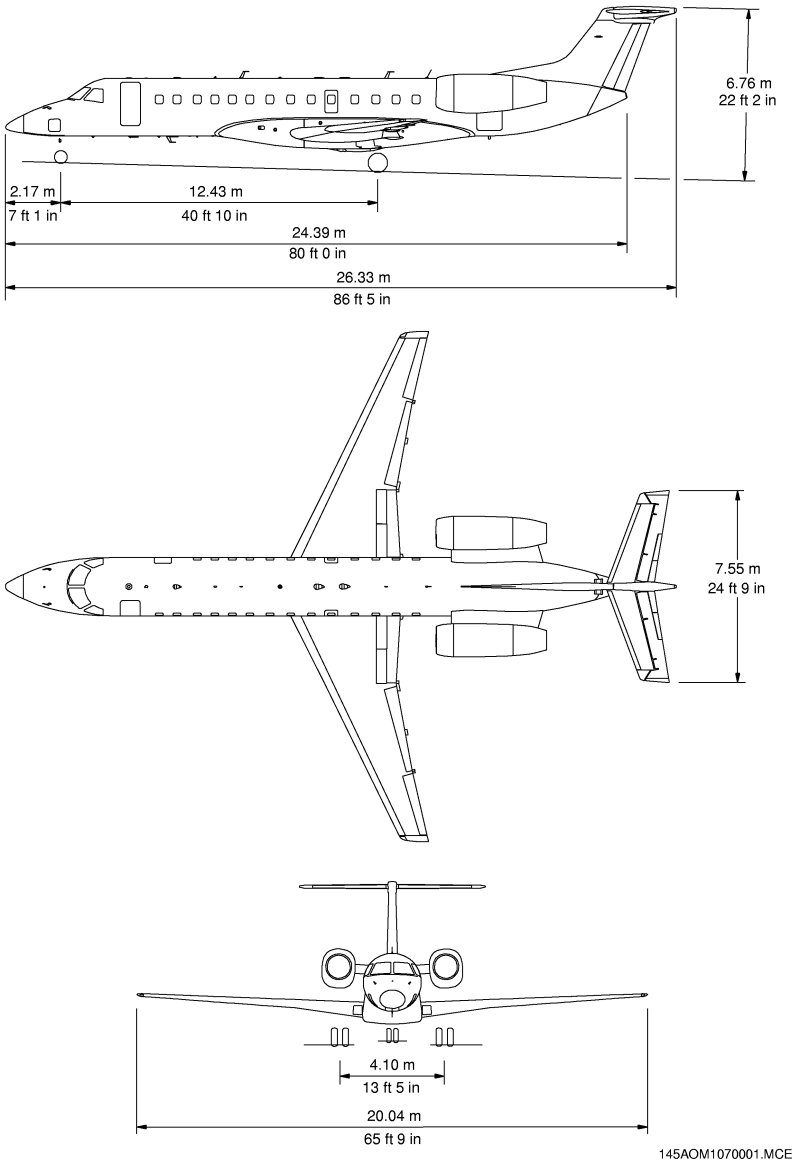
THREE VIEW DRAWING (EMB-135 MODELS)



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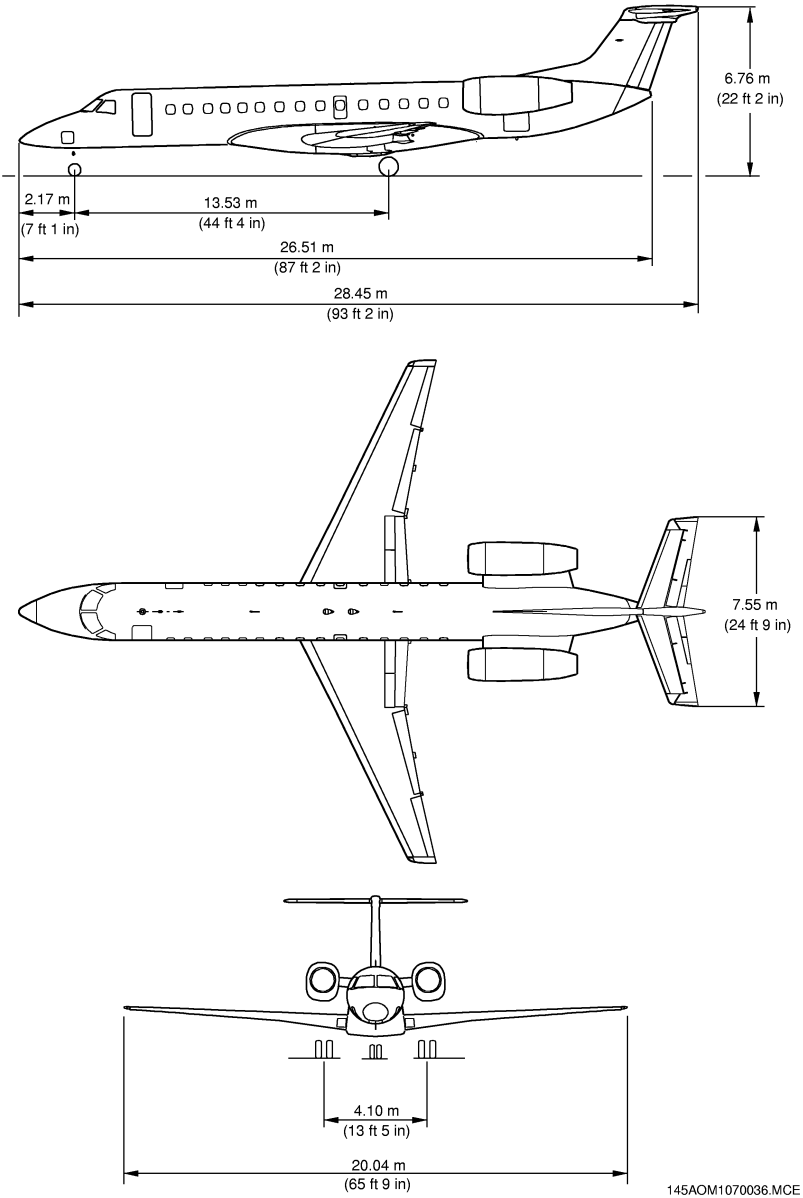
THREE VIEW DRAWING (ERJ-140 MODELS)



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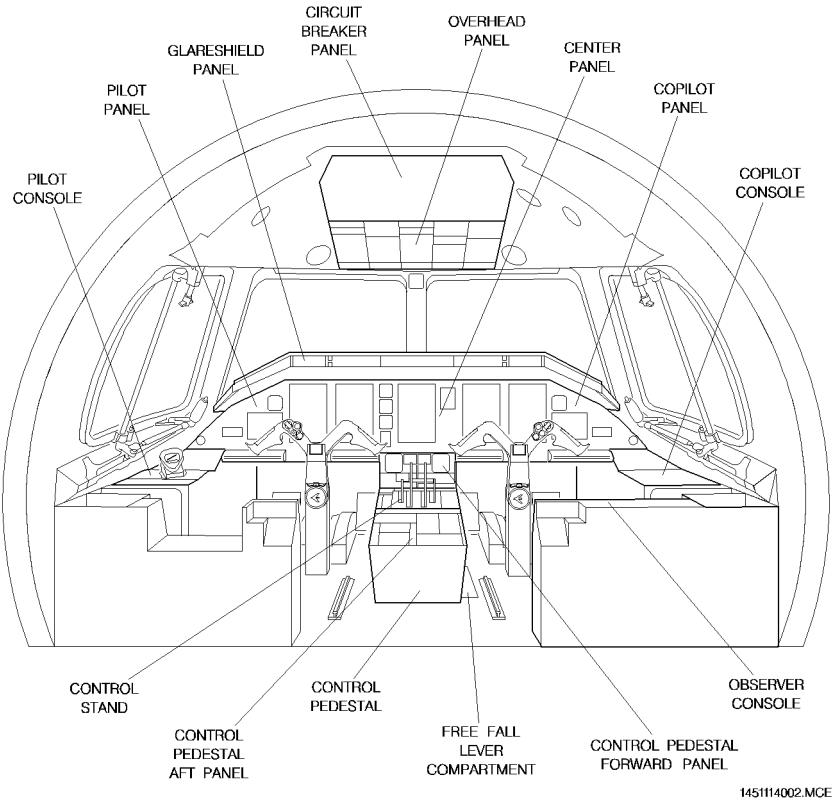
COCKPIT ARRANGEMENT



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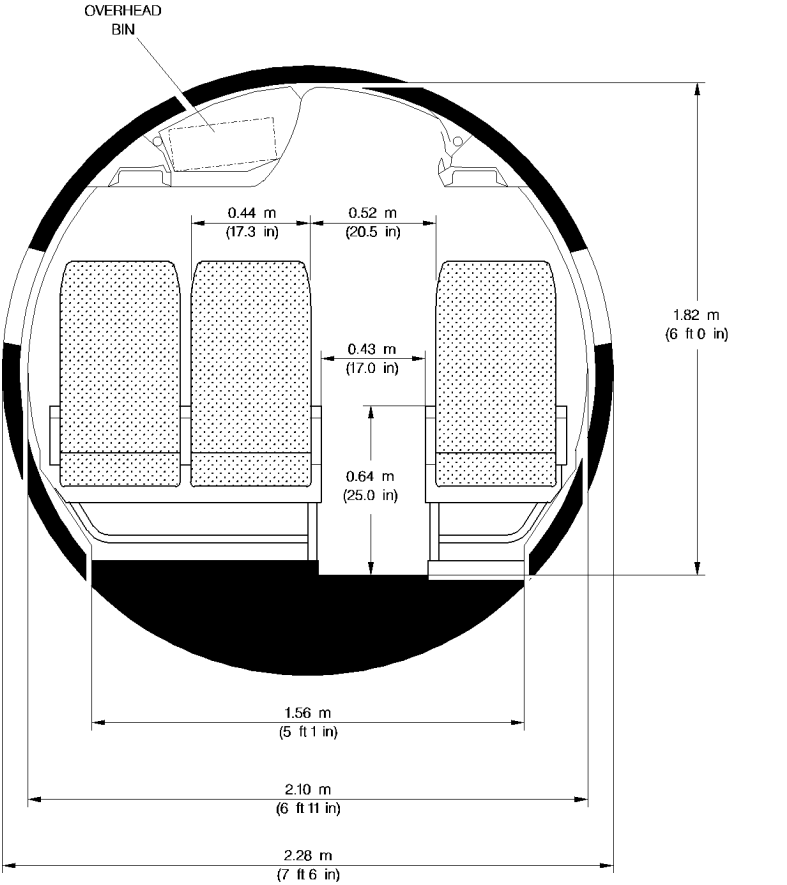
INTERIOR ARRANGEMENT

CROSS SECTION (TYPICAL)



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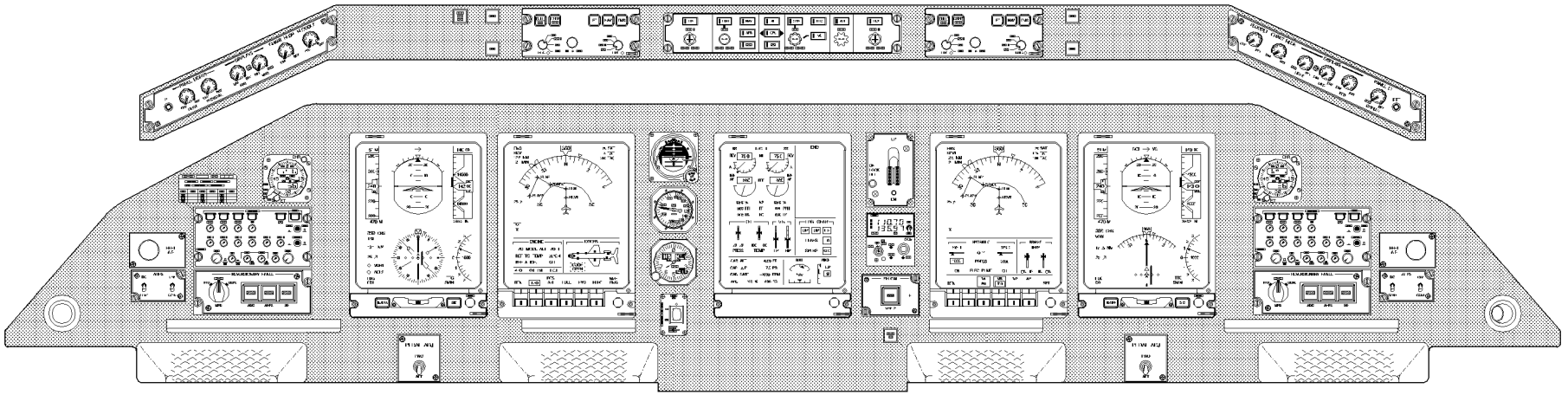
MAIN/GLARESHIELD PANELS (TYPICAL I)



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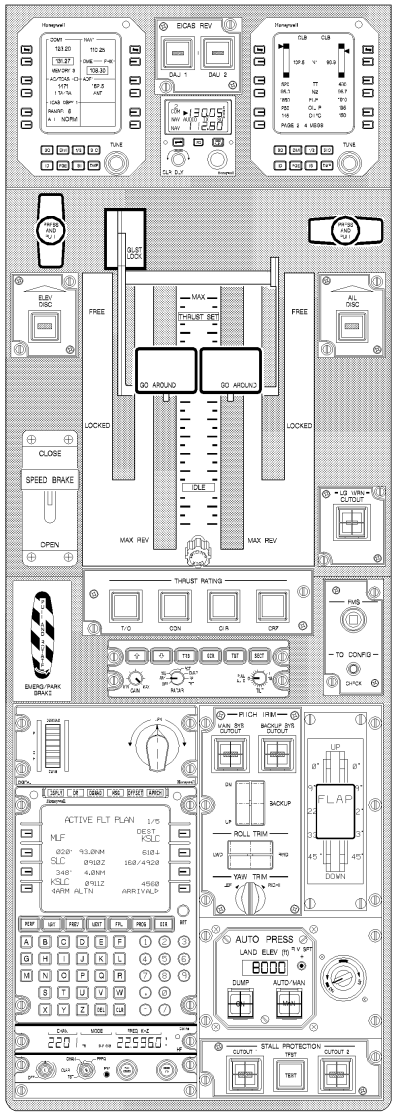
CONTROL PEDESTAL (TYPICAL I)



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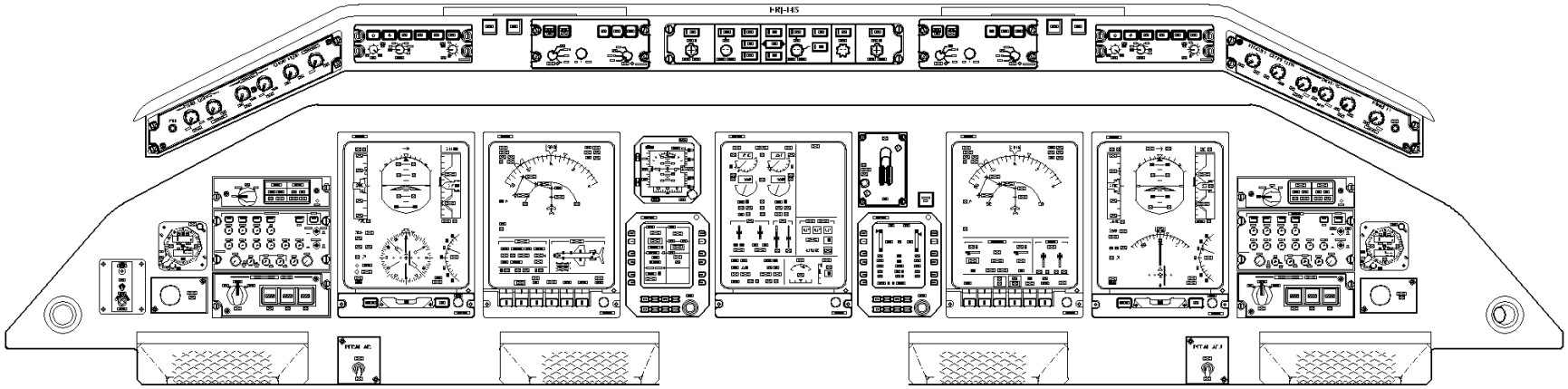
MAIN/GLARESHIELD PANELS (TYPICAL II)



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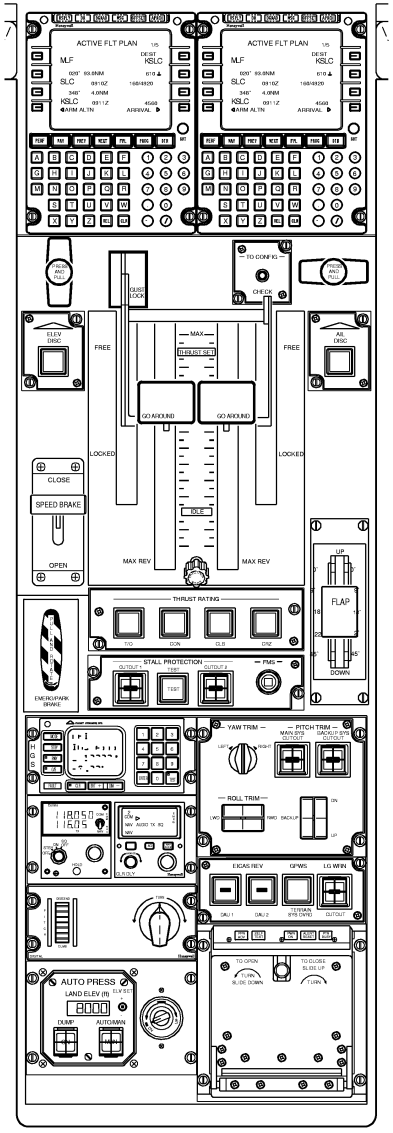
CONTROL PEDESTAL (TYPICAL II)



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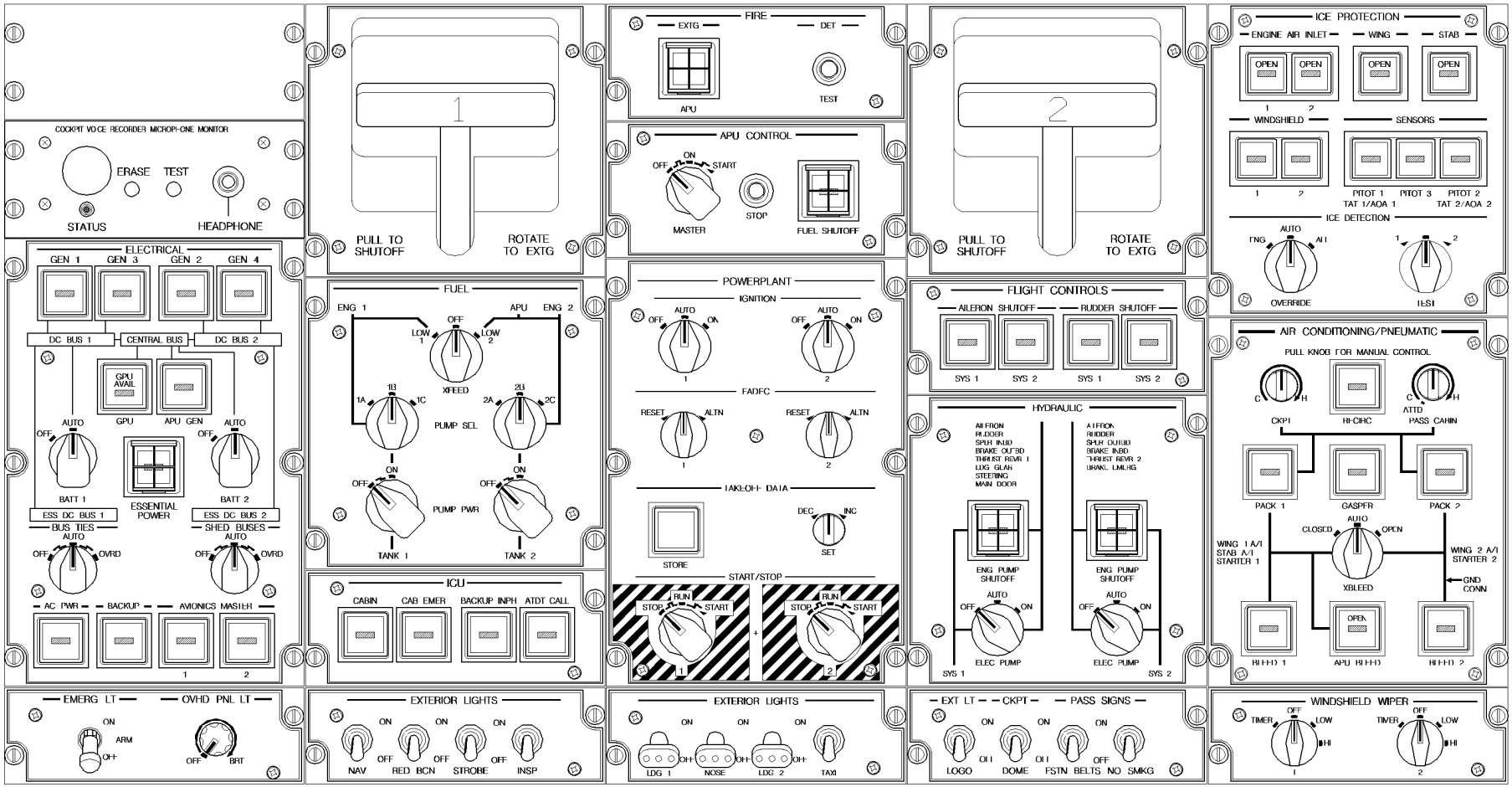
OVERHEAD PANEL (TYPICAL)



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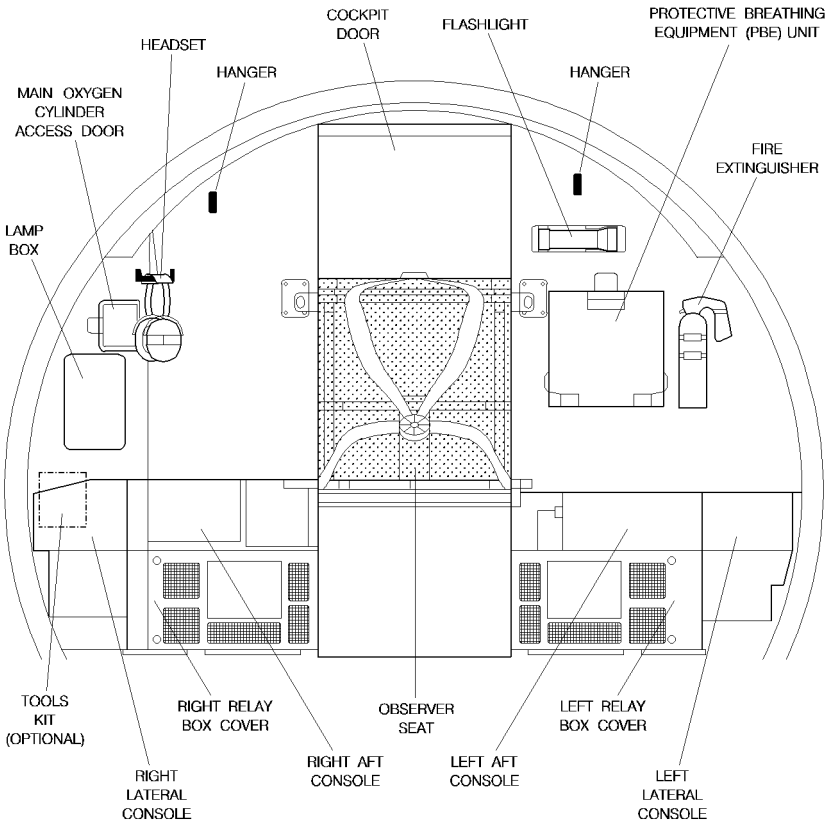
COCKPIT PARTITION (TYPICAL)



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SECTION 2-02
EQUIPMENT AND FURNISHINGS

TABLE OF CONTENTS

	Block	Page
Cockpit	2-02-05	01
Pilot Seats	2-02-05	01
Pilot Seat Controls	2-02-05	02
Pilot Seat Adjustment	2-02-05	04
Pedal Adjustment	2-02-05	05
Observer Seat	2-02-05	06
Direct Vision Windows	2-02-05	08
Attendant Stations and Seats	2-02-10	01
Attendant's Control Panels	2-02-15	01
Galley	2-02-20	01
Controls and Indicators	2-02-20	03
Passenger Service Unit	2-02-25	01
Controls and Indicators	2-02-25	02
Cockpit/Passenger Cabin Partition	2-02-27	01
Water and Waste	2-02-30	01
Water	2-02-30	01
Waste	2-02-30	01
Airstair Main Door (*)	2-02-35	01
EICAS Message	2-02-35	01
Controls and Indicators	2-02-35	02
Main Door Acoustic Curtain	2-02-35	06
Jetway Main Door (*)	2-02-35	01
EICAS Message	2-02-35	01
Main Door Acoustic Curtain	2-02-35	04
Access Doors and Hatches	2-02-40	01
Service Door	2-02-40	01
Baggage Door	2-02-40	05
Compartment Hatches	2-02-40	07
Refueling Panel Access Door	2-02-40	08
Emergency Exit Hatches	2-02-40	10
Doors and Hatches Indication on MFD	2-02-40	10

NOTE: Optional equipment are marked with an asterisk (*) and its description may not be present in this manual.

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PC Power System (*) ..... 2-02-50 ...01
Controls and Indicators ..... 2-02-50 ...02
In-Flight Entertainment System (*) ..... 2-02-55 ...01
Controls and Indicators ..... 2-02-55 ...02
Audio System ..... 2-02-55 ...08
Telephone System (*) ..... 2-02-60 ...01
Cockpit Security Door (*) ..... 2-02-65 ...01
Door Description ..... 2-02-65 ...02
Security Door Placards ..... 2-02-65 ...04
Video Surveillance System (VSS) (*) ..... 2-02-67 ...01
General ..... 2-02-67 ...01
Video Unit ..... 2-02-67 ...01
Video Cameras ..... 2-02-67 ...03
Controls and Indicators ..... 2-02-67 ...04
Lavatory Door ..... 2-02-70 ...01

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NOTE: Optional equipment are marked with an asterisk (*) and its description may not be present in this manual.

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COCKPIT

PILOT SEATS

The pilot seats are fixed to slide rails that permits fore and aft adjustments. When the seats are in their aftmost position, a lateral movement is also available, in order to ease crew access to the seat. Each seat is equipped with adjustable armrests, seat backs, thigh support and lumbar position, and can also be adjusted for height. Backrest inclination, thigh support and lumbar positions are hydromechanically adjusted. Seat aft, fore and lateral adjustments are mechanically actuated, the same applying to armrest adjustments.

The pilot and copilot seats are identical, except for the symmetrical arrangement of the controls. Controls on the pilot's seat are on the opposite side from those on the copilot's seat.

A switch installed in the seat allows height adjustment, which is performed by an electrical actuator. In case of electrical actuator malfunction height adjustment may also be accomplished manually by attaching a crank to the actuator and rotating it. Extension or retraction of the actuator rod connected to the seat structure permits vertical displacement.

The crew seat belts consist of five straps. The left (for the pilot seat) and right (for the copilot seat) lap belt straps are permanently fixed to a rotary buckle, provided with quick-release latch locks that are operated by turning the existing rotary device on the buckle face. The two upper straps are connected to an inertia reel attached to the seat backrest, which allows the pilot to bend forward in normal, slow movements. Abrupt movements or high acceleration locks the upper straps, preventing the pilot from impacting against the instrument panel. The inertia reel can be mechanically locked through a lever installed on the seat.

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PILOT SEAT CONTROLS

1 - SEAT FORE/AFT AND LATERAL ADJUSTMENT LEVER

- Pulling the lever up, the seat is free to slide along its rails. Lateral movement is allowed only when the seat is at the aft stop.
- Releasing the lever, the seat is locked. Fore/aft movement has predetermined fixed positions. Lateral movement has only the left and right stops.

2 - SEAT HEIGHT ADJUSTMENT BUTTON (spring loaded, center off rocker button)

- Pressing the button up or down causes the seat to raise or to lower respectively, provided the airplane is energized.

3 - BACKREST INCLINATION ADJUSTMENT BUTTON

- Pressing the button allows the occupant to select the required inclination by pressure exerted upon the backrest.
- Releasing the button, backrest is retained in the desired position.

4 - LUMBAR ADJUSTMENT WHEEL

- When rotated, provides in and out lumbar adjustment.

5 - THIGH SUPPORT ADJUSTMENT WHEEL

- When rotated, provides thigh support height adjustment.

6 - ARMREST ANGLE ADJUSTMENT WHEEL

- When rotated, allows armrest adjustment to the desired angle.

7 - INERTIA REEL LOCK LEVER

LOCK - Locks the inertia reel in the current position.

UNLOCK - Unlocks the inertia reel, permitting normal belt movement.

8 - HEIGHT ADJUSTMENT LEVER BACK-UP

- When attached to the height adjustment actuator and rotated, it causes the seat to raise or to lower.

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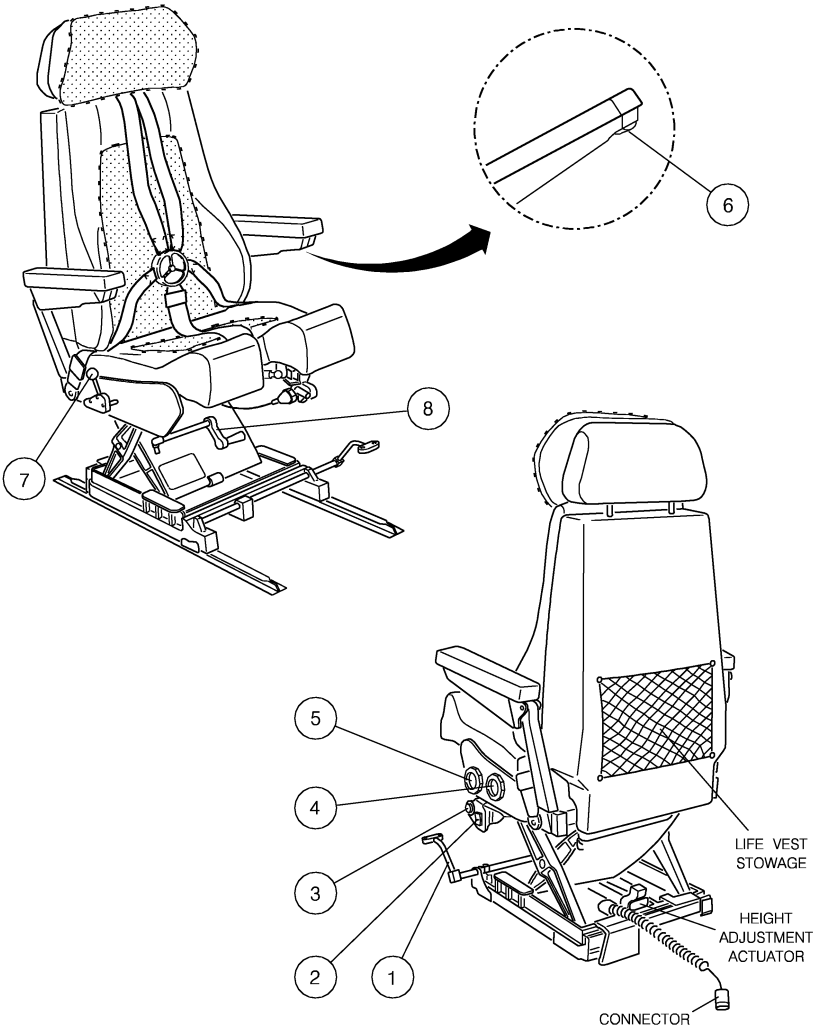

NOTE

Pilot's seat shown. Copilot's seat controls are on the opposite side.

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PILOT SEAT CONTROLS

PILOT SEAT ADJUSTMENT

Seat adjustment should be accomplished to accommodate the pilot's eye level and position best suited for control column actuation. The seat should be moved up or down until the pilot's line of sight reaches the same horizontal plane of a sight device made up of two white spheres and a black sphere. Then, move the seat fore or aft until the opposite white sphere is aligned with the black one. The seat should not be moved anymore. To adjust the rudder pedals, refer to PEDAL ADJUSTMENT.

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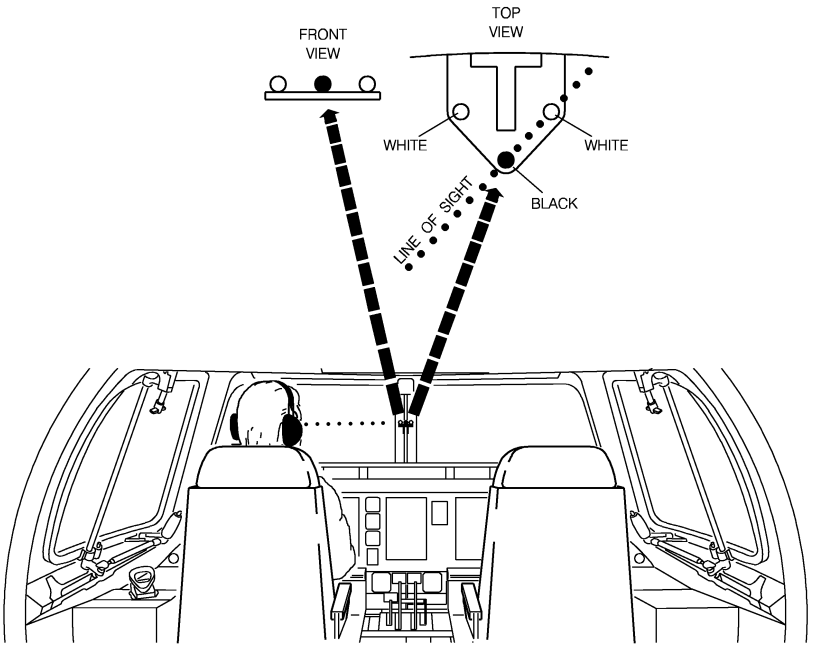

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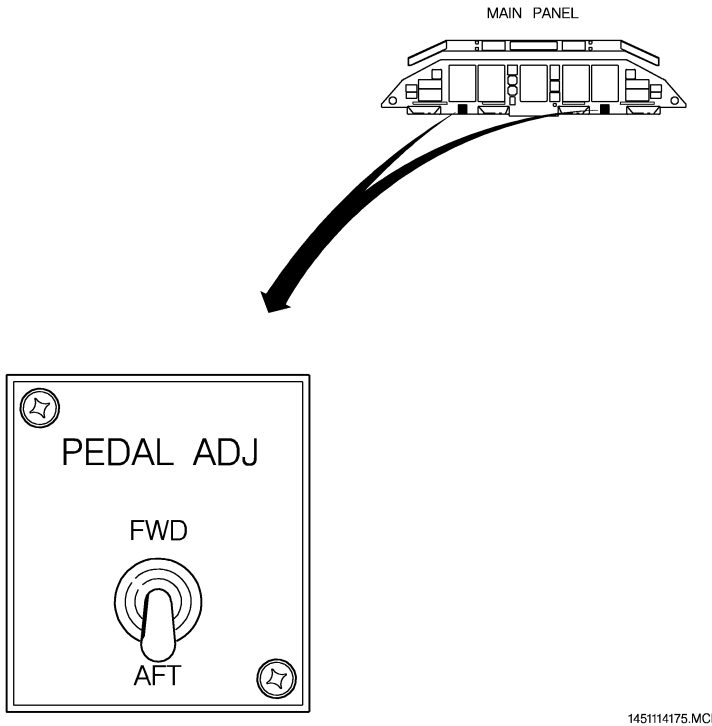
PEDAL ADJUSTMENT

Toggle switches installed on the pilot and copilot's panels allows rudder pedals adjustment, which is performed by electric actuators. Setting the switch up or down signals the actuator to move the pedals fore or aft, to assure the pilot's comfort and a full rudder throw from the adjusted seat position.



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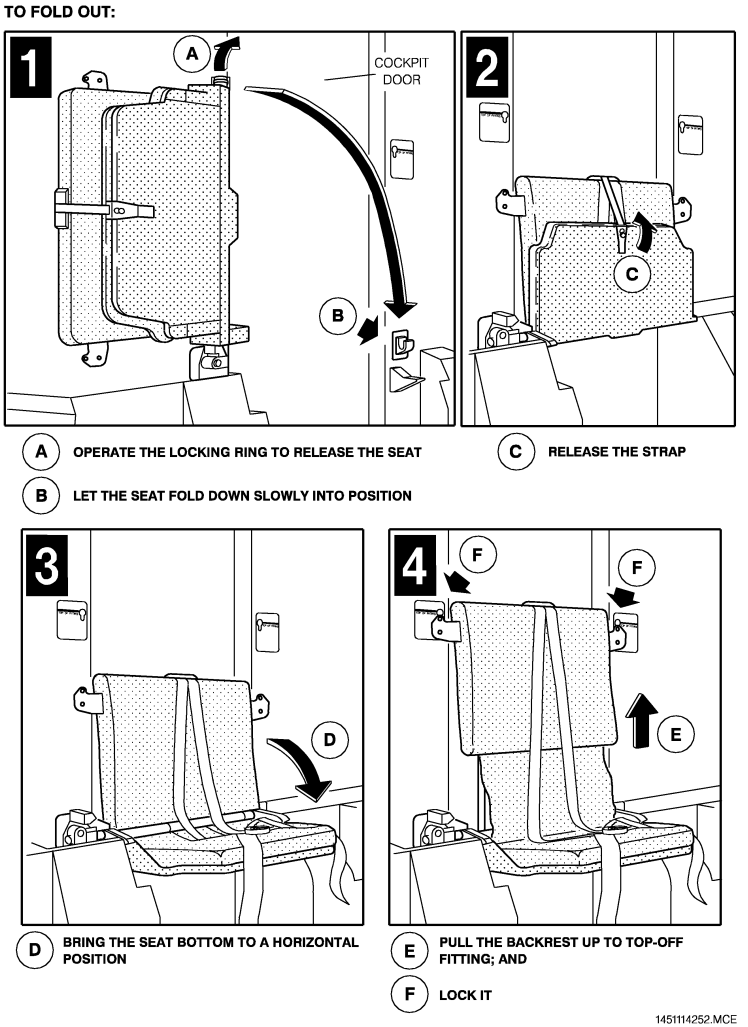
OBSERVER SEAT

The observer seat is located behind and between the pilot seats. When in use, it lies in front of the cockpit door. Stow it by folding and rotating away from the door area against the right side of the cockpit partition, behind the copilot's seat.

The cockpit door can be opened or closed with either the observer seat in use or stowed.



OBSERVER SEAT

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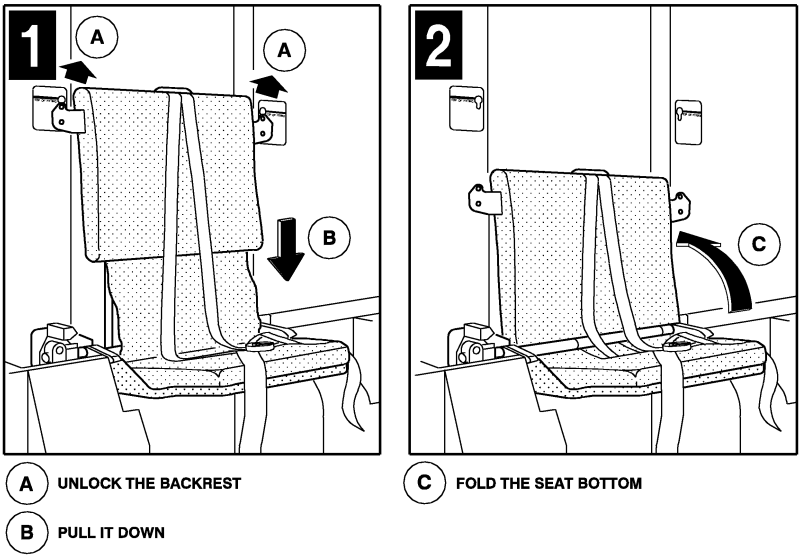
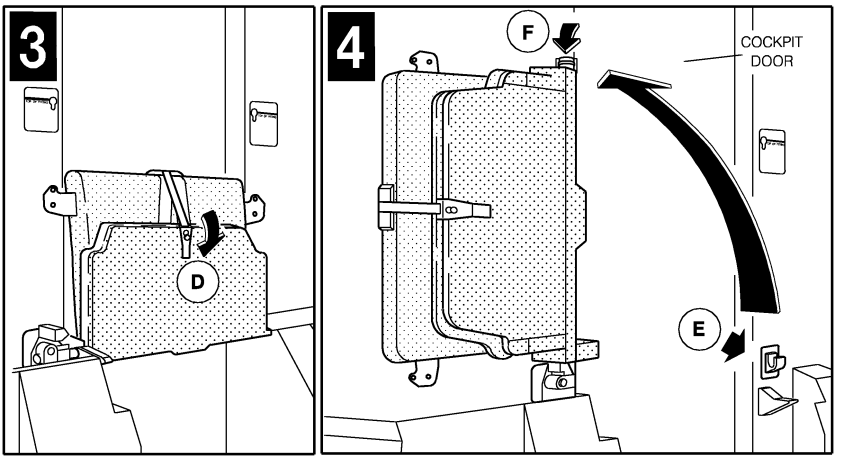
TO FOLD IN:



A UNLOCK THE BACKREST

B PULL IT DOWN

C FOLD THE SEAT BOTTOM



D STRAP THE SEAT

E ROTATE SEAT INTO STOWED POSITION

F LOCK THE RING

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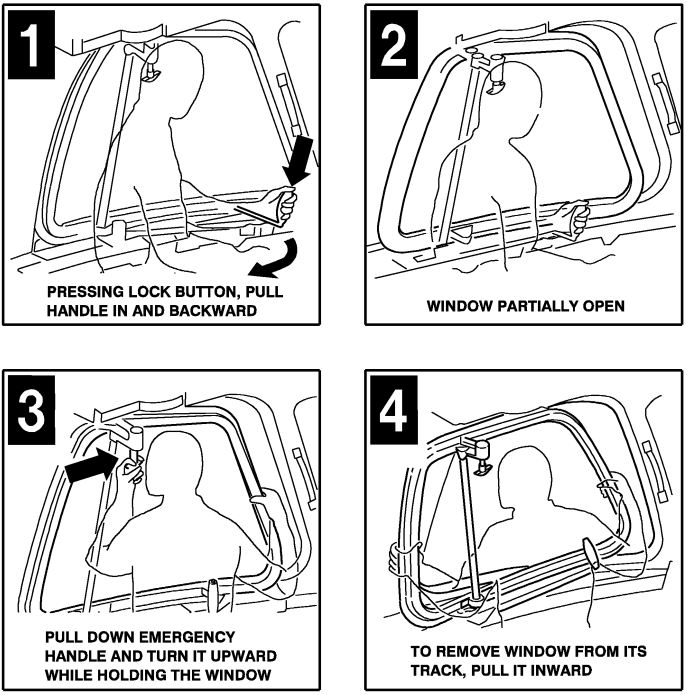
OBSERVER SEAT

DIRECT VISION WINDOWS

The normal position for the direct vision windows is closed. However, they may be partially opened on the ground, and may be totally removed in case of loss of visibility through the windshield or for cockpit emergency evacuation. Placing respective pilot seat to the aftmost position makes for easier window removal.

A yellow pin protrudes near the opening handle when the window is not properly locked in the closed position, indicating the unlocked condition.

A WINDOW NOT CLOSED inscription on the window front frame will be visible when the window is not properly closed.



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DIRECT VISION WINDOW REMOVAL

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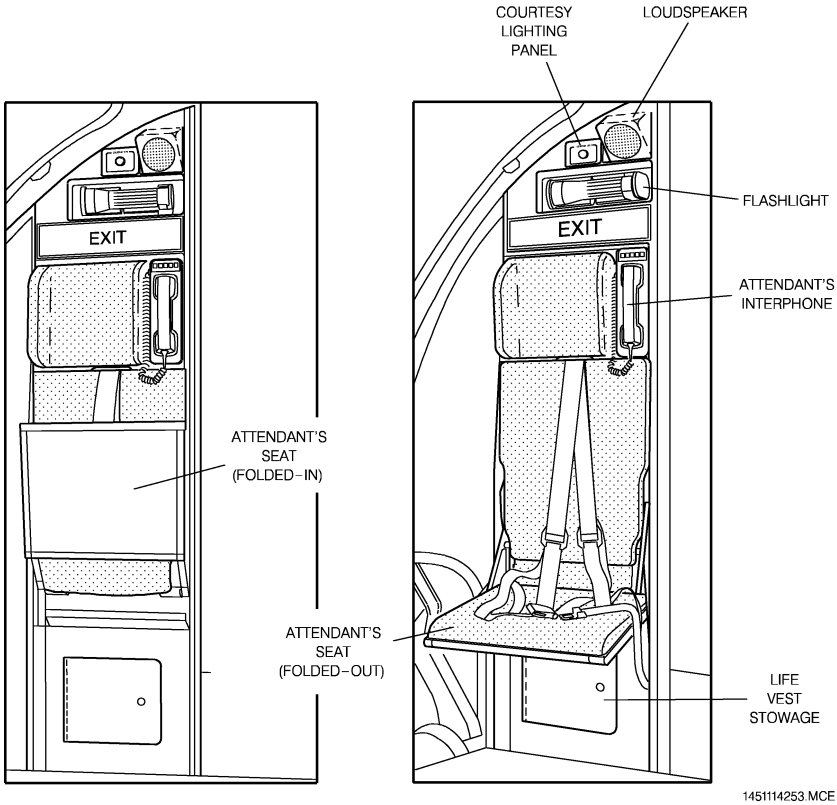
ATTENDANT STATIONS AND SEATS

The standard flight attendant station is positioned at the cockpit partition, close to the main door. The seat is of the fold-away type, to prevent passageway blockage.

An optional second flight attendant seat is available at the aft end of the aisle in front of the lavatory door. When not in use, an adequate mechanism allows its sliding against the lavatory wall, behind the last double seat row.



FORWARD FLIGHT ATTENDANT STATION

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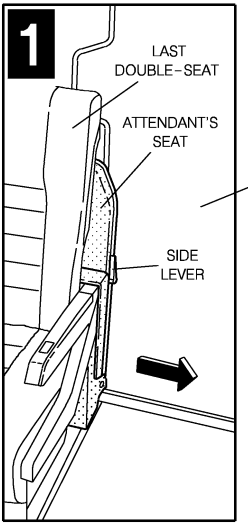
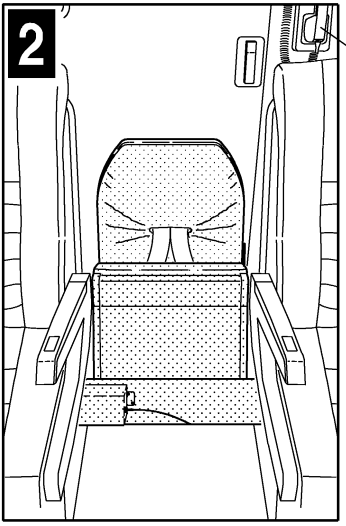
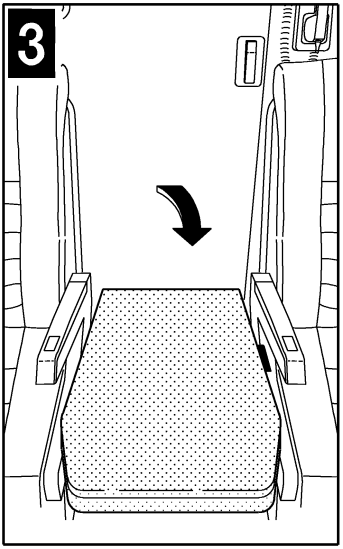


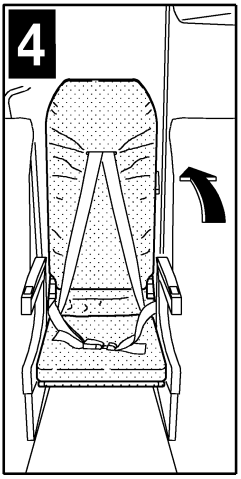
OPERATE THE SIDE LEVER
TO RELEASE THE SEAT



LET THE SEAT LOCK IN POSITION



OPERATE THE SIDE LEVER AND BRING
THE SEAT TO A HORIZONTAL POSITION



OPERATE THE SIDE LEVER AND MOVE
THE BACKREST UNTIL IT LOCKS IN POSITION

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AFT FLIGHT ATTENDANT SEAT

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ATTENDANT'S CONTROL PANELS

The Forward Attendant Control Panel is located on the passenger cabin divider opposite the forward attendant seat, in the entry area. This panel provides controls and indications for some functions of the Lighting System, Air Conditioning temperature control, Attendant Call System and Passenger Service Unit (PSU).

The Aft Attendant Call Panel is located on the left face of the lavatory wall and consists of four attendant call indication lights.

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FORWARD ATTENDANT CONTROL PANEL (OPTION 1)

1 - ATTENDANT CALL INDICATION LIGHTS

LAV (Amber) - Illuminates when the call is from the lavatory.

PA (Green) - Illuminates when the call is from the passenger cabin.

2 - PSU TEST BUTTON

- When pressed, provides PSU test, illuminating all the PSU's reading lights and attendant call lights. The associated attendant call chimes are also activated.

3 - PSU RESET BUTTON

- When pressed after test, allows resetting all PSUs to the initial state.

4 - CALL RESET BUTTON

- When pressed, clears all attendant call signals.

AFT ATTENDANT CALL PANEL

1 - ATTENDANT CALL INDICATION LIGHTS

LAV (Amber) - Illuminates when the call is from the lavatory.

PA (Green) - Illuminates when the call is from the passenger cabin.

PILOT (Green) - Illuminates when the call is from the cockpit.

PILOT EMERG (Red) - Illuminates when an emergency call to the attendant is from the cockpit.

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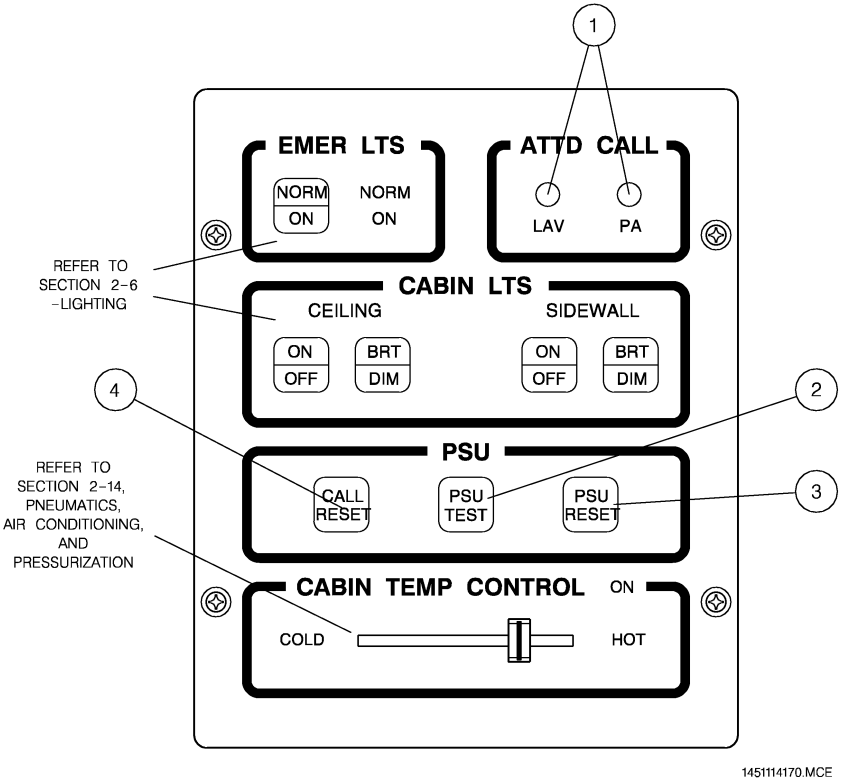
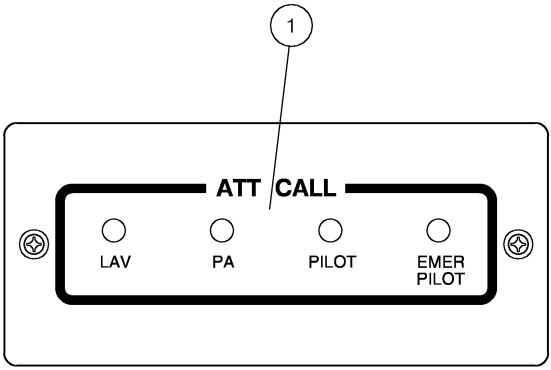


FORWARD ATTENDANT CONTROL PANEL (OPTION 1)



AFT ATTENDANT CALL PANEL

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FORWARD ATTENDANT CONTROL PANEL (OPTION 2)

1 - ATTENDANT CALL INDICATION LIGHTS

LAV (Red) - Illuminates when the call is from the lavatory.

PAX (Amber) - Illuminates when the call is from the passenger cabin.

2 - PSU TEST BUTTON

– When pressed, provides PSU test, illuminating all the PSU's reading lights and attendant call lights. The associated attendant call chimes are also activated.

3 - PSU RESET BUTTON

– When pressed after test, allows reseting all PSUs to the initial state.

4 - CALL RESET BUTTON

– When pressed, clears all attendant call signals.

AFT ATTENDANT CALL PANEL

1 - ATTENDANT CALL INDICATION LIGHTS

LAV (Red) - Illuminates when the call is from the lavatory.

PAX (Amber) - Illuminates when the call is from the passenger cabin.

PILOT (Green) - Illuminates when the call is from the cockpit.

PILOT EMERG (Red) - Illuminates when an emergency call to the attendant is from the cockpit.

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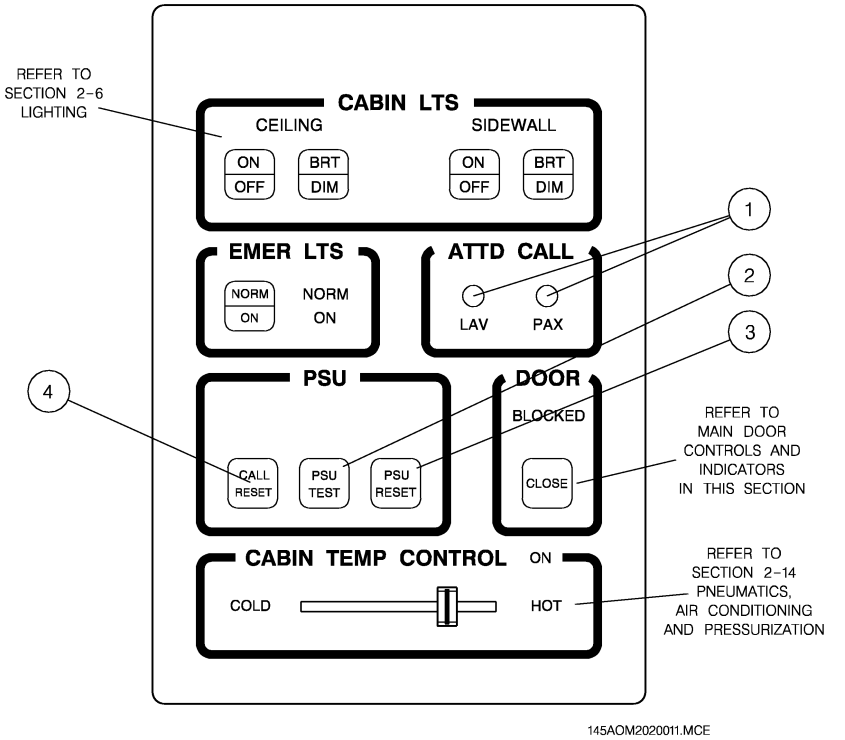
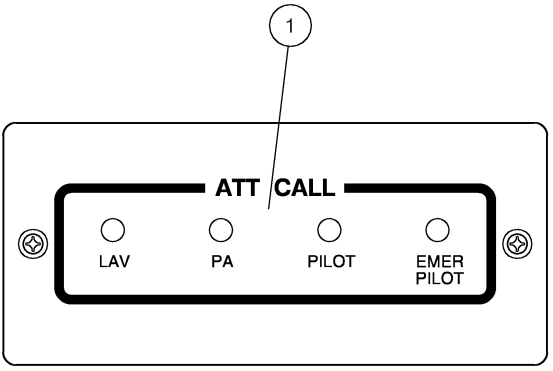


FORWARD ATTENDANT CONTROL PANEL (OPTION 2)



AFT ATTENDANT CALL PANEL

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FORWARD ATTENDANT CONTROL PANEL (OPTION 3)

1 - ATTENDANT CALL INDICATION LIGHTS

LAV (Red) - Illuminates when the call is from the lavatory.

PAX (Amber) - Illuminates when the call is from the passenger cabin.

2 - PSU TEST BUTTON

- When pressed, provides PSU test, illuminating all the PSU's reading lights and attendant call lights. The associated attendant call chimes are also activated.

3 - PSU RESET BUTTON

- When pressed after test, allows reseting all PSUs to the initial state.

4 - CALL RESET BUTTON

- When pressed, clears all attendant call signals.

AFT ATTENDANT CALL PANEL

1 - ATTENDANT CALL INDICATION LIGHTS

LAV (Red) - Illuminates when the call is from the lavatory.

PAX (Amber) - Illuminates when the call is from the passenger cabin.

PILOT (Green) - Illuminates when the call is from the cockpit.

PILOT EMERG (Red) - Illuminates when an emergency call to the attendant is from the cockpit.

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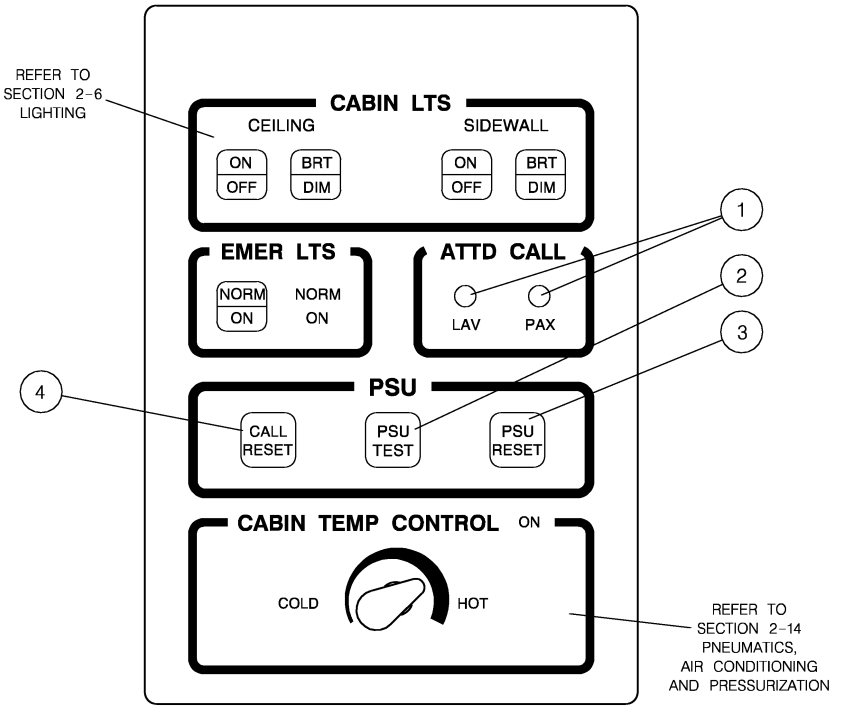
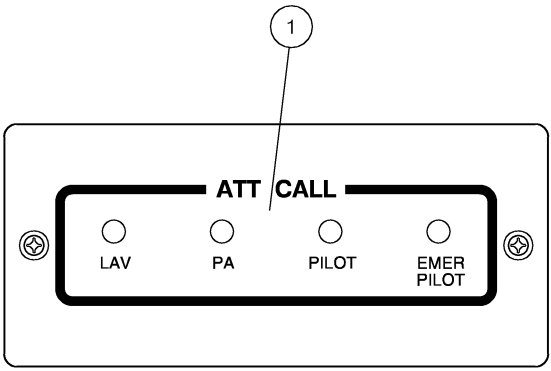


FORWARD ATTENDANT CONTROL PANEL (OPTION 3)



AFT ATTENDANT CALL PANEL

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FORWARD ATTENDANT CONTROL PANEL (OPTION 4)

1 - ATTENDANT CALL INDICATION LIGHTS

LAV (Red) - Illuminates when the call is from the lavatory.

PAX (Amber) - Illuminates when the call is from the passenger cabin.

2 - PSU TEST BUTTON

- When pressed, provides PSU test, illuminating all the PSU's reading lights and attendant call lights. The associated attendant call chimes are also activated.

3 - PSU RESET BUTTON

- When pressed after test, allows reseting all PSUs to the initial state.

4 - CALL RESET BUTTON

- When pressed, clears all attendant call signals.

AFT ATTENDANT CALL PANEL

1 - ATTENDANT CALL INDICATION LIGHTS

LAV (Red) - Illuminates when the call is from the lavatory.

PAX (Amber) - Illuminates when the call is from the passenger cabin.

PILOT (Green) - Illuminates when the call is from the cockpit.

PILOT EMERG (Red) - Illuminates when an emergency call to the attendant is from the cockpit.

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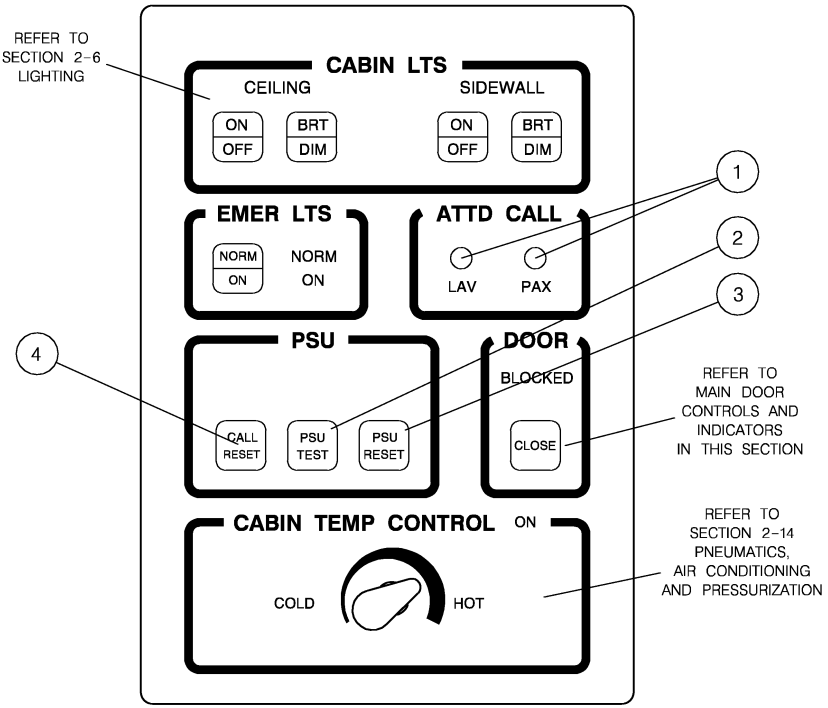
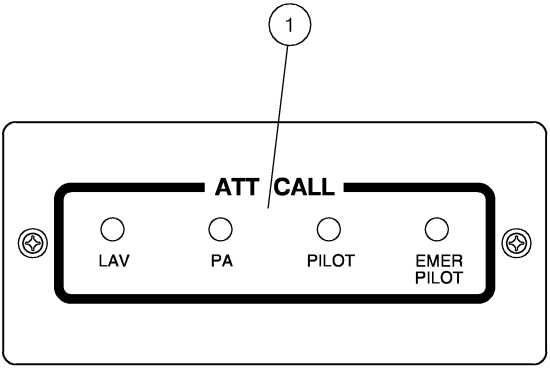


FORWARD ATTENDANT CONTROL PANEL (OPTION 4)



AFT ATTENDANT CALL PANEL

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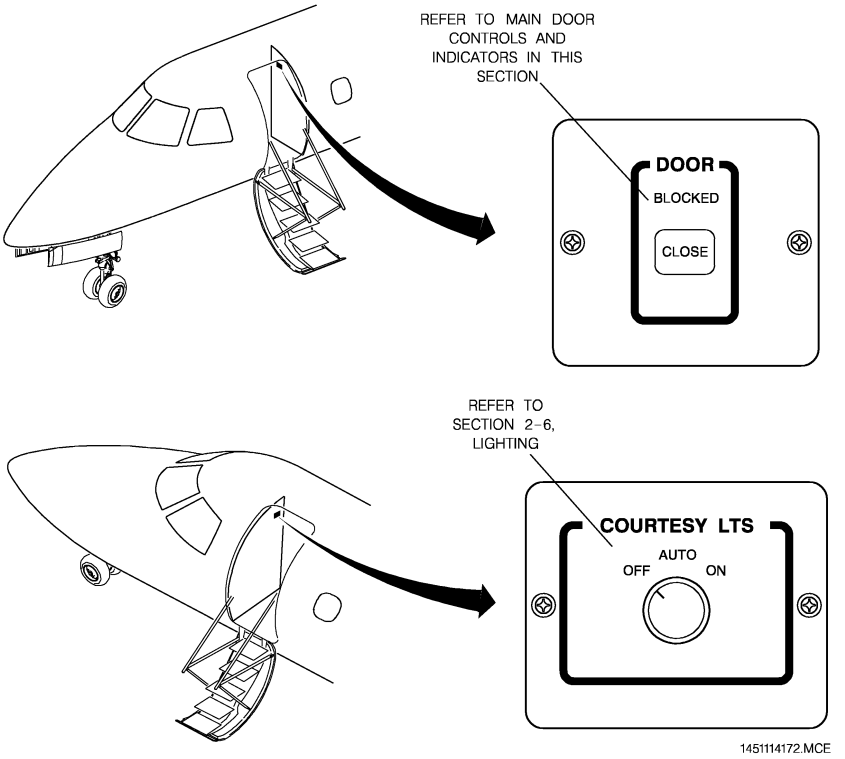
ENTRANCE PANELS

The Entrance Panels are located in the entry area, and provides main door control and indication and courtesy lights control.



NOTE: - The Interior Main Door Control Button is available only to airplanes equipped with Airstar door.

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GALLEY

The galley can be positioned in different locations of the forward area in passenger cabin.

The galley has many compartments that can be configured in different ways and can be equipped with different optional equipment to facilitate and provide an appropriate flight service to the passengers.

The following items can equip the galley:

- Switches and Circuit Breaker Panel (Galley Control Panel);
- CD player;
- Toilet Smoke Detector Panel;
- Pre-Recorded Messages Control Panel;
- Half Trolleys;
- Waste Compartment;
- Ice Box;
- Hot Jugs;
- Pull-out Working Table;
- Stowage Compartment;
- Miscellaneous Compartment;
- Literature Pocket.

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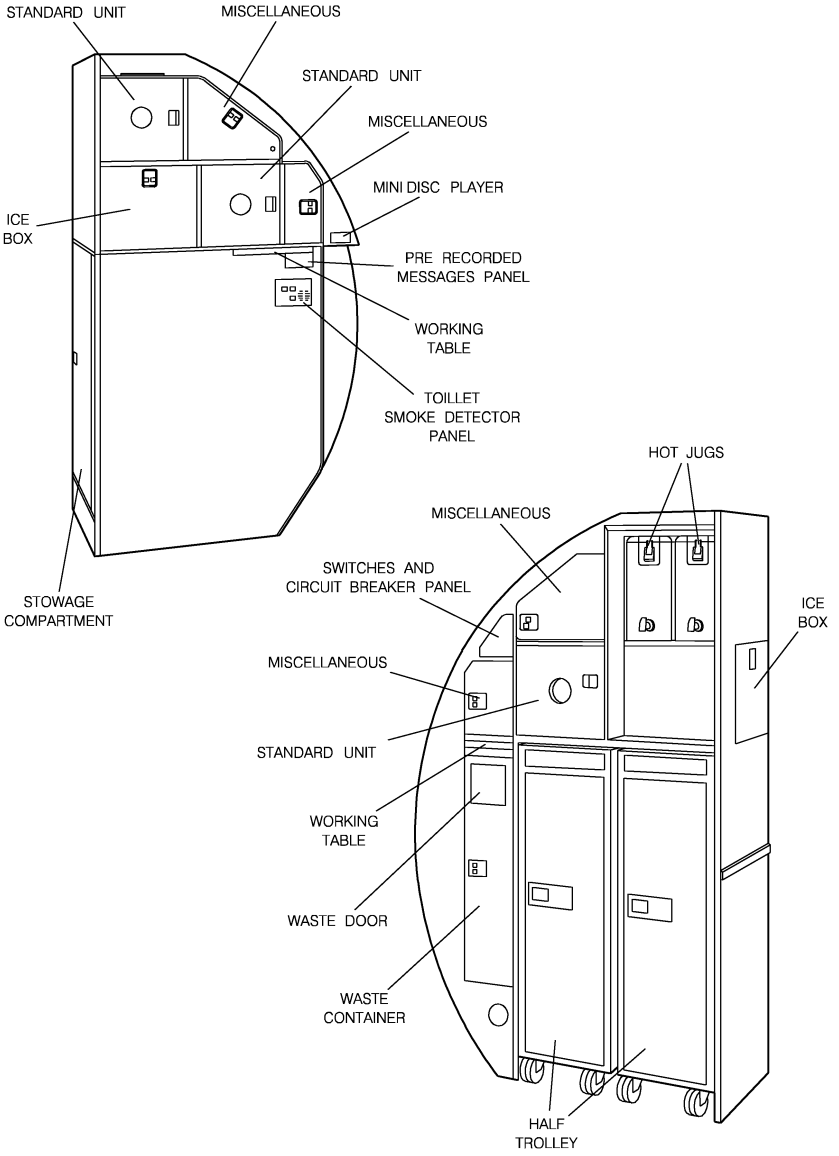

GALLEY (STANDARD)

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CONTROLS AND INDICATORS

GALLEY CONTROL PANEL

1 - AREA LIGHTING BUTTON

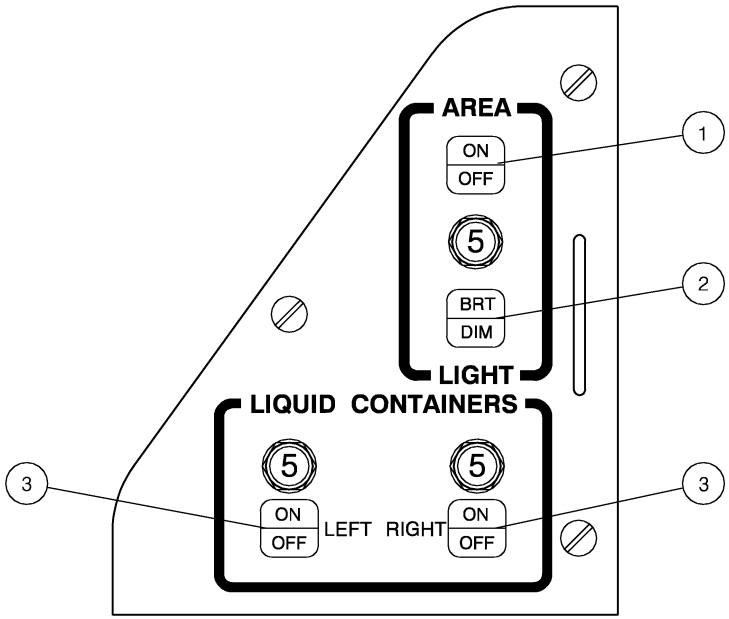
- When alternately pressed, turns on or off the galley area lighting.

2 - AREA LIGHTING BRIGHT/DIM BUTTON

- When alternately pressed, selects the bright or dim mode for galley area lighting.

3 - LEFT AND RIGHT LIQUID CONTAINER BUTTON

- When alternately pressed turns on or off heating for the associated liquid container.
- When the heating is turned on, the respective left or right indication is lit.



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GALLEY CONTROL PANEL

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PASSENGER SERVICE UNIT

The Passenger Service Unit (PSU) provides the following services:

- Reading light with associated control button at each passenger seat.
- Passenger information sign informing the passenger of NO SMOKING and FASTEN SEAT BELTS instructions.
- Pushbutton and indicator for attendant call.
- Air gasper for each individual passenger seat (refer to Section 2-14 – Pneumatics, Air Conditioning and Pressurization).
- Oxygen Masks Dispensing unit (refer to Section 2-16 – Oxygen).
- Loudspeaker for internal communication.

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CONTROLS AND INDICATORS

1 - ATTENDANT CALL INDICATOR LIGHT (amber)

- It also illuminates whenever the associated Attendant Call Button is pressed (attendant call is activated), for quick identification of the passenger by the flight attendant.

2 - INDIVIDUAL READING LIGHT CONTROL BUTTON

- Turns on/off the associated individual reading light.

3 - ATTENDANT CALL BUTTON

- When pressed, it activates the attendant call.
- When pressed again, it deactivates the attendant call.
- When the attendant call is activated:
  - An associated chime will be heard in all cabin loudspeakers.
  - The PA indication, located on the Attendant Control Panel, will illuminate.
  - The associated zone attendant call annunciator will illuminate to provide easy identification to the flight attendant. There are four zone attendant call annunciators distributed in the passenger cabin ceiling.

4 - NO SMOKING/FASTEN SEAT BELT SIGNS

- These passenger-warning signs are commanded by two separate switches, located on the Overhead Panel. Refer to Section 2-6 – Lighting.
- An associated chime, activated by the passenger address system, will be heard whenever any passenger warning signs is turned on or off by the pilot.
- The signs may also be activated by the automatic oxygen relay activation whenever sudden cabin depressurization occurs above 14000 ft cabin altitude.

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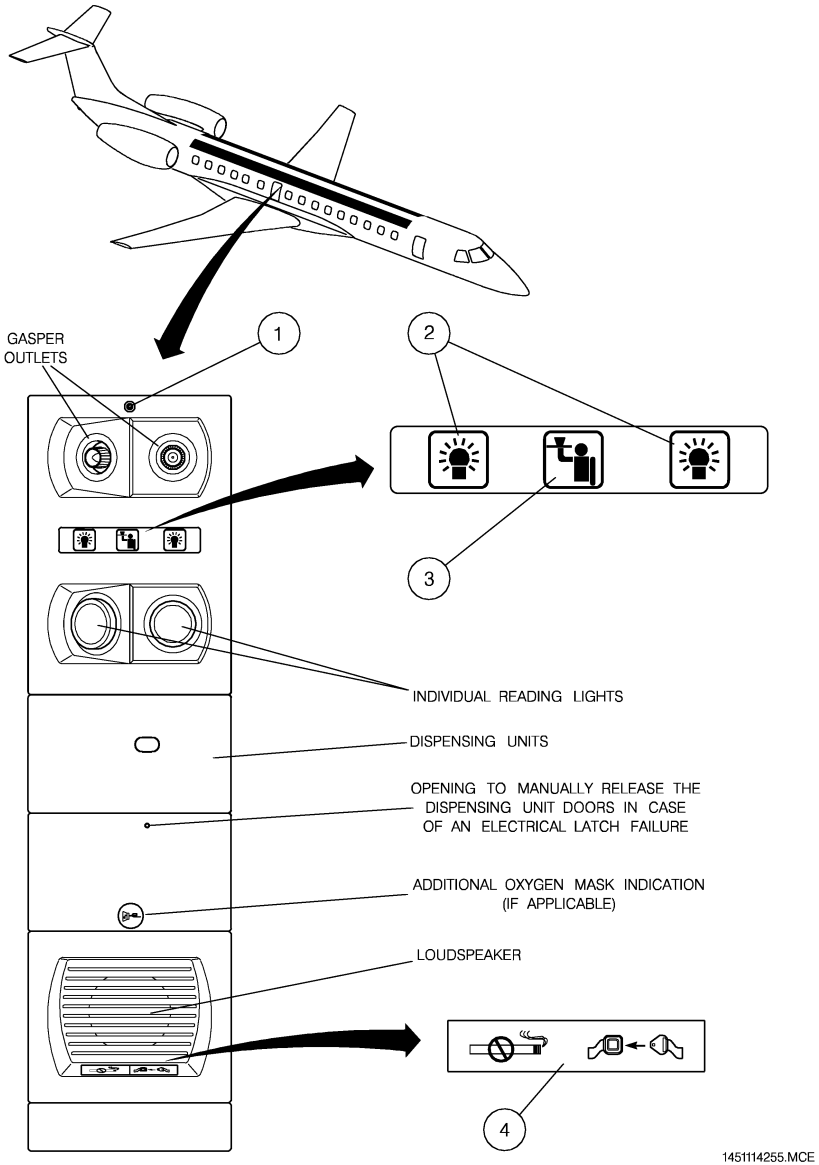

PASSENGER SERVICE UNIT

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COCKPIT/PASSENGER CABIN PARTITION

The cockpit/passenger cabin partition possesses a cockpit door, LH and RH partitions.

The cockpit door assembly is composed of a blowout panel assembly and a door assembly. The door assembly contains a locking latch assembly and a viewer. Two strap assemblies keep the blowout panel assembly attached to the door in the event of a significant pressure increase or decrease in the airplane. The peephole (optional) allows the cockpit occupants to see through the door assembly. The locking latch assembly engages a striker on the LH partition to secure the door when it is closed.

The cockpit/passenger cabin LH partition contains a striker and an electrical installation. The electrical installation possesses a harness assembly.

The cockpit/passenger cabin RH partition is provided with an access panel assembly that gives access to the relay box.

One blue light can be provided above the cockpit door to advise when the cockpit is to be shut out. This light is commanded through the STERILE light switch located at the overhead panel.

The figure on the next page presents the location of the cockpit/passenger cabin partition components.

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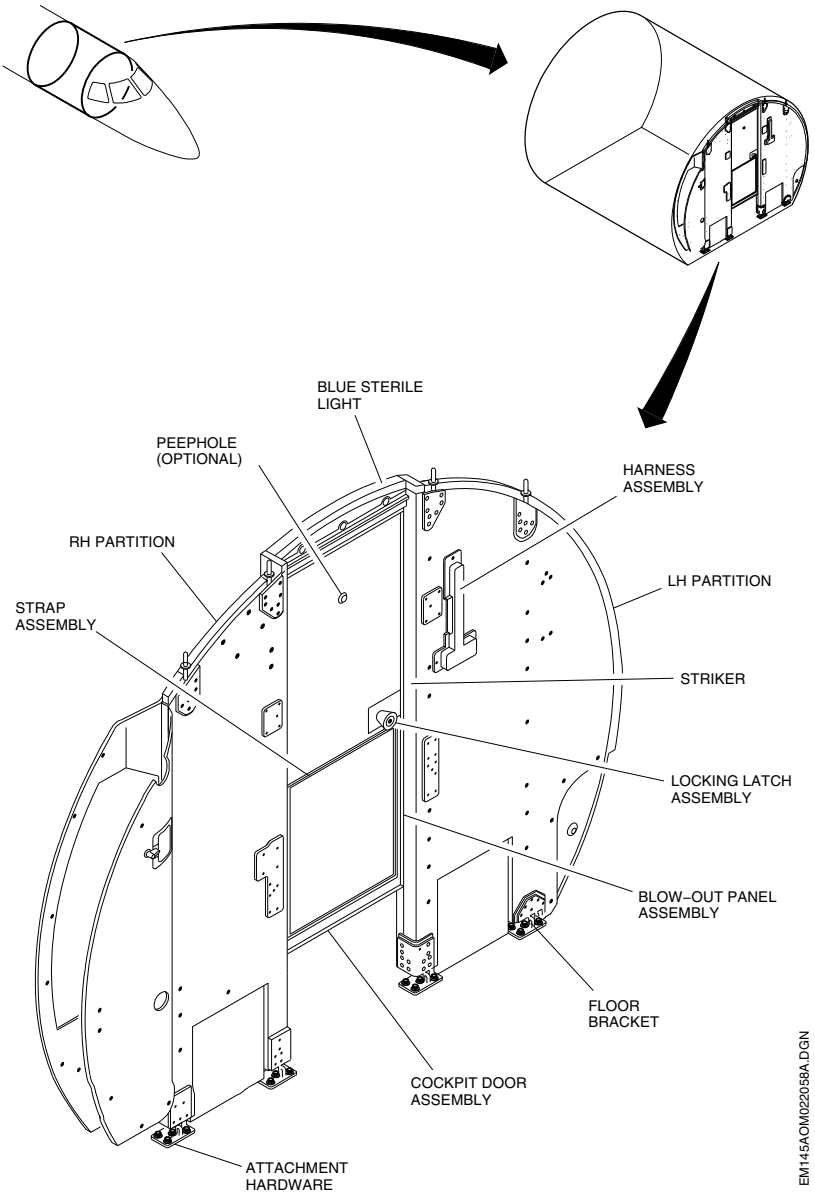

COCKPIT/PASSENGER CABIN PARTITION COMPONENTS LOCATION

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WATER AND WASTE

Water service is provided to the washbasin for crew members and passenger hygiene.

The waste system consists of a self-contained recirculating flushing toilet.

WATER

The water supply consists of a tank, a faucet, drain valves and required tubing.

The faucet is installed on the washbasin and supplies water from the tank when the valve is pressed.

A lever beside the faucet actuates a valve to drain accumulated washbasin water into the atmosphere. Draining is performed by gravity on the ground or by differential pressure while in flight. A heater at the end of the drain line prevents its obstruction by ice formation. The heater is activated whenever the DC BUS 1 is energized.

The wash basin drain line is also connected to the exterior by a muffler providing ventilation of the lavatory.

A water service control panel on the lower rear right side of the wing-to-fuselage fairing allows the supply of water to the tank and to draining it, if necessary.

WASTE

The waste system consists of an electrically-operated self-contained recirculation toilet unit, which collects and stores human waste in an internal holding tank. Adequate chemical products are used to disinfect and deodorize the waste holding tank.

A vent line connecting the waste holding tank to the exterior performs its ventilation (odors exhaust) by means of differential pressure.

Toilet flushing is initiated by pressing and releasing the flush button adjacent to the toilet. This button actuates a motor-driven pump and filter, which delivers flushing fluid for a pre-timed interval.

A restrictor at the bowl bottom prevents waste material return when it is carried directly to the tank.

A waste service panel on the lower rear right side of the fuselage is equipped with a control cable, a waste drain valve and a rinse nipple with cap, and allows the waste system to be serviced.

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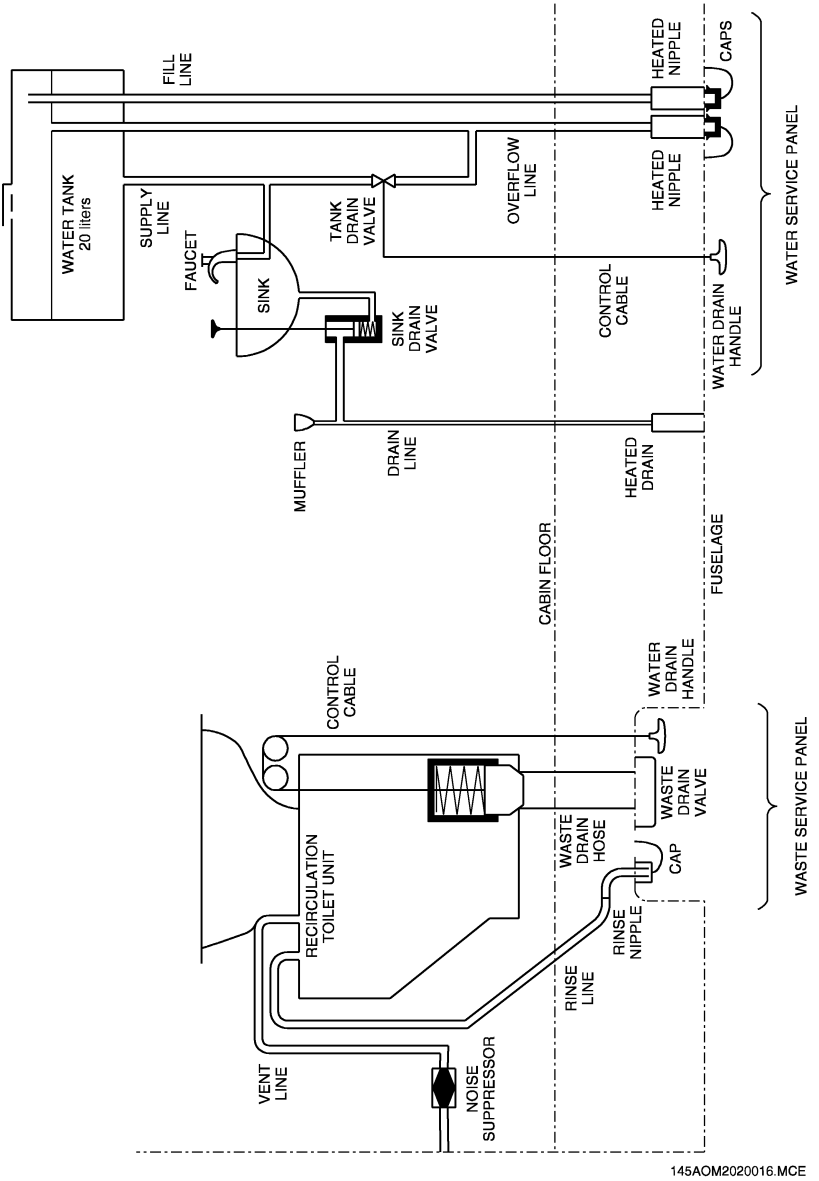
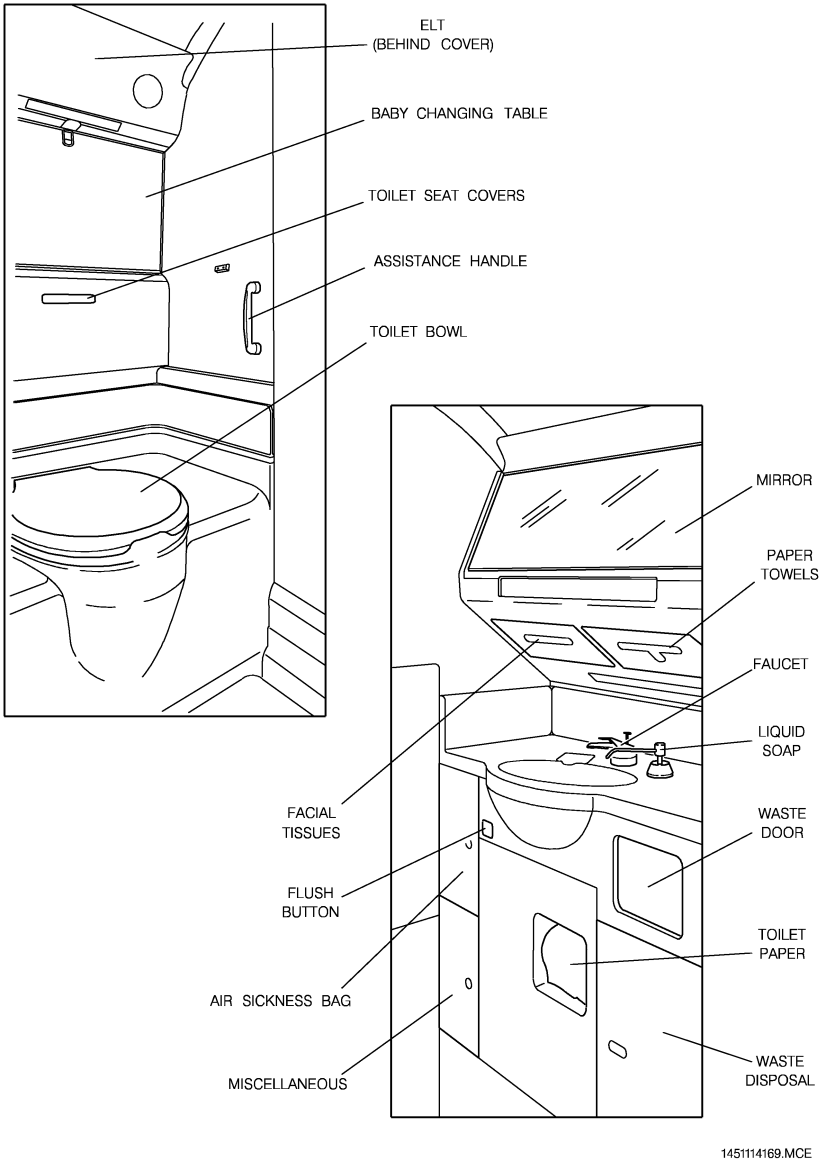


WASTE AND WATER SYSTEM SCHEMATIC



LAVATORY

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AIRSTAIR MAIN DOOR

The airplane is provided with one main entry door located on the left forward fuselage section and is designed as type I door.

The main door, incorporating folding air stairs, is hinged at its lower edge. The door is raised in normal operation by two hydraulic door actuators powered by hydraulic system 1 or by an accumulator with sufficient capacity for four complete door operation cycle.

The door opening operation is manual. The hydraulic circuit damping function allows a smooth operation when the door is lowered.

The system may be controlled from inside or outside, through the entrance panel or through the exterior main door control panel, respectively.

The door may also be closed and locked raising it manually, by an outside ground attendant, and actuating either the inner or the outer handle.

An alternative opening valve is provided in the cockpit to allow the main door to be lowered if it is blocked by hydraulic system pressure (solenoid valve failure).

NOTE: - No more than three persons should be standing on the doorsteps simultaneously.

- If the need arises, a person may be carried into and out of the airplane by two people provided there is at least one load-free step between the carriers and the sum of the weight of the three people is no more than 231 kg (509 lb). If at least one of the carriers weighs more than 77 kg (169 lb), the heavier one should be the first to step onto the stair when getting in the airplane, and the last one when getting out.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
WARNING	MAIN DOOR OPN	Main door is open or not properly locked either on the ground with engine 1 running or in flight.

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CONTROLS AND INDICATORS

1 - EXTERIOR MAIN DOOR CONTROL BUTTON

- When pressed, a solenoid valve is energized, allowing hydraulic power to raise the main door.

2 - INTERIOR MAIN DOOR CONTROL BUTTON

- When pressed, a solenoid valve is energized, allowing hydraulic power to raise the main door.
- A BLOCKED inscription illuminates when the main door actuator hydraulic line remains pressurized after door closing. In this case the main door is hydraulically blocked.

NOTE: The BLOCKED inscription may momentary illuminate when the main door is commanded to close, which does not mean that the main door is hydraulically blocked. The blockage is only characterized when the inscription remains illuminated.

3 - MAIN DOOR ALTERNATIVE OPENING VALVE

- When actuated for 2 minutes, it depressurizes the door close line, allowing the main door to be lowered when blocked by hydraulic system pressure, provided Hydraulic System 1 is depressurized.

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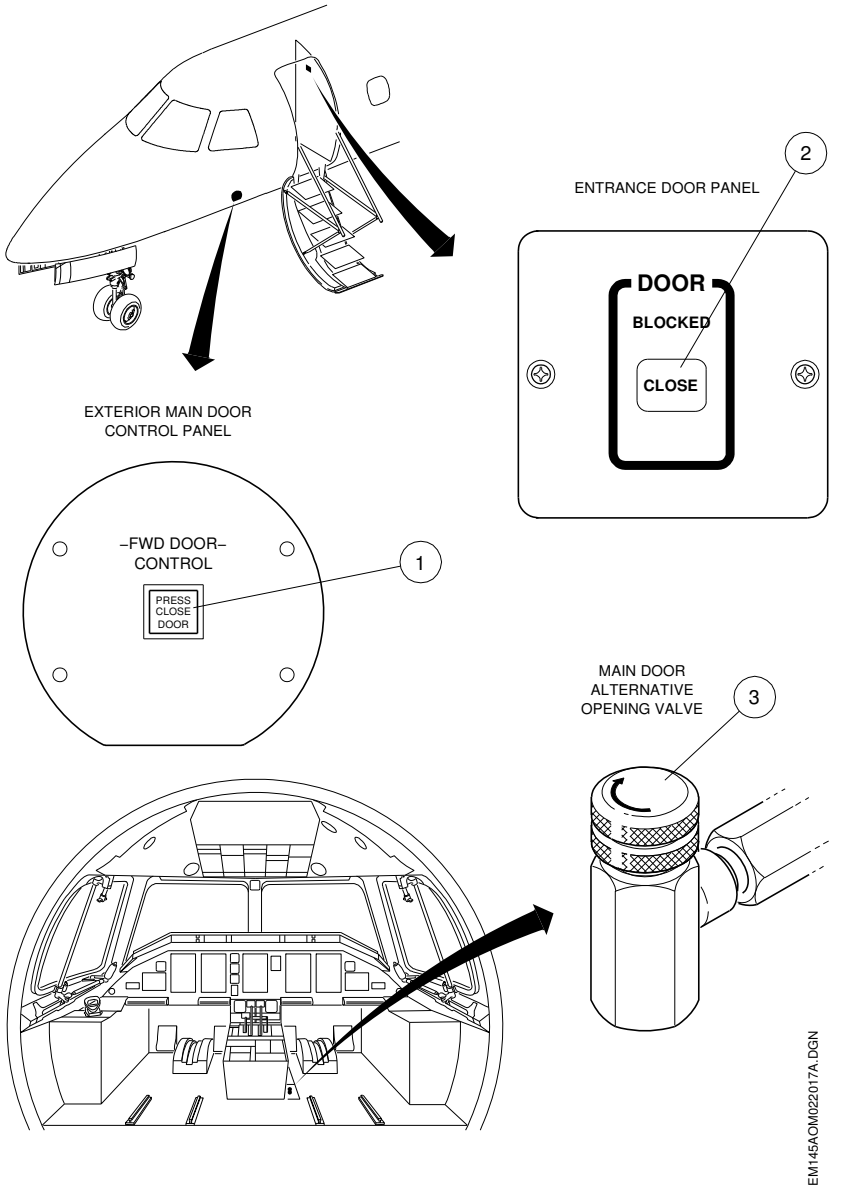
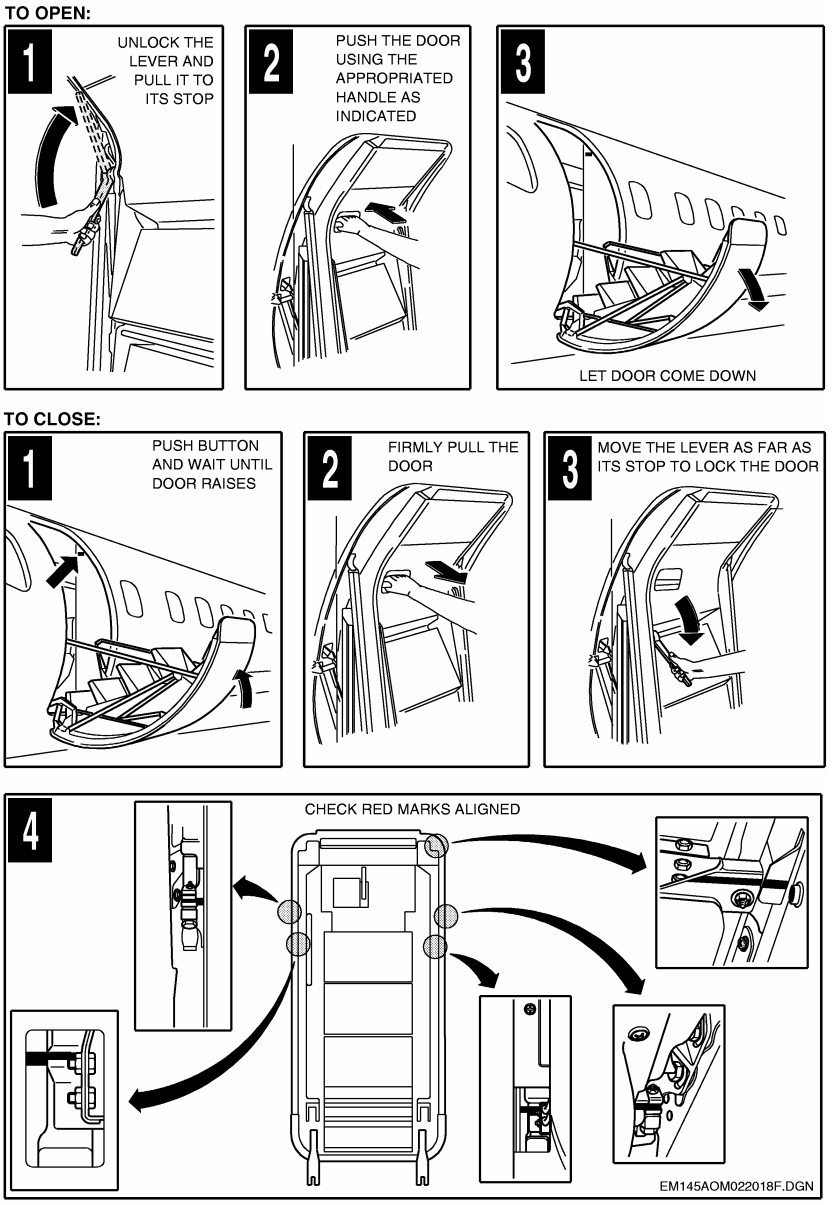


AIRSTAIR MAIN DOOR CONTROLS AND INDICATORS



AIRSTAIR DOOR OPERATION (INSIDE CABIN)

NOTE: The number of red marks may vary with the airplane configuration.

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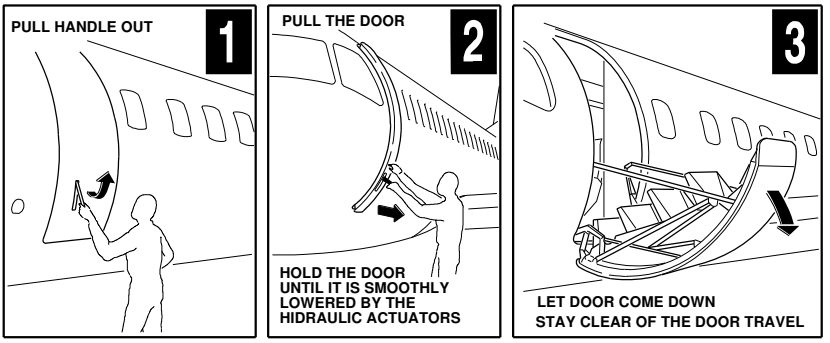
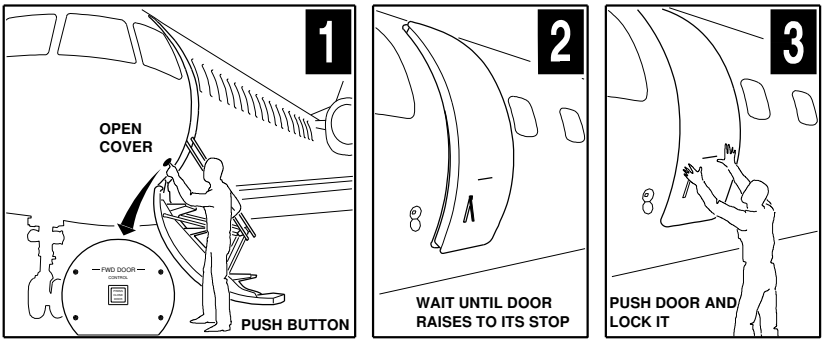
TO OPEN:



TO CLOSE:



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AIRSTAIR DOOR OPERATION (OUTSIDE CABIN)

MAIN DOOR ACOUSTIC CURTAIN

The airplane is equipped with an acoustic curtain at the main door area. The acoustic curtain reduces noise level in the forward passenger cabin area when it is installed.

NOTE: - The acoustic curtain must be stowed for takeoff and landing.

- The acoustic curtain should be installed during flights for passenger comfort.
- The acoustic curtain should be rolled-up with the ultra-leather facing outward. Thus, in case of rain, snow, wind or other weather conditions, the ultra-leather will be the exposed material.

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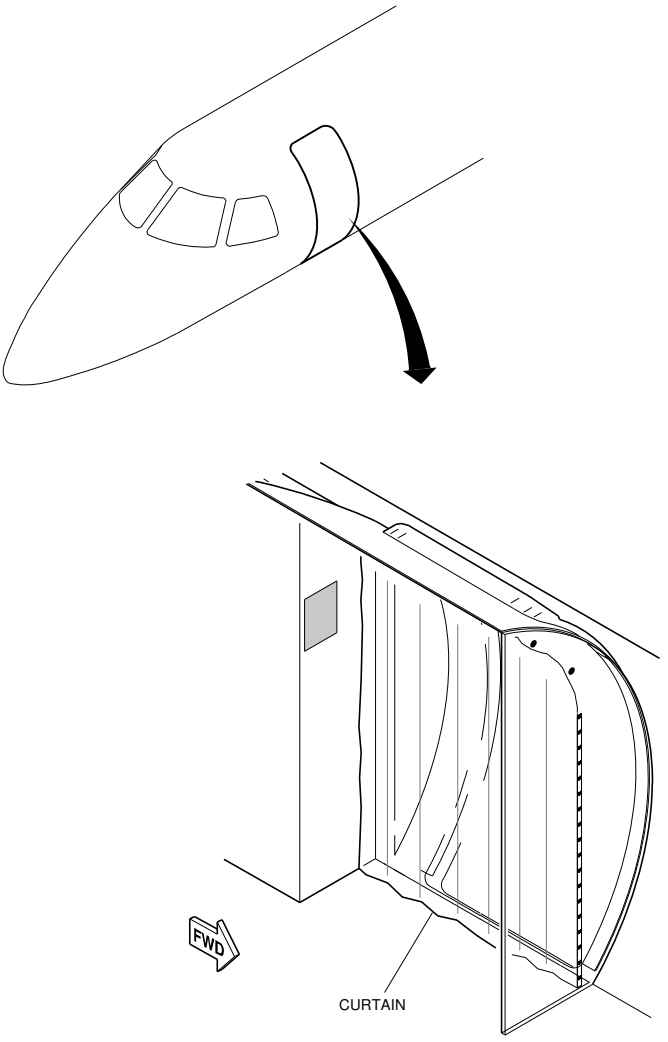

MAIN DOOR ACOUSTIC CURTAIN

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JETWAY MAIN DOOR

The airplane is provided with one main entry door located on the left forward fuselage section and is designed as type I door.

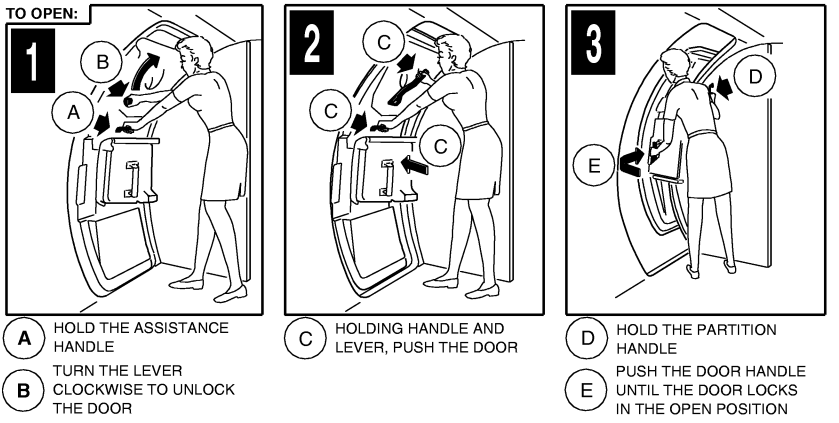
Some airplanes may be optionally equipped with a main door without handrails and stairs. This door will allow docking at jetway terminals. The door opening operation is manual. The system is mechanical and the door swings opens laterally and toward the airplane's front end.

The door movement is operated by internal and external handles. The door remains against the airplane fuselage when fully open, leaving the entrance completely free for the airport's jetway.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
WARNING	MAIN DOOR OPN	Main door is open or not properly locked either on the ground with engine 1 running or in flight.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37



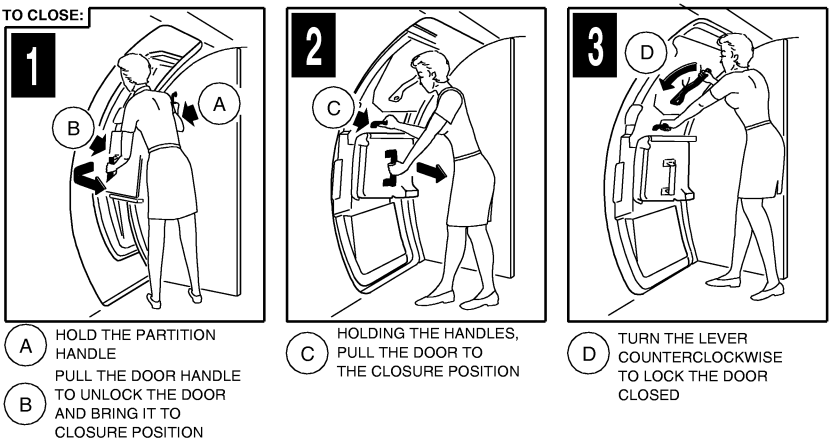
A HOLD THE ASSISTANCE HANDLE

B TURN THE LEVER CLOCKWISE TO UNLOCK THE DOOR

C HOLDING HANDLE AND LEVER, PUSH THE DOOR

D HOLD THE PARTITION HANDLE

E PUSH THE DOOR HANDLE UNTIL THE DOOR LOCKS IN THE OPEN POSITION

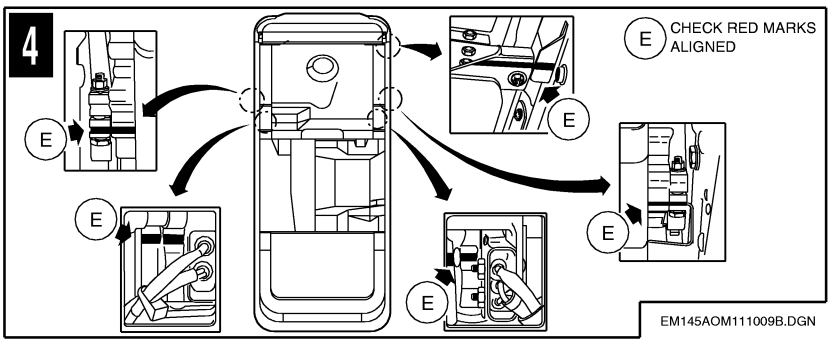


A HOLD THE PARTITION HANDLE

B PULL THE DOOR HANDLE TO UNLOCK THE DOOR AND BRING IT TO CLOSURE POSITION

C HOLDING THE HANDLES, PULL THE DOOR TO THE CLOSURE POSITION

D TURN THE LEVER COUNTERCLOCKWISE TO LOCK THE DOOR CLOSED



JETWAY DOOR OPERATION (INSIDE CABIN)

NOTE: The number of red marks may vary with the airplane configuration.

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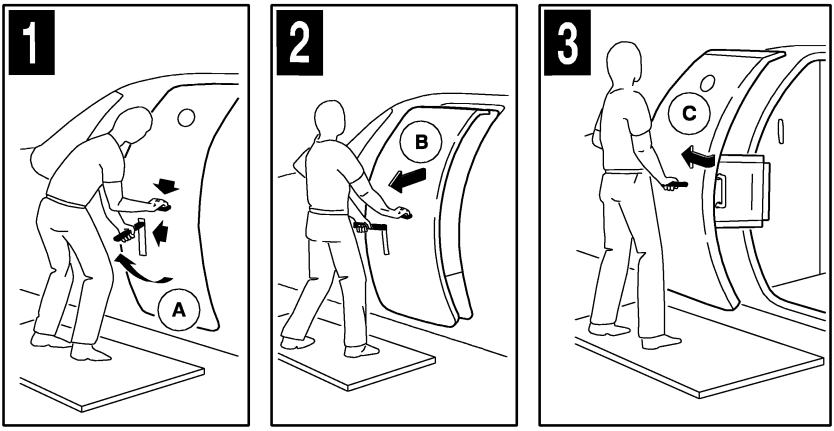
TO OPEN:

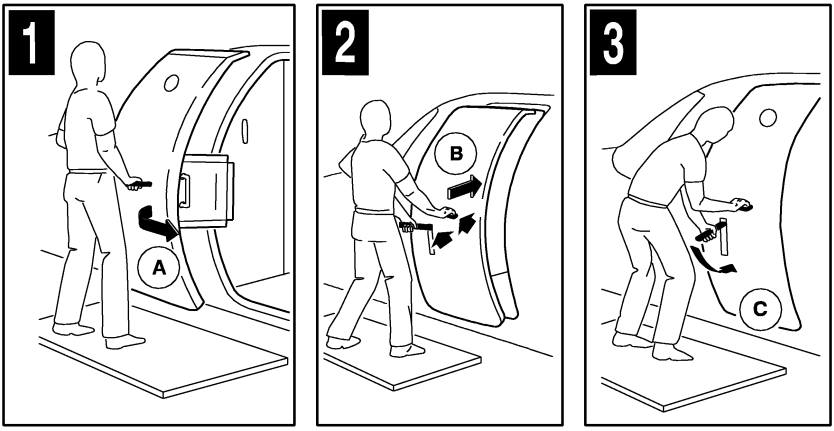


A LIFT THE LEVER TO UNLOCK THE DOOR

B PULL THE DOOR TO OPEN POSITION

C FULLY OPEN THE DOOR AND LOCK IT OPENED

TO CLOSE:



A HOLD THE DOOR HANDLE TO UNLOCK THE DOOR AND BRING IT TO CLOSURE POSITION

B PULL THE DOOR TO THE CLOSED POSITION

C LOWER THE LEVER TO LOCK THE DOOR CLOSED

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JETWAY DOOR OPERATION (OUTSIDE CABIN)

MAIN DOOR ACOUSTIC CURTAIN

The airplane is equipped with an acoustic curtain at the main door area. The acoustic curtain reduces noise level in the forward passenger cabin area when it is installed.

NOTE: - The acoustic curtain must be stowed for takeoff and landing.
- The acoustic curtain should be installed during flights for passenger comfort.
- The acoustic curtain should be rolled-up with the ultra-leather facing outward. Thus, in case of rain, snow, wind or other weather conditions, the ultra-leather will be the exposed material.

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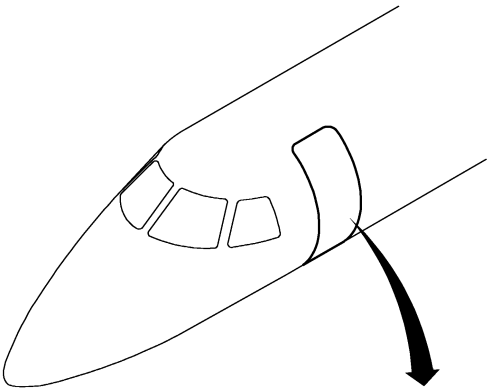

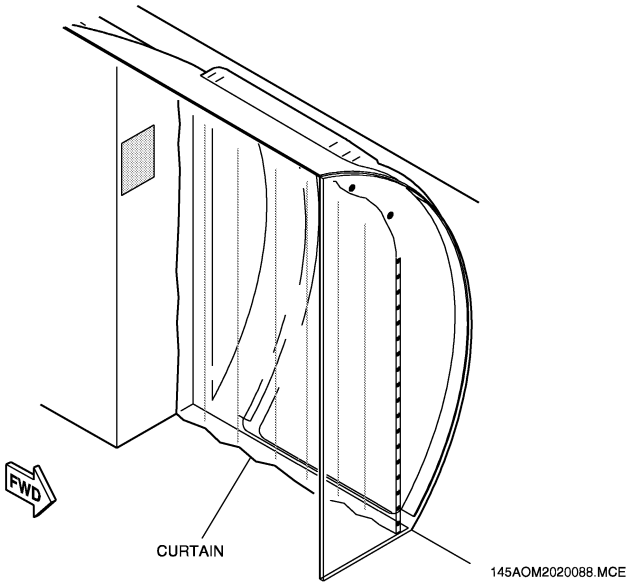

MAIN DOOR ACOUSTIC CURTAIN

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ACCESS DOORS AND HATCHES

The airplane is provided with one service door on the right side. Two passenger cabin emergency escape hatches are located over the wings. Finally, a number of access doors and hatches for different airplane systems can be found along the fuselage.

SERVICE DOOR

The service door on the right side of the forward fuselage section is used for galley servicing and cabin cleaning between flights. It may also be used as an emergency exit.

The door is manually operated by internal and external handles. Open the service door by lifting the handle and moving the door outward, followed by a forward rotation.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
WARNING	SERVICE DOOR OPN	Service door is open or not properly locked either on the ground with engine 1 running or in flight.

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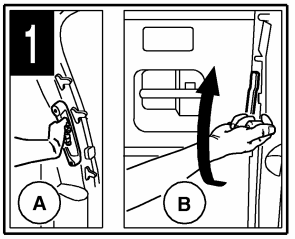
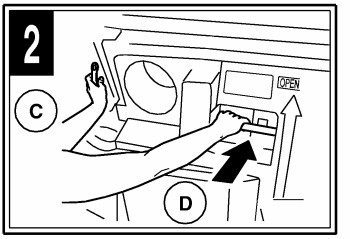
TO OPEN:



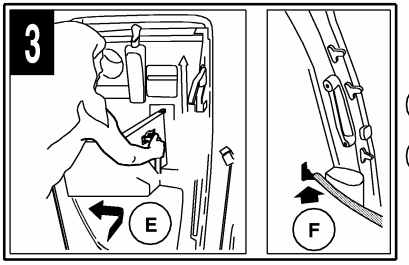


A HOLD THE ASSISTANCE HANDLE

B LIFT THE LEVER TO UNLOCK THE DOOR

C KEEP HOLDING THE ASSISTANCE HANDLE

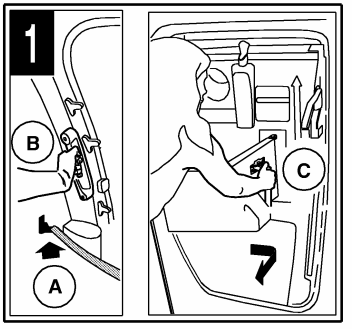
D PUSH THE DOOR TO OPEN

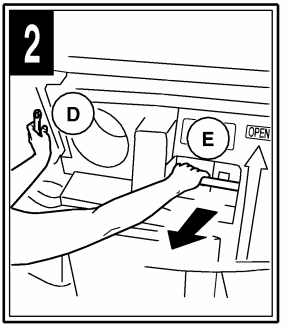


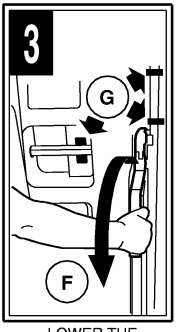
E MOVE THE DOOR UNTIL IT LOCKS IN THE OPEN POSITION

F MAKE SURE THAT THE SAFETY STRAP IS IN ITS CORRECT POSITION

TO CLOSE:







A REMOVE THE SAFETY STRAP

B HOLD THE ASSISTANCE HANDLE

C PULL THE LOWER HANDLE TO UNLOCK THE DOOR FROM THE OPEN POSITION AND BRING IT TO THE CLOSED POSITION

D KEEP HOLDING THE ASSISTANCE HANDLE

E FIRMLY PULL THE DOOR

F LOWER THE LEVER TO LOCK THE DOOR

G CHECK RED MARKS ALIGNED

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SERVICE DOOR OPERATION

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For airplanes Post-Mod. SB 145-52-0040, Part II and Part III, or equipped with an equivalent modification factory incorporated, the service door can be locked with a locking pin.

On ground, at pilot discretion, the pin can be used but must be removed and guarded in the quick-release pin support, in the LH cockpit rear console, behind the pilot seat, before any flight.

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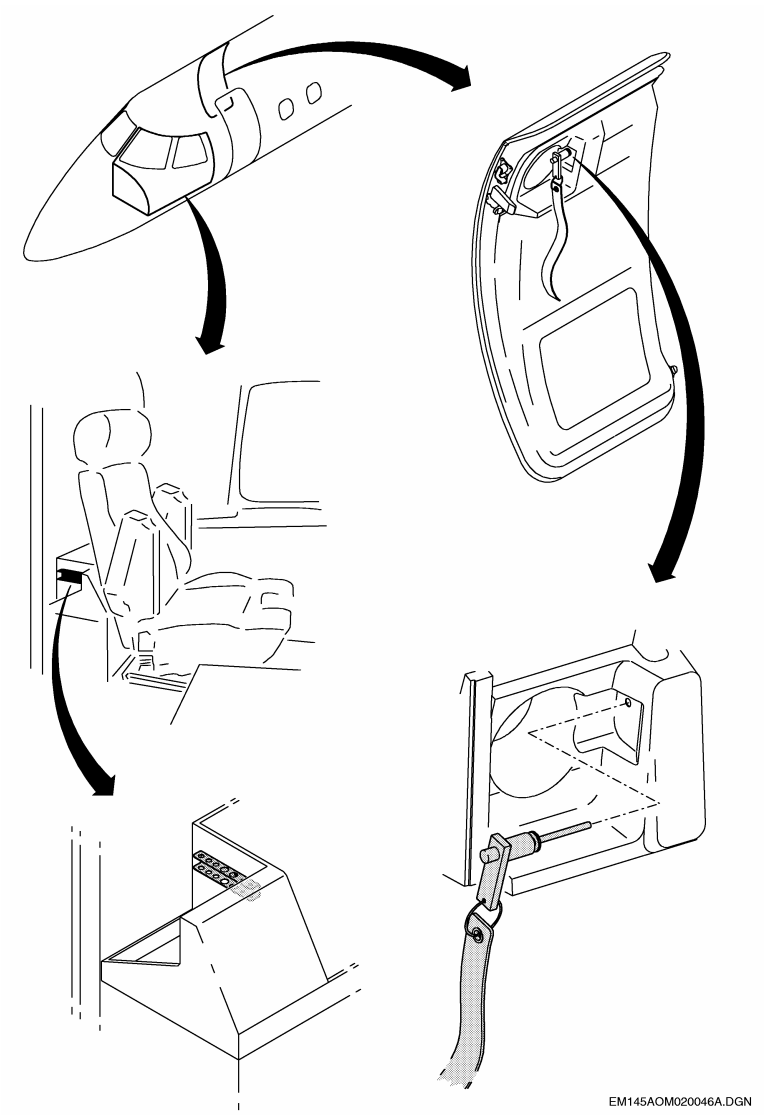

SERVICE DOOR LOCKING PIN

BAGGAGE DOOR

The baggage door on the rear left side of the fuselage is manually operated from the outside. It is provided by a locking mechanism controlled by an external handle, stowed in the lower half of the door. The door is provided by depressurization vent that allows the opening operation.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
CAUTION	BAGGAGE DOOR OPN	Baggage door open or not properly locked.

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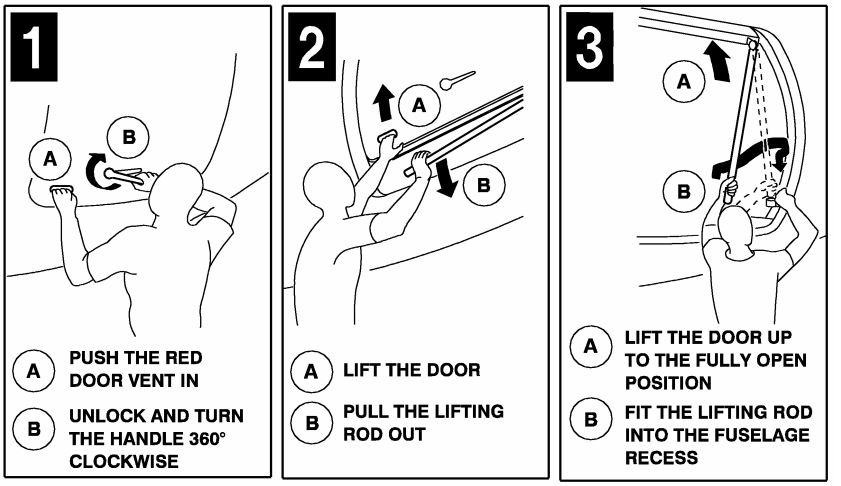
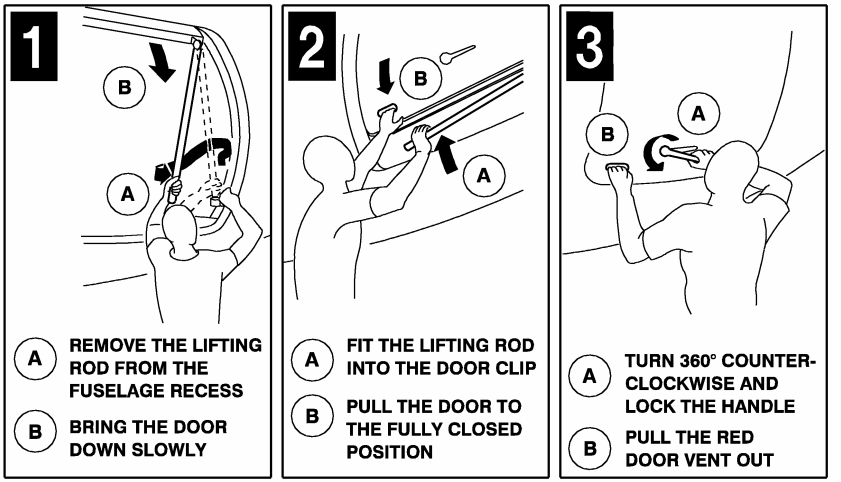
TO OPEN:



TO CLOSE:



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BAGGAGE DOOR OPERATION

COMPARTMENT HATCHES

A number of access doors and hatches for different airplane systems can be found along the fuselage.

The compartment hatches provide access for servicing the airplane systems and equipment.

The under cockpit access hatch is located under the fuselage, providing access to the fuselage pressurized compartment.

The forward electronic compartment access hatch is inside the nose landing gear wheel well.

The rear electronic compartment access hatch is located on the rear right side of the fuselage. This hatch provides access to the airplane pressurized area containing the rear electronic compartment, rudder autopilot servo, rudder control cables and electrical harness, stabilizer electrical harness and elevators control cables.

A unlocked condition of any compartment hatch causes a single caution message on Eicas. In addition, the MFD indicates the open-hatch(es) condition in a graphical representation.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
CAUTION	ACCESS DOORS OPN	At least one compartment access hatch open or not properly locked.

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REFUELING PANEL ACCESS DOOR

The refueling panel access door is located on the forward right side of the wing-to-fuselage fairing (refer to Section 2-8 – Fuel System).

The opening of the fueling panel access door causes a caution message on Eicas. In addition, the MFD indicates the open-door condition in a graphical representation.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
CAUTION	FUELING DOOR OPN	Refueling panel access door open or not properly closed.

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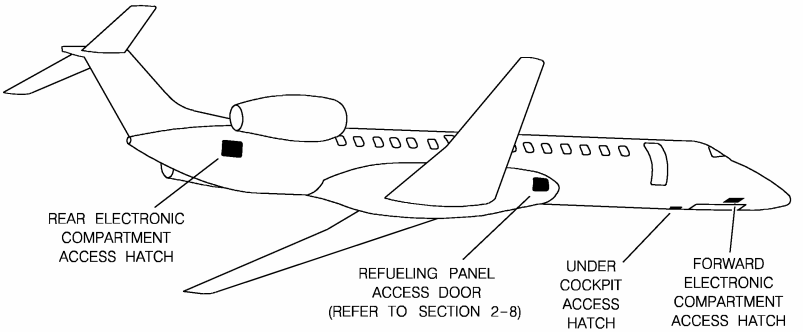

ACCESS DOORS AND HATCHES

EMERGENCY EXIT HATCHES

Two passenger cabin emergency escape hatches are located over the wings. Refer to Section 1-10 – Emergency Information.

DOORS AND HATCHES INDICATION ON MFD

The doors section of the Takeoff System Page on MFD consists of a graphical representation of the airplane (white) with squares located along the fuselage to denote the various doors and hatches to be monitored.

If a door or hatch is ajar, the associated graphical square will change from green to red and a red DOOR OPEN inscription will be presented, boxed in red, in the lower left corner of the DOORS section.

The following doors and hatches are monitored for status:

- Main door;
- Service door;
- Baggage door;
- Fueling panel access door;
- Rear electronic compartment access hatch;
- Forward electronic compartment access hatch;
- Under cockpit access hatch;
- Emergency exits hatches.

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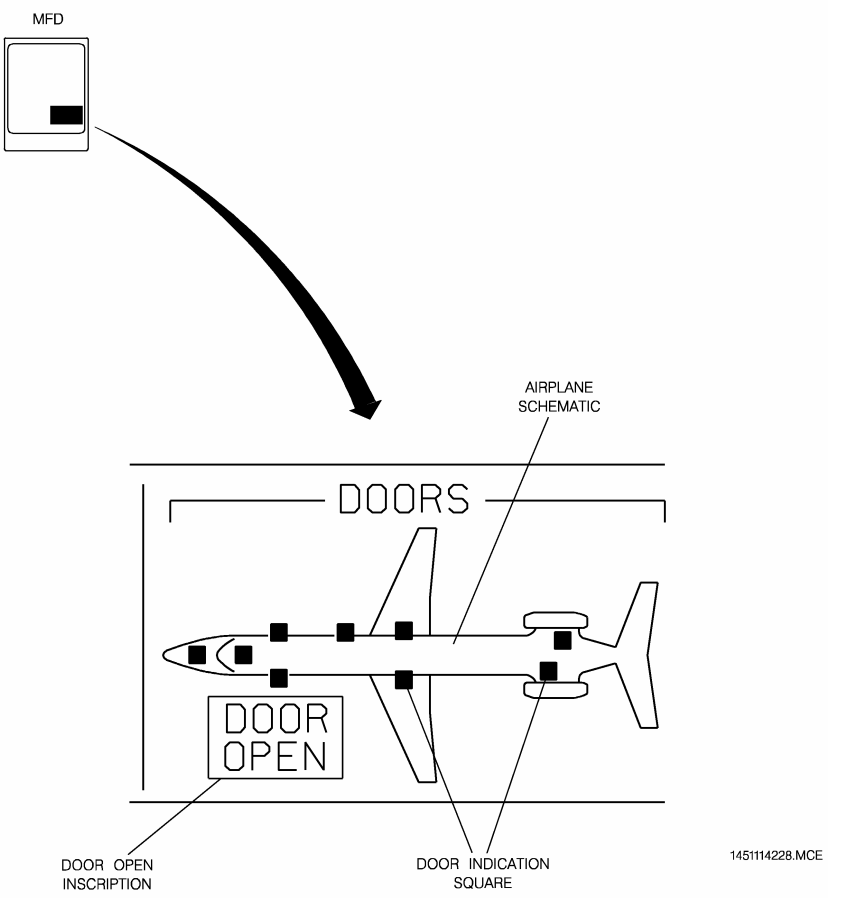

DOORS AND HATCHES INDICATION ON MFD

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PC POWER SYSTEM

The PC Power system is designed to supply aircraft seats with 110V/60Hz AC-power for Personal Electronic Devices (PED) such as laptop computers and other passenger equipment.

A control switch in the In-flight Entertainment Panel (IFE), installed in the Cockpit Overhead Panel, controls the PC Power System.

The Master Control Unit (MCU) controls the power available to the AC Outlet Units in the seat armrest. The MCU has power programming capability, which monitors the total electrical current in use at the Outlet Units and, if necessary, disables or enables the available power outlets.

If any cabin decompression occurs during the flight, the MCU is deactivated by a ground signal from the pressurization system.

Each outlet incorporates a LED, that is visible to the passenger and indicates that AC power is available. The green color indicates the power supply, the yellow color indicates power not available at the moment, and the red color indicates that AC outlet unit out of service.

A blue color LED on the aisle seats indicates if the In-Seat Power Converter is providing power.

NOTE: The PC Power System may be turned off during take-off and landing conditions or when operating below 10000 ft.

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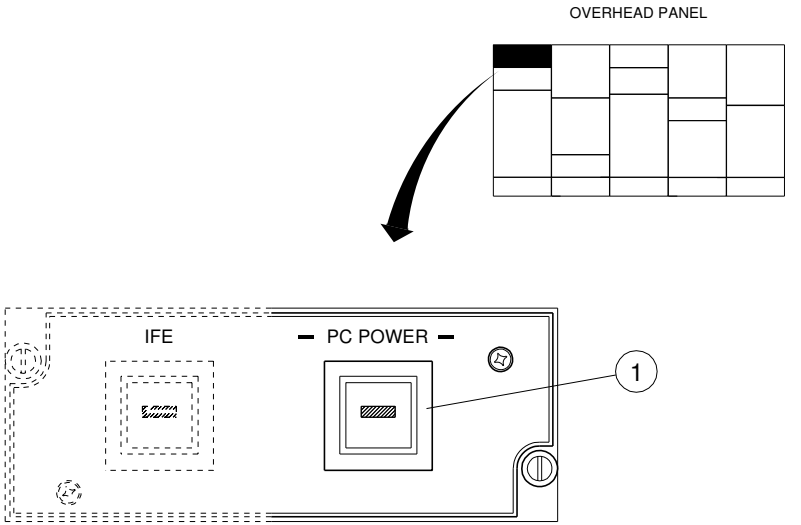
CONTROLS AND INDICATORS

IN-FLIGHT ENTERTAINMENT PANEL

The PC Power System is only activated or deactivated by releasing or pressing the PC Power Button on the IFE Panel.

1 - PC POWER BUTTON

- Enables (pushed in) or disables (pushed out) the power supply to the AC-outlet units.
- A striped bar illuminates in the button to indicate that it is pushed out.



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PC POWER SYSTEM BUTTON ON THE IFE PANEL

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IN-FLIGHT ENTERTAINMENT SYSTEM

The In-Flight Entertainment System provides the passengers with real-time flight information through the Airshow system and video/audio entertainment through a DVD player, a VHS video cassette player and a CD changer.

An In-Flight Entertainment (IFE) control switch on the IFE Panel, installed in the Cockpit Overhead Panel, controls the In-Flight Entertainment System.

The DVD Player and the Video Cassette Player are independent units and both are connected to the Video System Control Unit. These two units are controlled by basic commands such as: play, rewind, forward and stop. A controller selects and controls the Airshow system exhibition mode.

The Video signal is exhibited on 10” monitors and on 6.4” monitors distributed in the passenger cabin. The Video System Control Unit (VSCU) selects the signal, and allows image viewing on the Preview Unit before the selected video signal is distributed to the monitors. The video and audio outputs will be determined by an operator command, from a switch located on the VSCU front panel.

The flight attendant defines the selection, composition and sequence of the video pictures and audio briefing at the time the Air Show is ordered. These can include:

- Geographic Maps of flight routes that show in real time the airplane position, previous flight path and planned route;
- Multi-language location names and interest points on the map;
- Multi-language flight information (e.g., ground speed, altitude, temperature, distance and times);
- Customized graphics, including customized logos and announcements;
- Audio briefings for safety and/or personal announcements.

A discrete signal from the Passenger Address mutes the Airshow Audio during announcements. A discrete signal from the No Smoking and Fasten Seat belts switches in the cockpit causes the Airshow to display an appropriate message.

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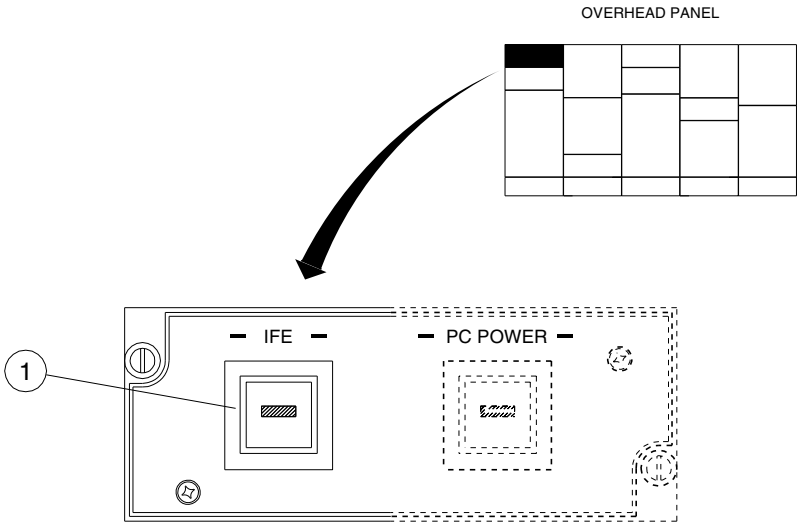
CONTROLS AND INDICATORS

IN-FLIGHT ENTERTAINMENT PANEL

The In-Flight Entertainment System should be activated or deactivated by releasing or pressing the IFE Button on the IFE Panel.

1 - IN-FLIGHT ENTERTAINMENT BUTTON (IFE)

- Enables (pushed in) or disables (pushed out) the power supply to the In-Flight Entertainment System.
- A striped bar illuminates in the button to indicate that it is pushed out.



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IN-FLIGHT ENTERTAINMENT BUTTON ON THE IFE PANE

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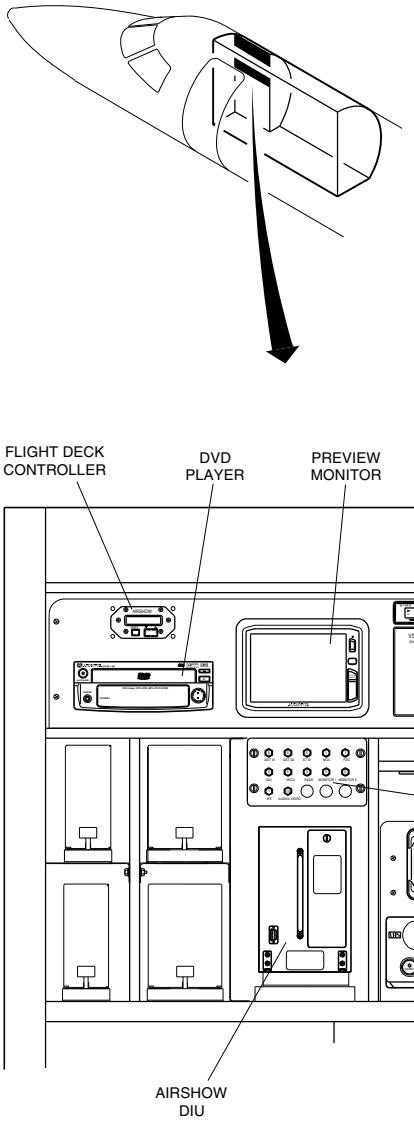

IN-FLIGHT ENTERTAINMENT PANEL

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VIDEO SYSTEM CONTROL UNIT (VSCU)

The VSCU is responsible for collecting Video signals from the DVD Player, Video Cassette Player and Airshow, and Audio signals from the DVD Player, CD Player, Video Cassette Player and Airshow.

1 - VSCU DISPLAY

- Shows the video and audio channels to be selected and displayed on the forward galley preview monitor and heard on the headphone connected to the VSCU Panel headphone jack.

2 - POWER KEY BUTTON

- When pressed, turns on the VSCU.

3 - SELECT RIGHT KEY

- Selects the subsequent channel to be displayed on the preview monitor.

4 - VOLUME UP KEY

- Increases the volume on the headphone.

5 - ENTER KEY

- Selects the video signal that will be displayed on passenger monitors, and which audio signal will be sent to passenger loudspeakers.

6 - HEADPHONE JACK

- To connect a headphone and allow the flight attendant to hear the audio signal associated with the video displayed on the preview monitor.

7 - VOLUME DOWN KEY

- Decreases the volume on the headphone.

8 - SELECT LEFT KEY

- Selects the previous channels to be displayed on the preview monitor

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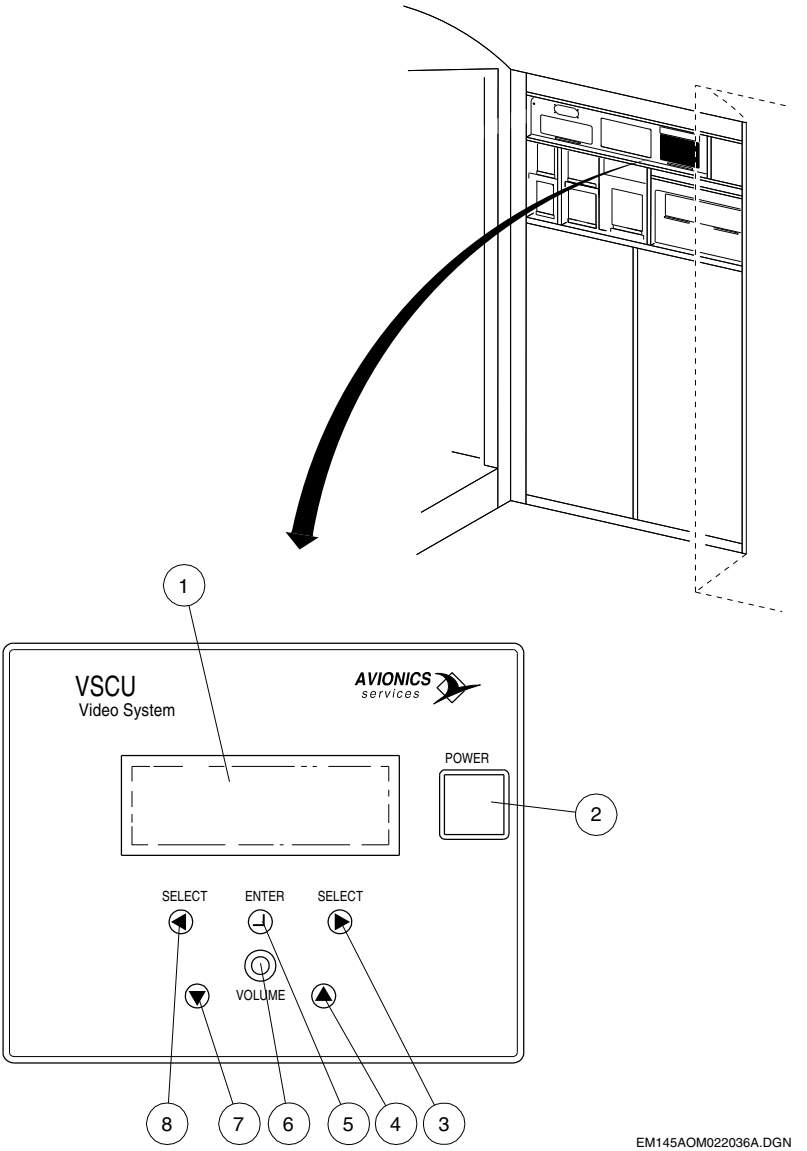

VIDEO SYSTEM CONTROL UNIT PANEL

FLIGHT DECK CONTROLLER PANEL

The Flight Deck Controller is used to monitor and change various customer-requested features in the Airshow Digital Interface Unit, including:

- Time to destination;
- Greenwich Mean Time;
- Destination Airport;
- Mode display;
- Graphic display (multiple logos);
- Languages;
- Audio Briefing/announcements.

When the ground speed reaches 100 knots, the FDC automatically begins to count down the time to destination and displays the time remaining on the Air Show info page.

After the system is powered, to access the cursor control on the main menu, press the “SELECT” button on the Cockpit Controller and the “asterisk” will stop flashing. Use the “SCROLL” knob to scroll up or down the menu. Press “SELECT” to access your choice.

1 - SEL KEY

- When pressed, sets the function pre-selected by the operator through the UP and DOWN selection keys.

2 - UP AND DOWN SELECTION KEY

- Moves up and down the active cursor on the active screen to enable the subsequent selection.

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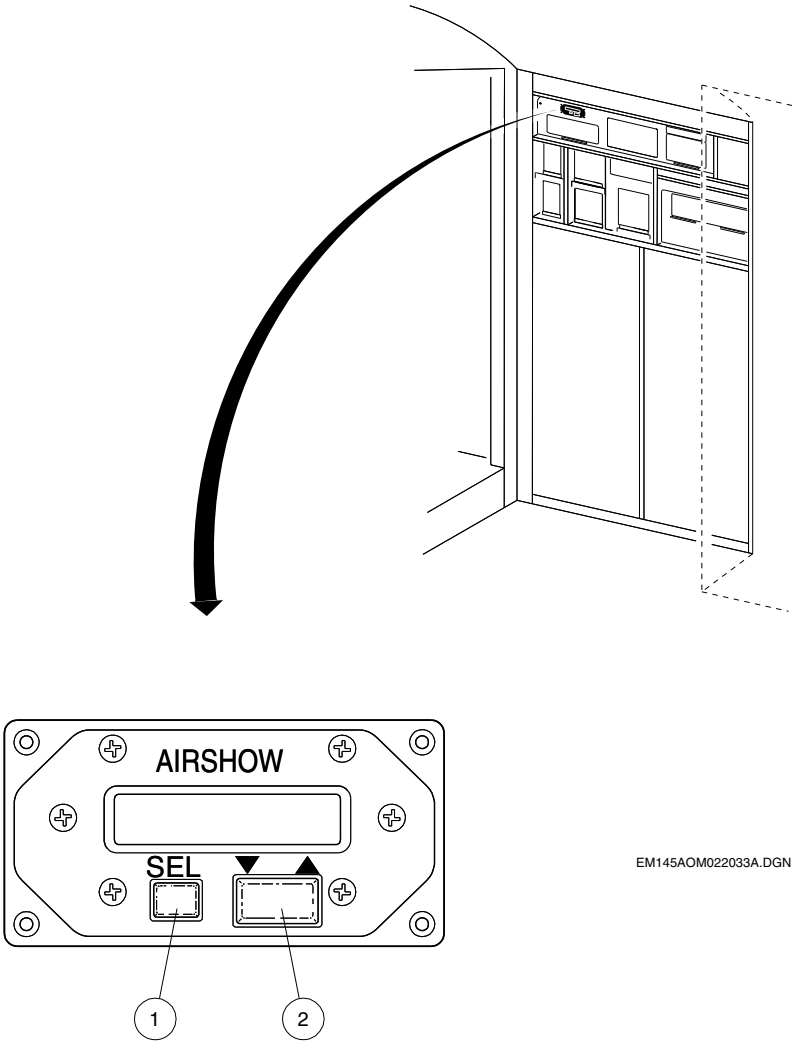

FLIGHT DECK CONTROLLER PANEL

AUDIO SYSTEM

The Audio system provides selectable audio entertainment at each passenger seat location, from three different sources: CD Player, DVD Player and Video Cassette Player. The controls to command the CD Changer are located on the CD Changer Control Unit. The system also provides priority interruption capability that enables a passenger address to simultaneously override all audio channels.

The Audio System has four stereo channels. These four channels are distributed as follows: CD Changer, DVD Player, Video Cassette Player and one channel for Airshow. The Digital Passenger Entertainment Control Unit (DPECU) selects the desired channel.

There is one DPECU installed in the armrest of each passenger seat. The DPECU buttons provide channel selection and volume control. A display indicates the channel selected and it is also used as a status indicator during the self-test. A jack for the passenger's headset is provided to listen to the current passenger selection.

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TELEPHONE SYSTEM

AIR-CELL SYSTEM

The air-cell telephone system is designed to provide air and air/ground telephone connection capability using existing ground based cellphone networks.

There are three telephone lines and four telephone handsets. Three handsets are located in the passenger cabin and one in the cockpit. An additional input/output data port is provided on every handset cradle for a fax machine or other analog device. Only one device can be used at a time (fax or phone).

The telephone handsets located in the cockpit and on the right forward bulkhead cannot be used simultaneously, since they are connected to the same telephone line.

NOTE: The telephone system will be turned off when the In-Flight Entertainment (IFE) Button is pressed.

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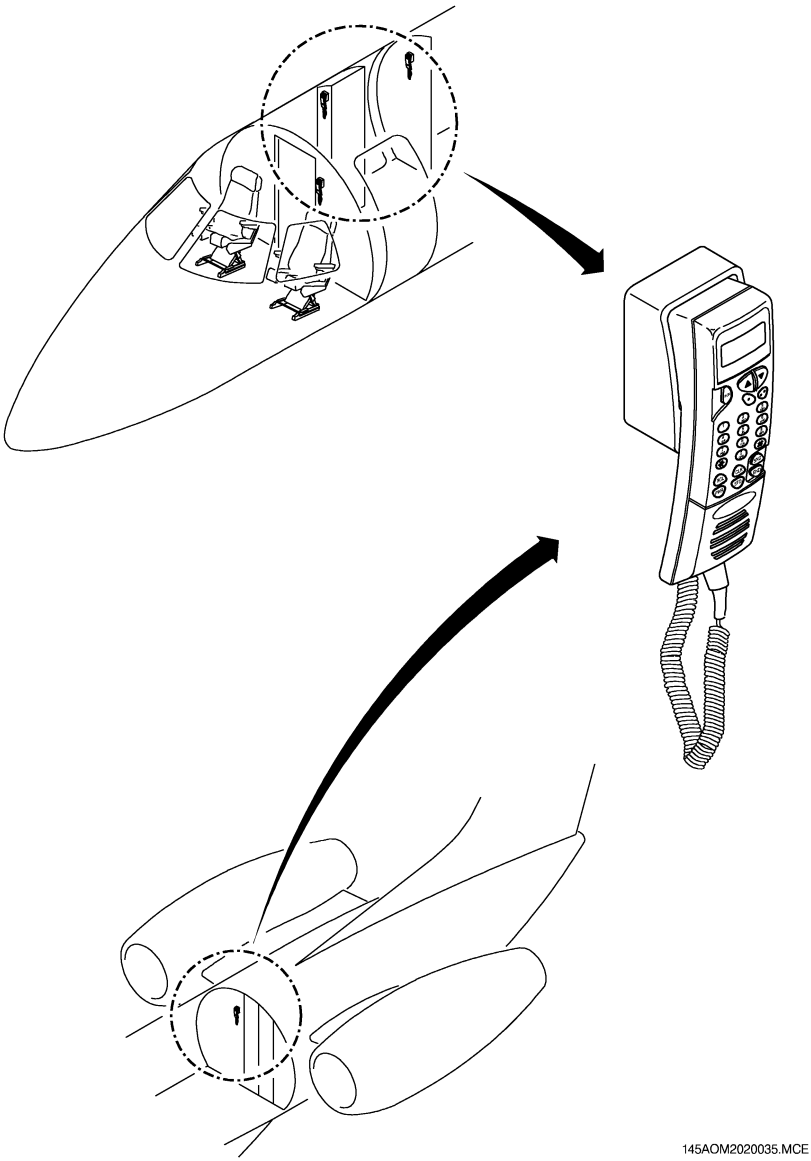

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TELEPHONE HANDSET LOCATIONS

CONTROLS AND INDICATORS

TELEPHONE HANDSET

The handsets provide voice communication control and programming of the system. A handset cradle provides secure storage of the handset when it is not in use. The cradle features a connection for the handset and a standard RJ-11 telephone jack for a fax or modem device.

The operation of the telephone system is similar to a cellphone:
– Press “PWR” to turn the power on or off;
– To place a call, enter the phone number and press “SND”;
– To receive a call, press “SND” or lift the handset and press “SND”;
– To end a call, press “END”.

1 - OPERATING DISPLAY AND STATUS INDICATOR
- Provides a visual indication of telephone numbers and mobile phone service messages.

2 - DOT MARK
- The dot in the lower left corner of the display is illuminated when the phone is on.

3 - IN USE MESSAGE
- Lights when the phone is in use.

4 - NO SRV MESSAGE
- Lights when the telephone is out of service range of an AirCell cell site.

5 - ROAM MESSAGE
- Lights when the unit is in range of an AirCell site that is not in your home system.

6 - ONE TOUCH DIALING KEY
- Calls a phone number stored in the phone memory.

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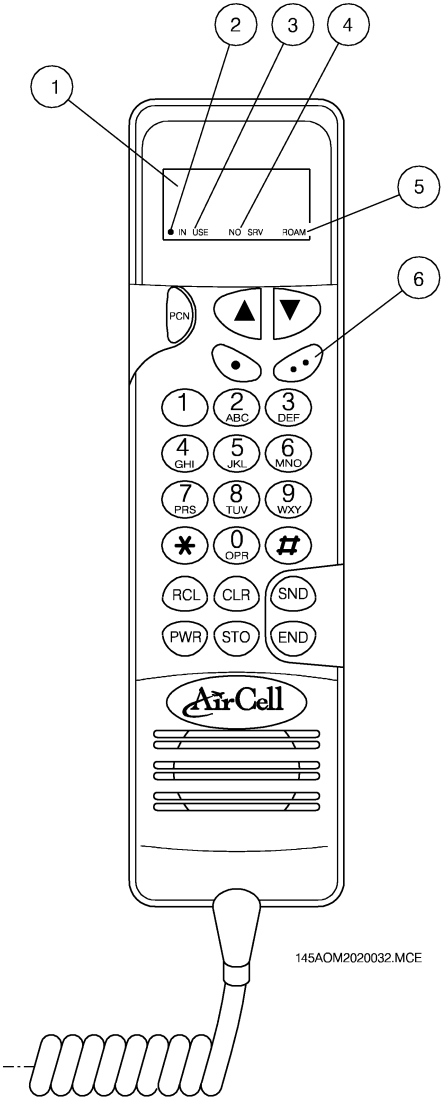

TELEPHONE HANDSET

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TELEPHONE SYSTEM

MAGNASTAR SYSTEM

The MagnaStar™ C-2000 digital airborne telephone system transmits and receives both voice and fax/modem type data to and from the aircraft, using an exclusive cellular-linked technology.

The telephone system has two air-ground voice/fax/data communications channels that can be used simultaneously. The digital airborne telephone system operates over the “GenStar” satellite system, which offers continuous coverage throughout the United States of America, southern section of Canada and most section of Mexico.

The frequency range of operation to transmit is 894 to 896 MHz and to receive is 849 to 851 MHz.

The telephone handsets contain noise-canceling microphones to overcome the aircraft noise environment, and the audio is digitized at the handset to further ensure clear communication. Special function keys and a liquid crystal display (LCD) allow easy use of all options. The handset has an adjustable audio volume, telephone call styles, and selects various options. The LCD display presents useful information and menu style selections.

There is a fax machine with fax/scanner/printer and copier functions installed in the credenza.

The operation of the telephone system is similar to a cellular phone. When in normal operation, the handset works as a normal telephone. To place a call, it is necessary to pick up the handset and dial the desired phone number with all prefix and country codes.

The figure on the next page presents the telephone handset and fax locations.

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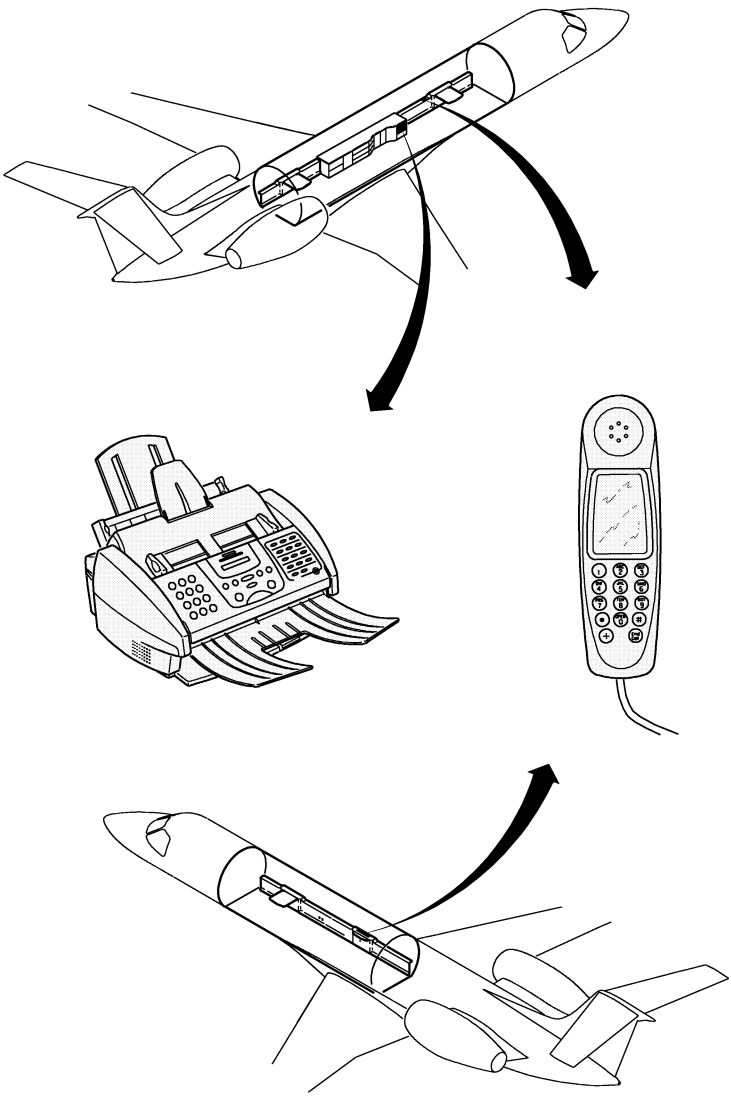

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TELEPHONE HANDSET AND FAX LOCATIONS

COCKPIT SECURITY DOOR

The Cockpit Security Door is a bullet proof reinforced door that isolates the cockpit from the cabin passengers, avoiding non authorized people to enter in the cockpit.

In addition, the intrusion resistant cockpit door system has been shown to comply with all other applicable regulations, including but not limited to:

– Static strength,
– Rapid decompression,
– Smoke evacuation and penetration,
– Required airflow, and
– Emergency ingress and egress.

Components of the intrusion resistant cockpit door system include:

– Cockpit door latch/striker/handle,
– Mechanical deadbolt,
– View Lens,
– Decompression Panel, and
– Decompression Latch.

NOTE: - The security cockpit door must be kept closed and locked at all times during flight except to permit access and egress according to the operator's procedures for opening, closing and locking the door.

- Two crewmembers must be in the cockpit during all flight phases. If one of the pilots leaves the flight deck, he must be replaced in the cockpit by another crewmember.

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DOOR DESCRIPTION

1. FIXED VENTING LOUVER

The fixed venting louver has movable horizontal slats for admitting air to the cockpit. The vent cover should normally be open. In smoke conditions, to close the louver vent, push the two spring clips through the vent holes and carefully pull the sliding panel away from the vent and slide the panel up to the closed position.

2. DEADBOLT ASSEMBLY

Deadbolt assembly has three positions.

– UNLOCKED position: Deadbolt is unlocked.
– LOCKED KEY OPERABLE position: Deadbolt is locked and it can be unlocked with maintenance deadbolt key. This position must be used only on ground by maintenance personnel.
– LOCKED KEY INOPERABLE position: Used by pilots to lock the door only if the main door slide latch is inoperative.

3. MAIN DOOR SLIDE LATCH

LOCKED position: Main door slide latch is locked.
UNLOCKED position: Main door slide latch is unlocked.

NOTE: If the slide latch is inoperative then pilots must lock the deadbolt at LOCKED KEY INOPERABLE position.

4. TOP STRAP ASSEMBLY

Top strap assembly is used only in case of emergency exit procedure. Pulling the top strap will disengage the pins.

NOTE: The pins must be fully engaged at all times to avoid intrusion through emergency exit.

5. BOTTOM STRAP ASSEMBLY

Bottom strap assembly is used only in case of emergency exit procedure.

6. PRESSURE SENSITIVE LATCH COVER

It covers the pressure sensitive latch and must be removed in an emergency exit procedure.

7. PRESSURE SENSITIVE LATCH

Pressure sensitive latch is partially and automatically released when the cockpit pressure is lower than the passengers cabin pressure.

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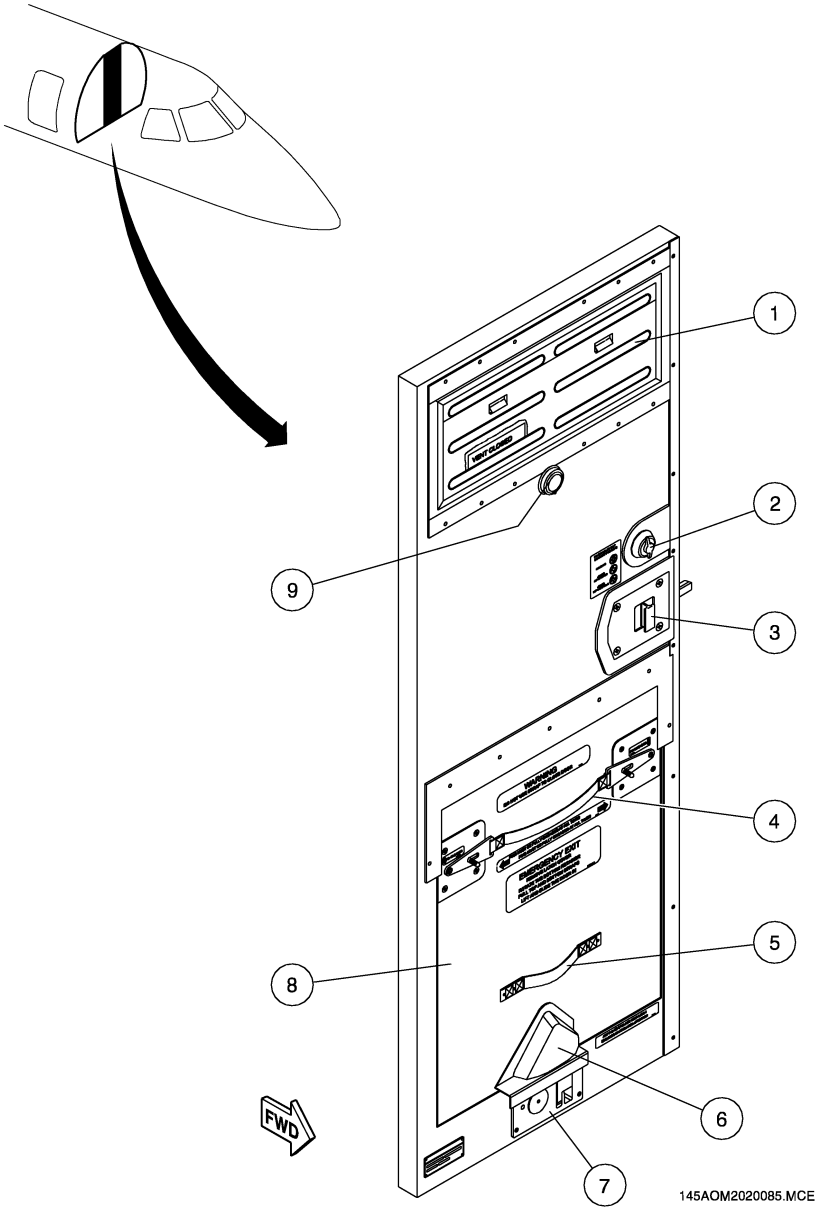

SECURITY DOOR

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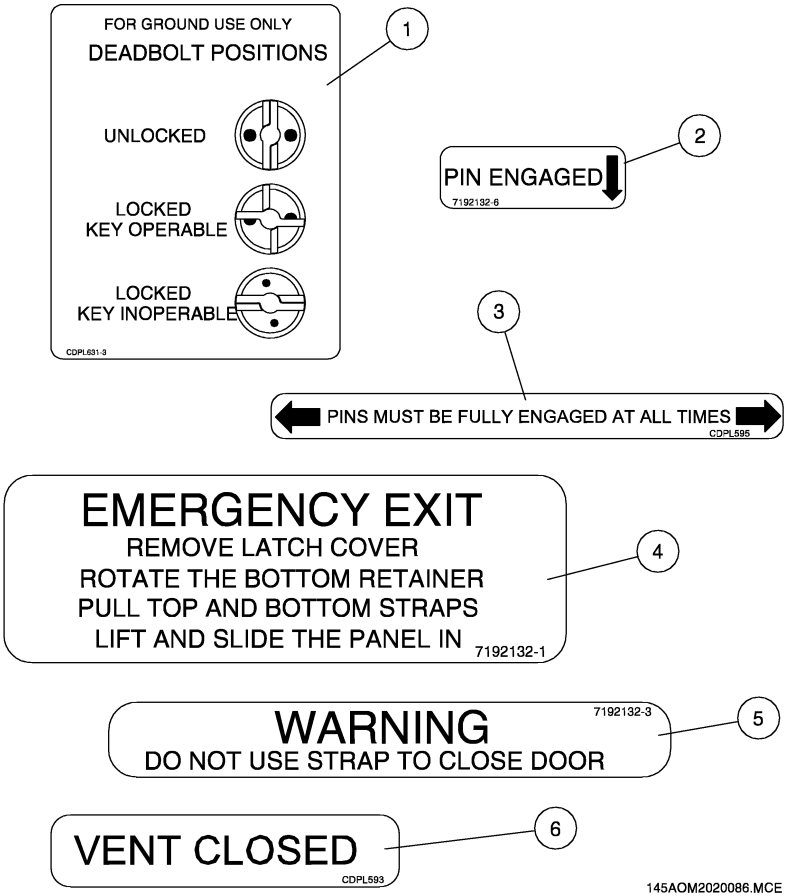
8. DECOMPRESSION PANEL

It is a blow out panel that is partially opened when the pressure sensitive latch is automatically released may be used as a cockpit emergency exit.

9. PEEPHOLE

Peephole allows crew members to observe passengers cabin side before open the door.

SECURITY DOOR PLACARDS



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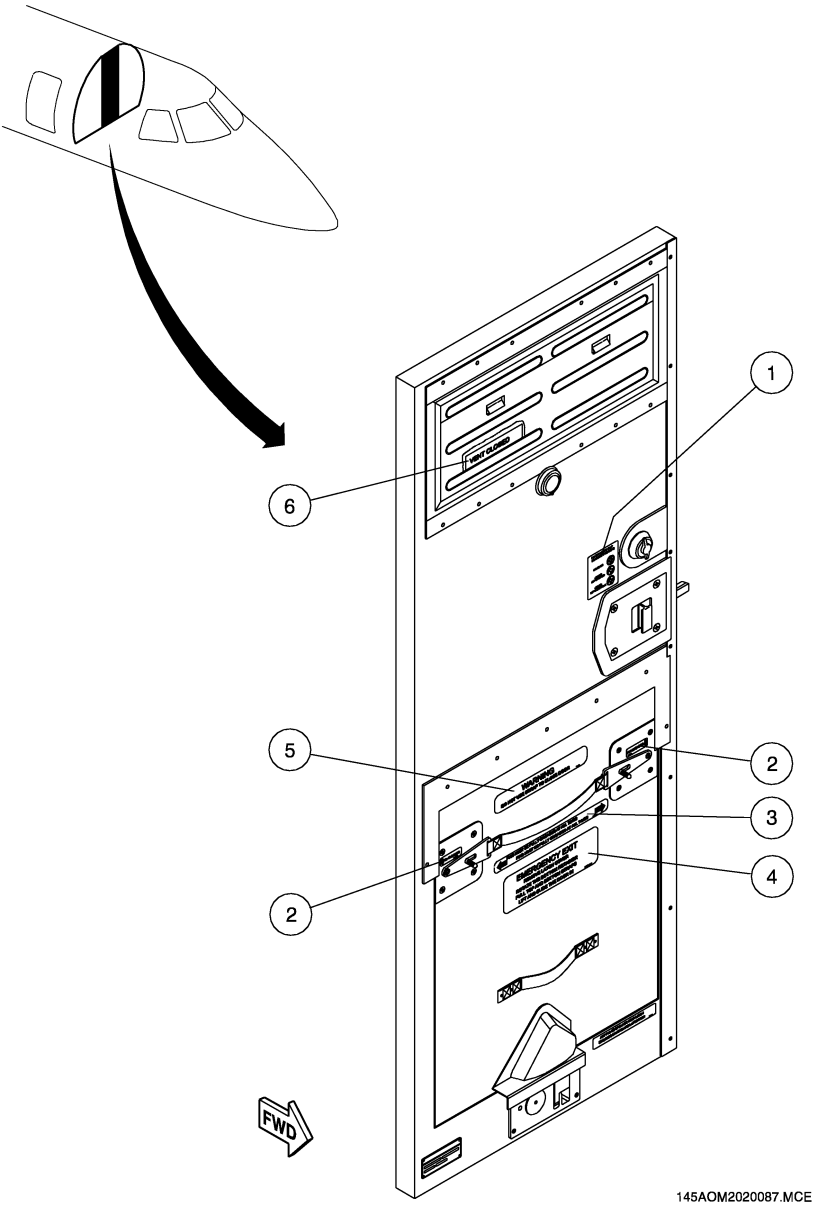

SECURITY DOOR PLACARDS

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VIDEO SURVEILLANCE SYSTEM (VSS)

GENERAL

The Video Surveillance System (VSS) provides the means to monitor the entire door area outside the cockpit from either pilot's seats. It aids the flight crew with the identification of persons requesting entry to the cockpit and the detection of suspicious behavior or a potential threat.
The VSS is comprised of three video cameras and one video unit, installed in the control pedestal. The DC BUS 1 powers the VSS.

VIDEO UNIT

Video display is achievable under all operational lighting conditions and provides sufficient resolution to clearly identify persons requesting entry into the cockpit. The images transmitted to the video display are not recorded.
The system is turned on by switching the BRT/OFF knob on the VSS video unit. The other knob selects the video camera that will transmit the image.

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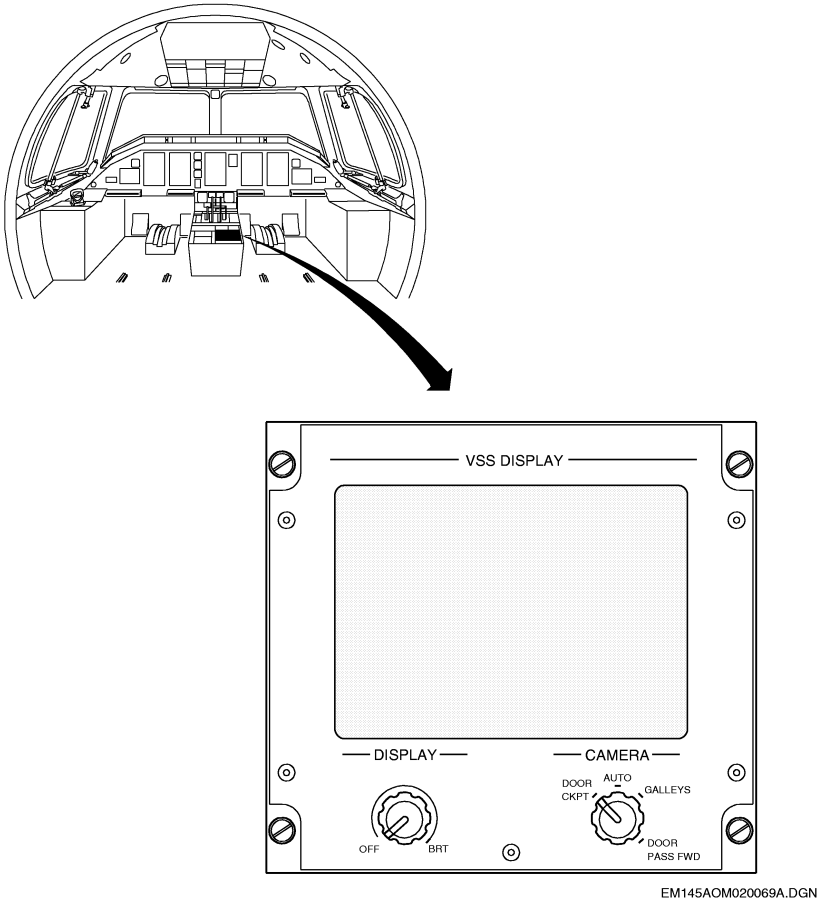

VSS VIDEO UNIT

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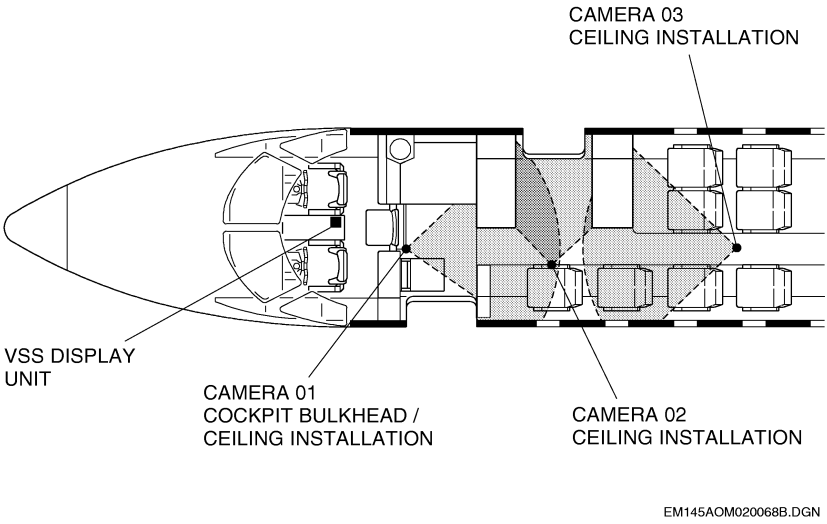
VIDEO CAMERAS

One video camera provides images of the cockpit door area. A second video camera covers the galleys area, and a third video camera furnishes images of the forward pax doors area. The passenger seats area are not monitored.



VSS VIDEO CAMERAS LOCATION

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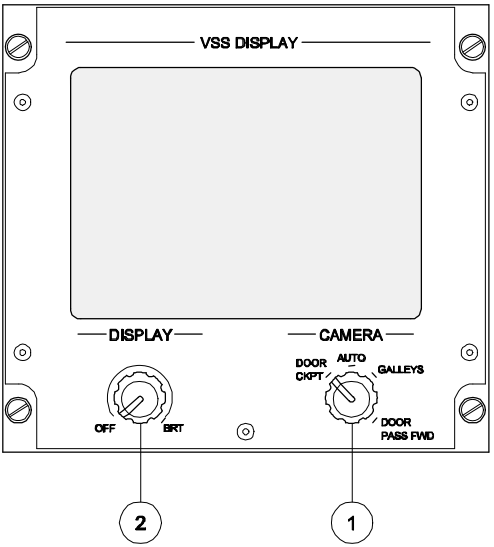
CONTROLS AND INDICATORS

VIDEO SURVEILLANCE SYSTEM (VSS)



1 – VIDEO CAMERA SELECTOR KNOB

- DOOR CKPT: furnishes images of cockpit door area.
- AUTO: automatically switches the image from one video camera to another with an interval of 3 seconds.
- GALLEYS: furnishes images of the galleys area.
- DOOR PAX FWD: furnishes images of the forward pax doors area.

2 – OFF/BRIGHT SELECTOR KNOB

- OFF: turns off the VSS.
- BRT: turns on the VSS and adjusts the brightness intensity.

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LAVATORY DOOR

When the lavatory door becomes jammed or hard to open, the procedures that should followed by the cabin crew to open it from outside the lavatory can be:

– **Using the slide latch:**

Under the LAVATORY placard, which is located on the lavatory door just above the “OCCUPIED/VACANT” display, there is an alternative mechanism to unlock the door in case of difficulty to open it from inside the lavatory.

To unlock the door, the Flight Attendant must lift this placard and, holding the placard lifted, slide the latch to the left position, until the display inscription changes from “OCCUPIED” to “VACANT” (see figure on the next page). Then, the door should be opened normally.

This mechanism is the same for both Slide and Bi-fold doors.

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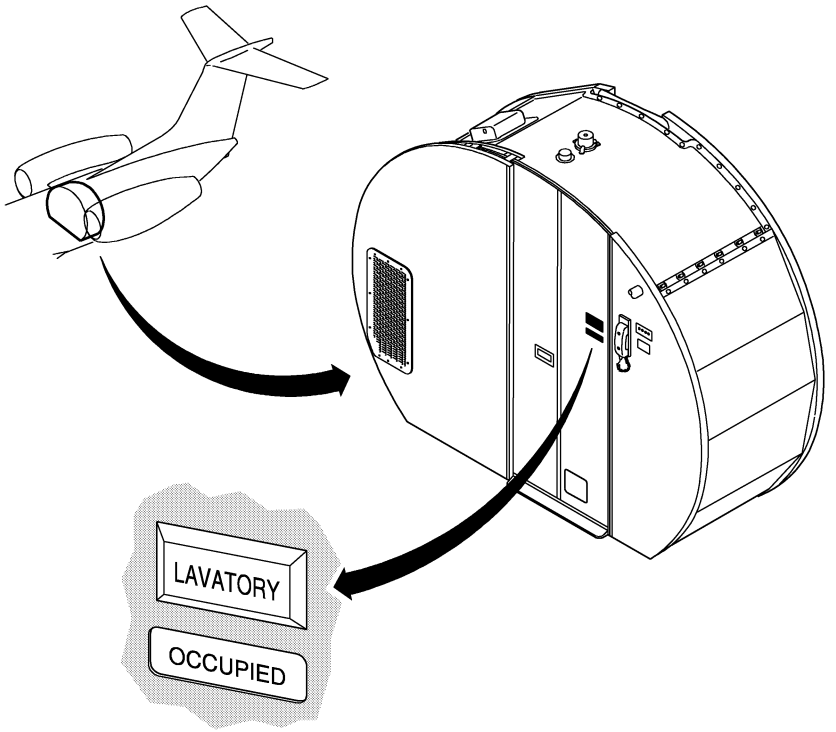

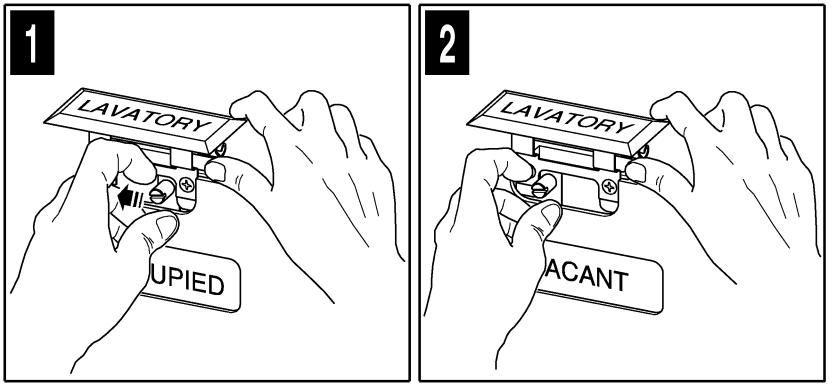

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SLIDE LATCH

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– **Using the cut-out access:**

For airplanes Post-Mod. SB 145-25-0287 (Slide Door) or Post-Mod. SB 145-25-0302 (Bi-fold Door) or equipped with an equivalent modification factory incorporated, there is an access box that can be used to unlock the door from outside the Lavatory.

To unlock the door, the flight attendant must remove the cover and move the rod upward and downward repeatedly.

In case of difficulty to move the rod, the flight attendant should hold the lavatory handle and move the door up and down or side to side with quick short movements, at the same time that moves the rod up and downward repeatedly until the door is unlocked (see figures on the next pages).

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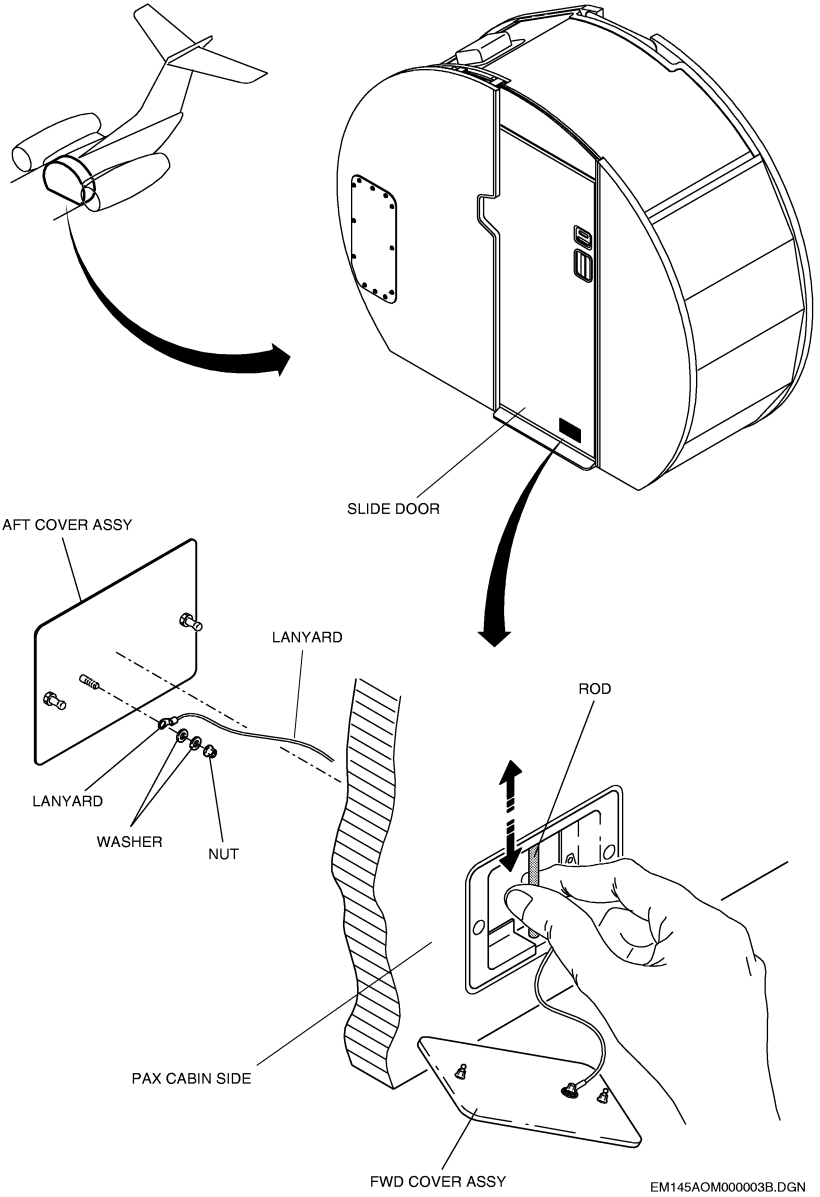

LAVATORY SLIDE DOOR (POST-MOD. SB 145-25-0287)

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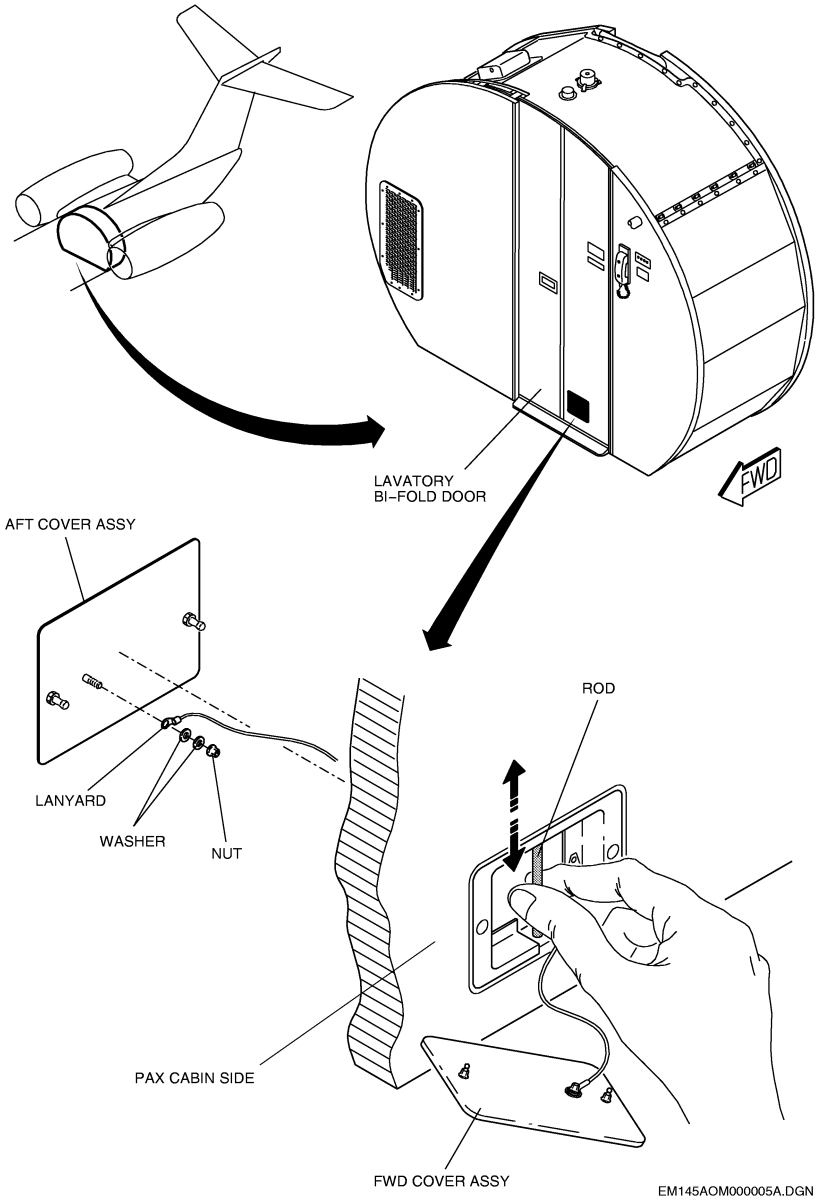

LAVATORY BIFOLD DOOR (POST-MOD. SB 145-25-0302)

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SECTION 2-03
EMERGENCY EQUIPMENT

This section has been removed from this volume. For emergency information, refer to Section 1-10 in Volume 1.

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SECTION 2-04
CREW AWARENESS

TABLE OF CONTENTS

	Block	Page
Index	2-04-00	01
General	2-04-05	01
Avionics Integration	2-04-05	01
Displays	2-04-05	06
EICAS Messages	2-04-05	18
Controls and Indicators	2-04-05	20
Built-in Test	2-04-05	29
Visual Warnings	2-04-10	01
Warning Lights	2-04-10	01
EICAS Messages	2-04-10	02
EICAS Message Dictionary	2-04-10	03
Displays Indications	2-04-10	10
Controls and Indicators	2-04-10	11
PFD Presentations	2-04-13	01
Comparison Monitors	2-04-13	01
Caution Annunciators	2-04-13	04
Warning Annunciators	2-04-13	08
PFD Additional Annunciators	2-04-13	10
Aural Warnings	2-04-15	01
Aural Warning Unit	2-04-15	01
EICAS Message	2-04-15	06
Takeoff Configuration Warning	2-04-20	01
EICAS Message	2-04-20	01
Controls and Indicators	2-04-20	02
Stall Protection System	2-04-25	01
General	2-04-25	01
EICAS Messages	2-04-25	04
Controls and Indicators	2-04-25	05

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Ground Proximity Warning System ..... 2-04-30 ...01
Modes and Messages ..... 2-04-30 ...06
EGPWS Features ..... 2-04-30 ...26
Warning Priorities ..... 2-04-30 ...36
EICAS Messages ..... 2-04-30 ...37
Controls and Indicators ..... 2-04-30 ...38
Steep Approach Operation ..... 2-04-30 ...43
Windshear Detection and Escape Guidance System ..... 2-04-35 ...01
Windshear General Information ..... 2-04-35 ...01
Windshear Detection ..... 2-04-35 ...04
Windshear Escape Guidance Mode ..... 2-04-35 ...06
EICAS Message ..... 2-04-35 ...10
Controls and Indicators ..... 2-04-35 ...10
Traffic and Collision Avoidance System ..... 2-04-40 ...01
General ..... 2-04-40 ...01
System Description ..... 2-04-40 ...02
TCAS Voice Messages ..... 2-04-40 ...08
Controls and Indicators ..... 2-04-40 ...10
TCAS Test ..... 2-04-40 ...15

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GENERAL

The EMB-145 is provided with a variety of visual, aural, and sensitive warnings to notify crew regarding systems status, malfunctions, and abnormal airplane configurations.

Alarm lights provide indication whether there is an abnormal situation. Some systems also provide indicating lights, for system status indication.

An Engine Indication and Crew Alerting System (EICAS) provides the flight crew with a three-level alerting and indications messages system: warning, caution and advisory. A fourth level is provided exclusively for maintenance purposes. Besides the five displays on the main panel, two back up displays are provided through the RMUs (Radio Management Unit). Some of the more critical messages also generate an aural warning.

Sensitive warning is available through the Stall Protection System (SPS), which shakes the control column, if an imminent stall is detected.

To aid in navigation and approach procedures, the airplane is also provided with a Ground Proximity Warning System (GPWS/EGPWS), a Traffic and Collision Avoidance System (TCAS), and a Windshear Detection and Escape Guidance System.

AVIONICS INTEGRATION

The EMB-145 is equipped with a variety of highly integrated computers and displays, so as to reduce pilots workload while providing high reliability and redundancy. This feature is achieved by providing different paths to each type of data, thus minimizing the possibility of losing information due to failure in one computer.

The system is composed of:
- Two Integrated Computers (IC-600);
- Two Integrated Computer Configuration Modules (IM-600) (If installed);
- Two Data Acquisition Units (DAU);
- One Central Maintenance Computer (CMC);
- One Horizontal Stabilizer Control Unit (HSCU);
- Two Primary Flight Displays (PFD), two Multi-Function Display (MFD) and one Engine Indications and Crew Alerting System (EICAS) display;
- Two Radio Management Units (RMU);

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– One Tuning Backup Control Head;
– Independent Standby Instruments or one Integrated Standby Instruments System (ISIS);
– Two Integrated Navigation Computers;
– Two Integrated Communication Computers;
– Three Digital Audio Panels (DAP);
– Two Attitude and Heading Reference System (AHRS) or Two Inertial Reference System (IRS);
– Two Air Data Computers (ADC);
– One Ground Proximity Warning System (GPWS) or Enhanced Ground Proximity Warning System (EGPWS);
– One Aural Warning Unit (AWU);
– One Cockpit Voice Recorder (CVR);
– One Flight Data Recorder System (FDR);
– One or two Flight Management Systems (FMS);
– One Traffic and Collision Avoidance System (TCAS);
– One Radar System;
– One Stall Protection System (SPS).

The primary components of such integration are the IC-600 units, which exchange information with all the other components, either directly or through auxiliary computers. The IC-600s are responsible for the interface among the many airplane systems, besides managing information presented on the displays. Each IC-600 computes the received data and sends the appropriate information to the displays.

The DAUs are the central data collection points for the EICAS. DAU 1 is dedicated to collect data from the forward airplane systems and left engine. DAU 2 collects data from the aft airplane systems and right engine. Engine data is sent to the DAUs through the FADECs and directly from the engine sensors.
The discrete signals collected by the DAUs are converted into digital signals and sent to the Integrated Computer (IC-600). In the IC 600 there is a symbol generator which provides images to Display Units.
Each DAU is a dual (A and B) channel unit. Channels B on both DAUs are kept as a standby source, which must be manually selected, through the DAU reversionary button in case of a channel A DAU failure. Both IC-600s use channel A of on-side DAU as the primary source of information.

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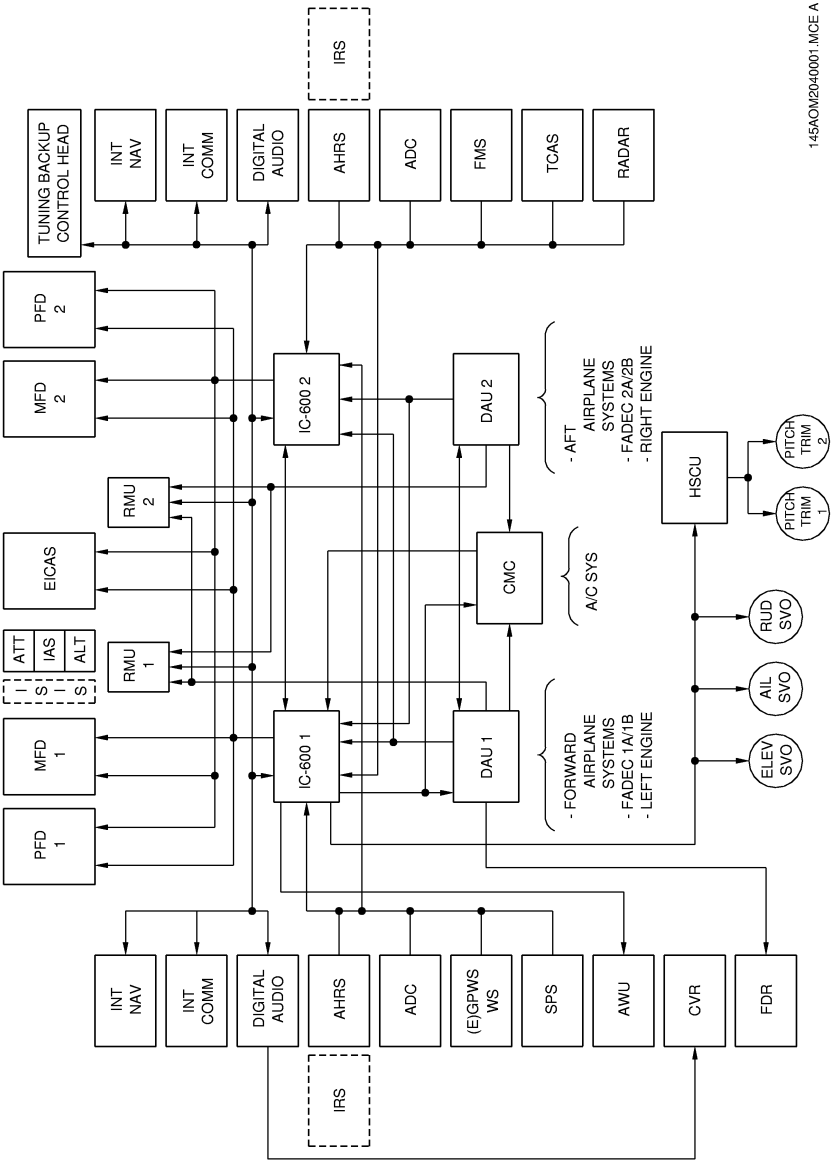

AVIONICS INTEGRATION SCHEMATIC

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During normal operation, information contained on PFD 1, MFD 1 and EICAS displays is provided by IC 600 # 1, while IC 600 # 2 provides images for MFD 2 and PFD 2.
Both computers interact with each other and send outputs to the Aural Warning unit to generate a tone indicating a caution or warning message when there is an abnormal situation.

If IC 600 # 1 fails, RMU # 1 displays engine backup page 1 automatically and a red X is presented on displays PFD 1, MFD 1 and EICAS. After the IC 600 # 1 failure, IC 600 # 2 can control the five displays if the Symbol Generator ("SG") button on the left reversionary panel is pressed. In this case, RMU # 1 goes back to the normal mode.

If IC 600 # 2 fails, a red X is displayed on PFD 2 and MFD 2. After the IC 600 # 2 failure, IC 600 # 1 can control the five displays if the Symbol Generator ("SG") button on the right reversionary panel is pressed. RMU # 1 remains operating normally.

If both ICs fail, besides all displays presenting a red X, RMU # 1 automatically displays engine backup page 1.

Usually, airplane configuration options are set on IC-600 through straps. If the number of installed options exceeds the maximum adjustable through the IC-600 wiring, a configuration module (IM-600) is installed. IM-600 can be installed only on airplanes equipped with EICAS 16 or later. It stores information for several airplane configurations.

On EICAS 16, an advisory CONFIG MISMATCH message appears if there is a discrepancy between the configuration information of both IM-600s in relation to both IC-600s.

On EICAS 16.5 or later, an amber CHK IC CONFIG message appears in case of discrepancy between the following data: EMB-135 or EMB 145 models, engine type, Long Range configuration, or English/Metric units. The CONFIG MISMATCH message is also active in case of discrepancy of the other parameters that do not trigger off the CHK IC CONFIG message .

On EICAS 19, the message DAU AC ID MISCMP was incorporated to inform a mismatch between the DAU 1 and DAU 2 configuration inputs regarding airplane type.

If a IM-600 failure occurs, the IC-600 will use the last data read from that source (when it was still working), and an advisory IC CONFIG FAIL message will appear.

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DISPLAYS

Five Cathode Ray Tube (CRT) displays are provided to present information to the flight crew, as follows:

- Two Primary Flight Displays (PFD) on the pilot and copilot panel.
- Two Multi-Function Displays (MFD) on the pilot and copilot panel.
- One EICAS display on the center panel.

In addition, the Radio Management Unit (RMU) displays on the control pedestal forward panel may be used as a back-up for the main panel displays.

The displays themselves are identical and interchangeable. The control panel installed just below each display, except for the RMUs, allows controlling some of the associated display features.

In case of failure of one display, its information may be presented in one of the remaining operative displays.

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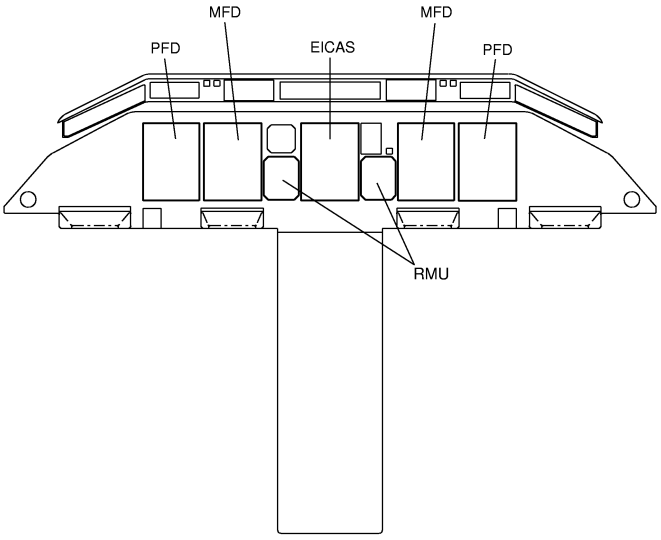

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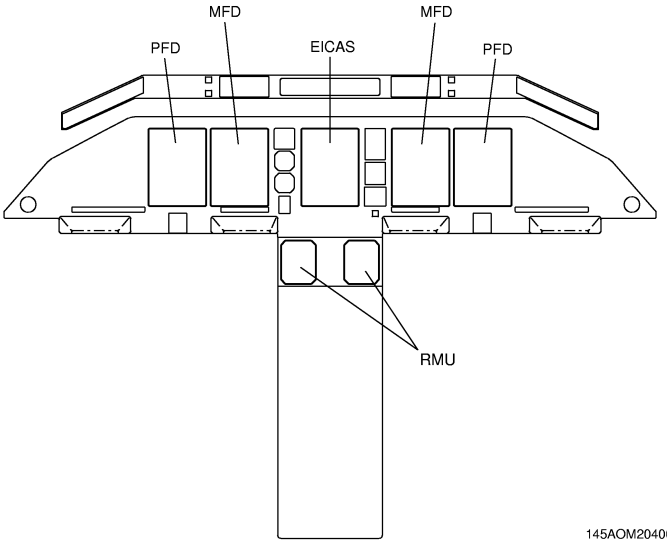

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AIRPLANE DISPLAYS

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PRIMARY FLIGHT DISPLAY (PFD)

The PFD is the primary pilots instrument. It presents the information formerly presented in a variety of instruments such as airspeed indicator, altitude indicator, ADI, HSI, vertical speed indicator. The PFD further provides radio aids, autopilot, flight director, yaw damper and radio altitude information. For further information on these parameters, refer to Sections 2-17 – Flight Instruments, 2-18 – Navigation and Communication, and 2-19 – Autopilot.

The PFD is divided into sections, each one presenting one group of information.

The PFD bezel incorporates an inclinometer, buttons and a knob for barometric settings.

In case of a display failure, information may be presented on the MFD by appropriately setting the MFD selector knob on the reversionary panel.

The RMU is also able to present PFD information (refer to Section 2-18 - Navigation and Communication for further details about this feature).

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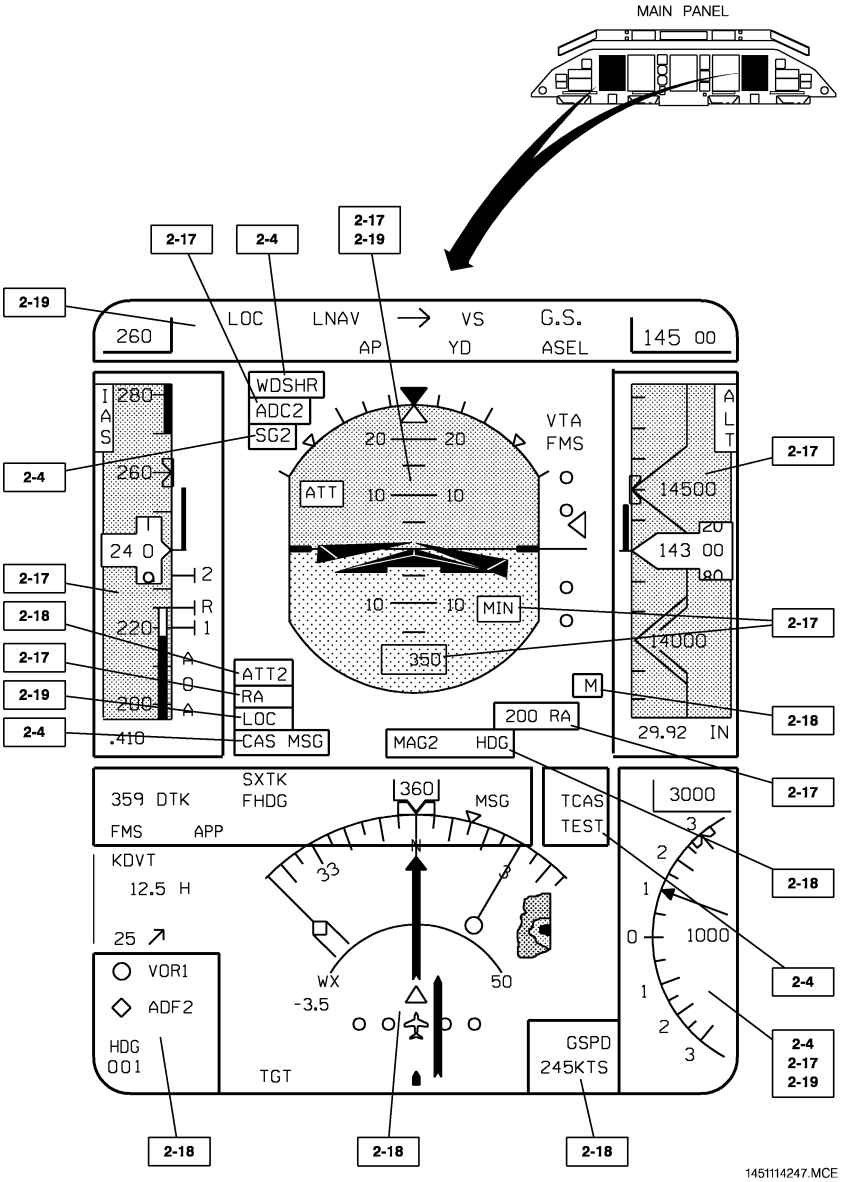

NOTE: Number inside boxes refer to Operations Manual Section where information concerning the associated item can be found.

PFD DISPLAY SCHEMATIC

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MULTI FUNCTION DISPLAY (MFD)

The Multi Function Display (MFD) presents radar, TCAS, FMS, CMC and other navigation information and systems pages. There are five system pages available:

- Fuel: provides fuel system parameters and status.
- Electrical: provides electrical system parameters and status.
- Environmental and Ice Protection: provides air conditioning, pneumatics, oxygen, and ice and rain protection systems parameters and status.
- Hydraulic and Brakes: provides hydraulic and brakes systems and status.
- Takeoff: provides takeoff temperature settings, oil level and doors status.

For further information on system pages, refer to each associated system description.

The MFD may operate in three different presentation modes, besides the reversionary ones. The Map and Plan modes present navigation information. For further information on these, refer to Section 2-18 - Navigation and Communication. The maintenance mode permits access to maintenance messages, but is available only on the left MFD for maintenance personnel when the airplane is on ground.

Selection of the different modes and pages may be made by using the controls located on the display bezel. Button functions are indicated in the menus presented in the lower part of the display, just above each button. Each button function changes, depending on which menu has been selected. Menu selection is made by using the buttons themselves. If required, radar modes and TCAS information may be shown.

The MFD also operates as a back-up display for either PFD or EICAS, in case of such displays failure. Appropriate selections may be made through the reversionary panel.

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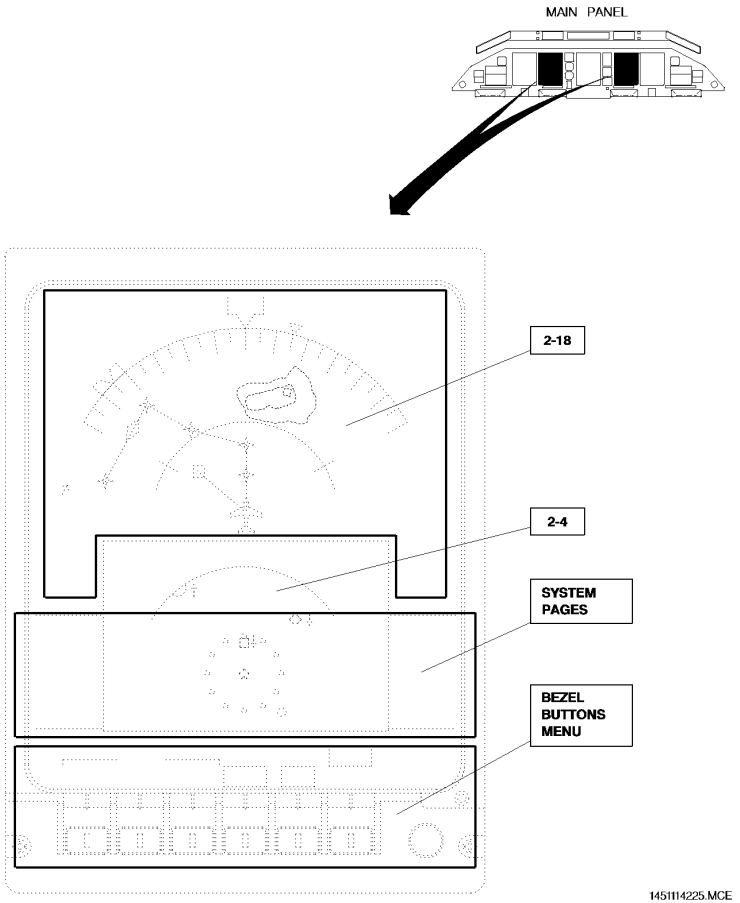

NOTE: Number inside boxes refer to Operations Manual Section where information concerning the associated item can be found.

MFD DISPLAY SCHEMATIC

EICAS DISPLAY

The EICAS display presents analogic engine indications and some systems parameters like flaps, landing gear, spoilers and trim positions, total fuel quantity, APU and environmental information.

In the upper right corner, the EICAS display presents crew awareness messages:

- Warning messages, red colored and always presented on the top of the list.
- Caution messages, amber colored and presented after warning messages.
- Advisory messages, cyan colored and presented after caution messages.

For further information on engine indications presented in the upper left corner, refer to Section 2-10 – Powerplant. For information on EICAS Messages, refer to the item Visual Warnings (Section 2-04-10).

In case of failure in the EICAS display, its information may be presented on the MFD, by appropriately setting the MFD selector knob on the reversionary panel. The RMU is also capable of presenting some EICAS information, should the need arise.

The EICAS bezel is provided with a knob to scroll messages if the system generates more messages than the display can present at once.

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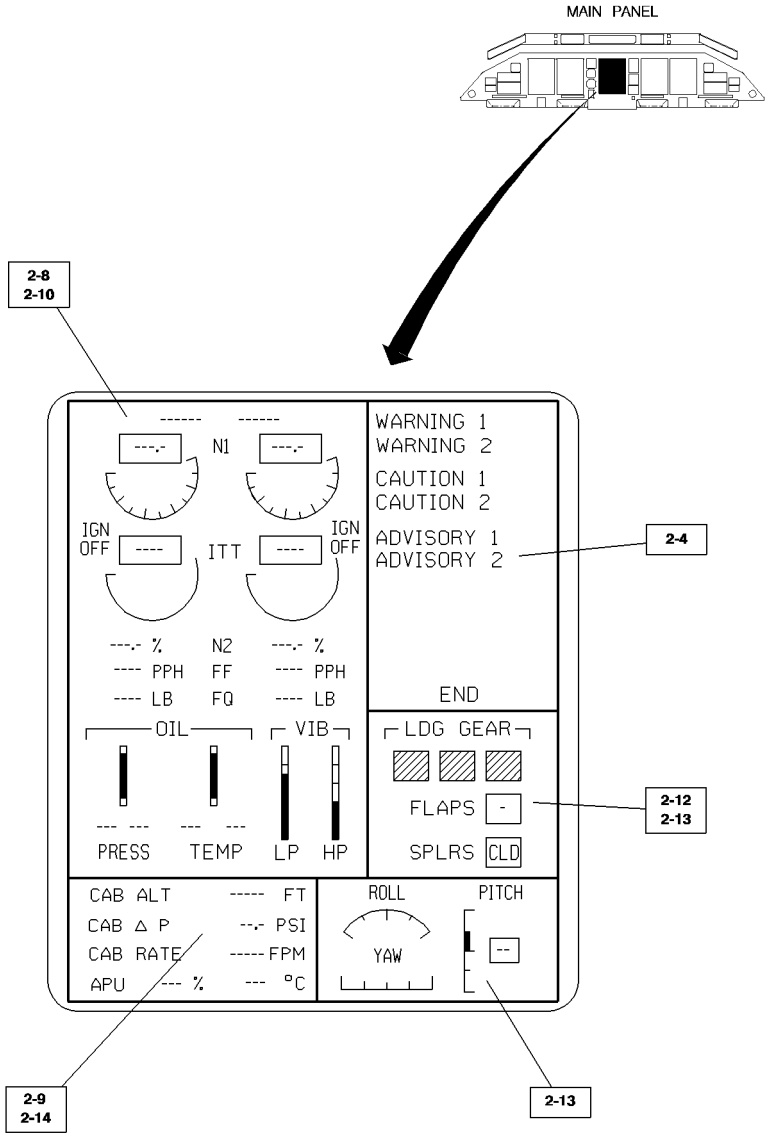

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NOTE: Number inside boxes refer to Operations Manual Section where information concerning associated item can be found.

EICAS DISPLAY SCHEMATIC

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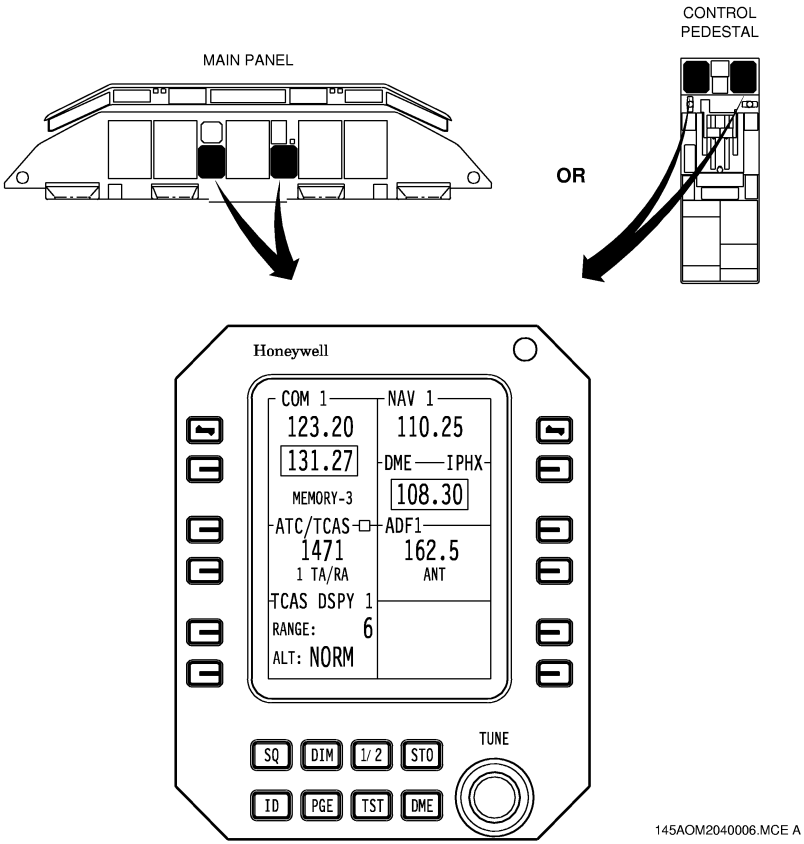
RADIO MANAGEMENT UNIT

The Radio Management Unit (RMU) is provided for radio controlling purposes, but may be used as a back-up for PFDs, MFDs and EICAS. The RMU display presents settings and modes for each radio (NAV and COMM), transponder, and TCAS. In case of failure of the main panel displays, the RMU may be selected to present navigation, engine or systems information, as well as some EICAS messages. The information presentation however may change, due to the size of the RMU display. Also, some items of information may not be presented to avoid display overload. For further information on RMU features, refer to Section 2-18 – Navigation and Communication.



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RMU DISPLAY EXAMPLE

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NORMAL OPERATION

When the airplane is first energized, the system performs a self-test to check abnormal conditions in the displays.

On power up, the displays default information are the following:

- PFD: presents EADI, EHSI, airspeed, altitude, radio altitude, vertical speed scales, flight director mode, autopilot and yaw damper status.
- MFD: presents takeoff page, system menu and navigation data in Map format. This information is supplied as follows:
  - MFD 1: supplied by channel A of both DAUs through IC-600 # 1.
  - MFD 2: supplied by channel A of both DAUs through IC-600 # 2.
- EICAS: presents engine and fuel indications, crew awareness messages (if any), landing gear, flaps, spoilers, pressurization, APU and trims status. This information is supplied by channel A of both DAUs through IC-600 # 1.

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FAILURE MODES

The system is developed to avoid absence of information in most of the failure combinations.

The failures that may affect the crew awareness system are associated with electrical power supply or computer malfunctions. In both cases, the system architecture is such that only major failures will lead to loss of information presentation. Even in this condition, crew will still have essential data available to safely continue the flight, using standby instruments.

ELECTRICAL SYSTEM FAILURES

Each display is supplied in such a way that in case of failure in one or more electric buses, the remaining buses will still be supplying one or more displays.
This feature is achieved by supplying all displays with four different buses (two DC Buses and two Essential buses). Furthermore, each pair of duplicated displays (PFDs, MFDs, and RMUs) are supplied by different buses, one for each display.

COMPUTER FAILURES

Since both IC-600s receive data from duplicated sources, a single failure will not lead to loss of information addressed to the flight crew. In case of any source failure, the reversionary panel permits shifting between existing sources, thus using cross side information. This feature may be used only when the system is not capable of providing information through normal means.

DISPLAYS FAILURES

In case of any failure in the PFD or EICAS displays, the corresponding information may be presented in one of the remaining displays, by using the reversionary panel. The MFD may present other display information, but its data may not be presented in the remaining displays.

If all displays are lost, the RMU is capable of providing essential flight data.

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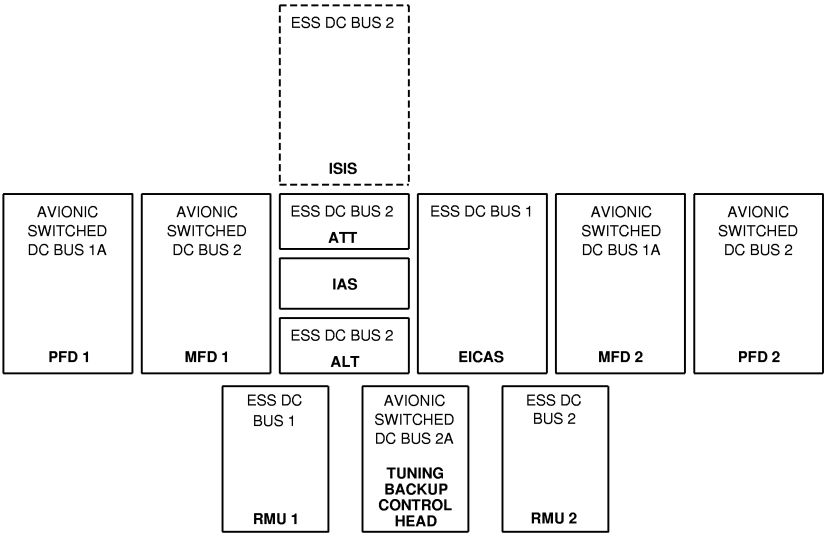

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DISPLAYS SUPPLYING SCHEMATIC

EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	DAU 1 (2) ENG MISCOMP	N1, N2, ITT engine parameters read from both engines are not matching.
	DAU 1 (2) SYS MISCOMP	Systems parameters for system pages generation are not matching.
	DAU 1 (2) WRN MISCOMP	Discrete signals for warning messages generation read from the many systems are not matching.
	DAU 1 (2) A FAIL	Associated DAU channel A has failed.
	DAU AC ID MISCMP	Mismatch between DAU 1 and DAU 2 configuration inputs regarding aircraft type.
	IC 1 (2) OVERHEAT	Associated temperature of the IC-600 is too high.
	IC BUS FAIL	A failure in the Interconnection Bus has been detected.
	IC 1 (2) WOW INOP	ICs/Weight - On - Wheels interface not working properly.
	CHECK PFD 1 (2)	A miscomparison on the associated PFD bus has been detected.
	CHECK IC 1 (2) SW	Updating error on IC-600.
	CHK IC CONFIG	Configuration module mismatch (airplane model, engine type, LR version, and units).

(Continued)

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(Continued)

TYPE	MESSAGE	MEANING
ADVISORY	CONFIG MISMATCH (if applicable)	For EICAS 16, means mismatch of any configuration between both IM-600s. For EICAS 16.5 or later, means mismatch of any of the configurations stored in the IM-600 modules except those considered in the CHK IC CONFIG logic.
	DAU 1 (2) B FAIL	Associated DAU channel B has failed.
	DAU 1 (2) REVERSION	Associated DAU has been commanded to operate with channel B mode.
	CMC FAIL	CMC has failed.
	IC 1 (2) CONFIG FAIL	A failure in the configuration module of the IC has been detected.
	DU 1 (2, 3, 4, 5) FAN FAIL	Associated display fan has failed.
	DU 1 (2, 3, 4, 5) OVHT	Associated display unit temperature is too high.
	IC 1 (2) FAN FAIL	Associated IC fan has failed.

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CONTROLS AND INDICATORS

PFD BEZEL

Provides controls that allow barometric settings in the PFD. For further information, refer to Section 2-17 - Flight Instruments.

MFD BEZEL

MAIN MENU

1 - SYSTEM BUTTON
- Selects system menu.
- If TCAS window is being displayed, it will be replaced by the previously selected system page.

2 - MFD BUTTON
- Selects MFD menu.

3 - CHECKLIST BUTTON
- This function is not enabled.

4 - TCAS BUTTON
- Selects TCAS information to be presented on the MFD. For further information refer to item TCAS presented in this section.
- If TCAS is already selected, pressing the button restores the previously selected system page.

5 - WEATHER RADAR BUTTON
- Selects weather radar information to be presented on the MFD. For further information on weather radar, refer to Section 2-18 - Navigation and Communication.

6 - MAP PLAN BUTTON
- When the radar is being displayed, enables the Map format for radar presentation. For further information on weather radar, refer to Section 2-18 – Navigation and Communication.

7 - MAP/PLAN RANGE KNOB
- Allows setting the Map format range that is displayed on the MFD. For further information on this feature, refer to Section 2-18 – Navigation and Communication.
- Except for the SPDS menu, this knob function is available in all menus.

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SYS SUBMENU

1 - RETURN BUTTON
- Returns to the main menu.

2 - TAKEOFF PAGE BUTTON
- Selects the takeoff page to be presented on the MFD. For further information on this page refer to Section 2-2 – Equipment and Furnishings and Section 2-10 – Powerplant.

3 - ENVIRONMENTAL CONTROL SYSTEM AND PNEUMATIC PAGE BUTTON
- Selects the environmental control system and pneumatic page to be presented on the MFD. For further information on this page refer to Sections 2-14 – Pneumatics, Air Conditioning and Pressurization and Section 2-16 – Oxygen.

4 - FUEL SYSTEM PAGE BUTTON
- Selects the fuel system page to be presented on the MFD.
- When fuel system page is being displayed, button function changes.
- For further information on this page refer to Section 2-8 – Fuel.

5 - HYDRAULIC PAGE BUTTON
- Selects the hydraulic page to be presented on the MFD. For further information on this page refer to Section 2-11– Hydraulic.

6 - ELECTRICAL SYSTEM PAGE BUTTON
- Selects the electrical system page to be presented on the MFD. For further information on this page refer to Section 2-5 – Electrical.

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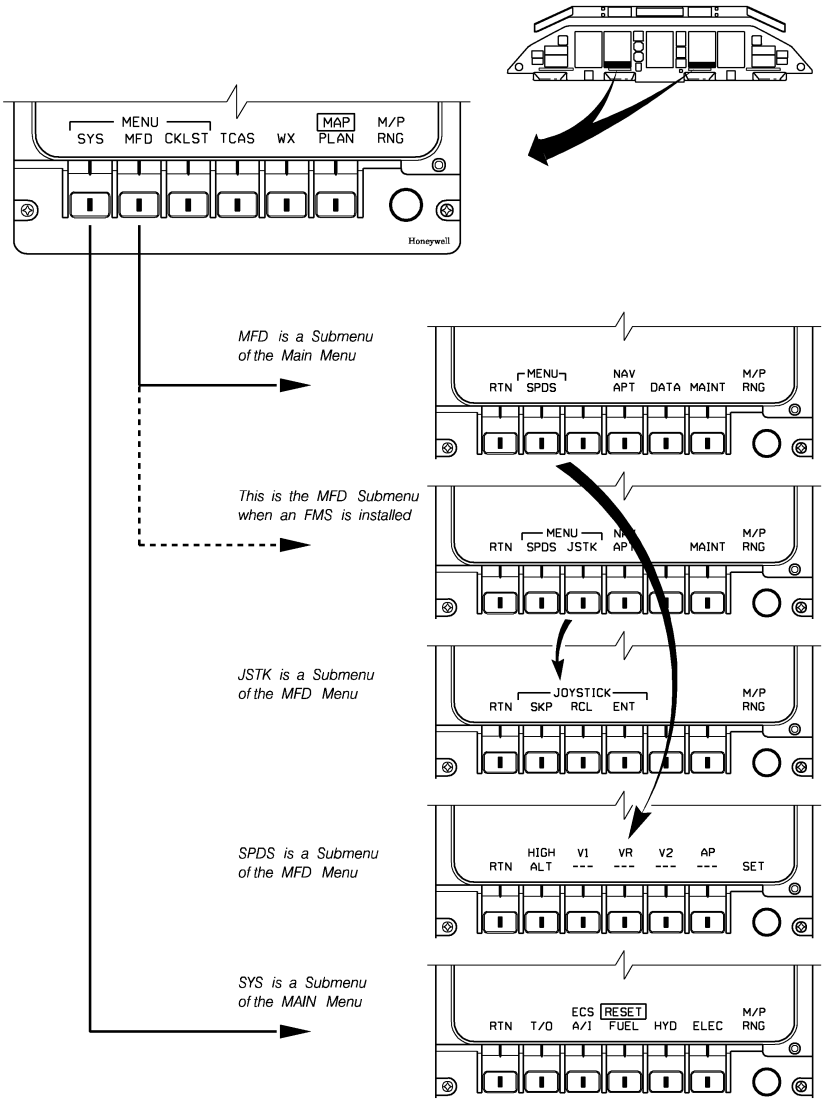

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MFD BEZEL BUTTON MENU TREE

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MFD SUBMENU

1 - RETURN BUTTON
- Returns to the main menu.

2 - REFERENCE SPEEDS BUTTON
- Selects SPDS menu. For further information on this menu, refer to Section 2-17 – Flight Instruments.

3 - JOYSTICK BUTTON
- **NOTE**: This function is available only when the FMS is installed.
- Selects JSTK menu. For further information on this menu, refer to Section 2-18 – Navigation and Communication.

4 - AIRPORT AND NAVIGATION AIDS BUTTON
- Provides selection and toggling of airport and navigation aids displays on the MFD. For further information on this feature, refer to Section 2-18 – Navigation and Communication.

5 - DATA BUTTON
- Provides selection and toggling of waypoint identifier displays on the MFD. For further information on this feature, refer to Section 2-18 – Navigation and Communication.

6 - MAINTENANCE SELECTION BUTTON (LEFT MFD ONLY)
- Presents maintenance messages on MFD.
- Function is available only on the ground.

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EICAS BEZEL

Provides a knob to allow EICAS messages scrolling. For further information, refer to Visual Warnings in this Section.

REVERSIONARY PANEL

1 - MFD SELECTOR KNOB

PFD - presents on the MFD the information normally presented on the PFD. The PFD bezel button remains their normal function.

NORMAL - Normal MFD operation mode.

EICAS - presents on the MFD the information normally presented on the EICAS.

2 - ADC BUTTON

- Changes the ADC information from the on-side ADC to the cross-side ADC.
- A striped bar illuminates inside the button to indicate that it is pressed.

3 - AHRS/IRS BUTTON

- Changes the attitude and heading source from the on-side AHRS/IRS to the cross-side AHRS/IRS.
- A striped bar illuminates inside the button to indicate that it is pressed.

4 - SYMBOL GENERATOR BUTTON

- Changes the symbol generator from the on-side SG to the cross-side Symbol Generator as well ADC and AHRS.
- A striped bar illuminates inside the button to indicate that it is pressed.

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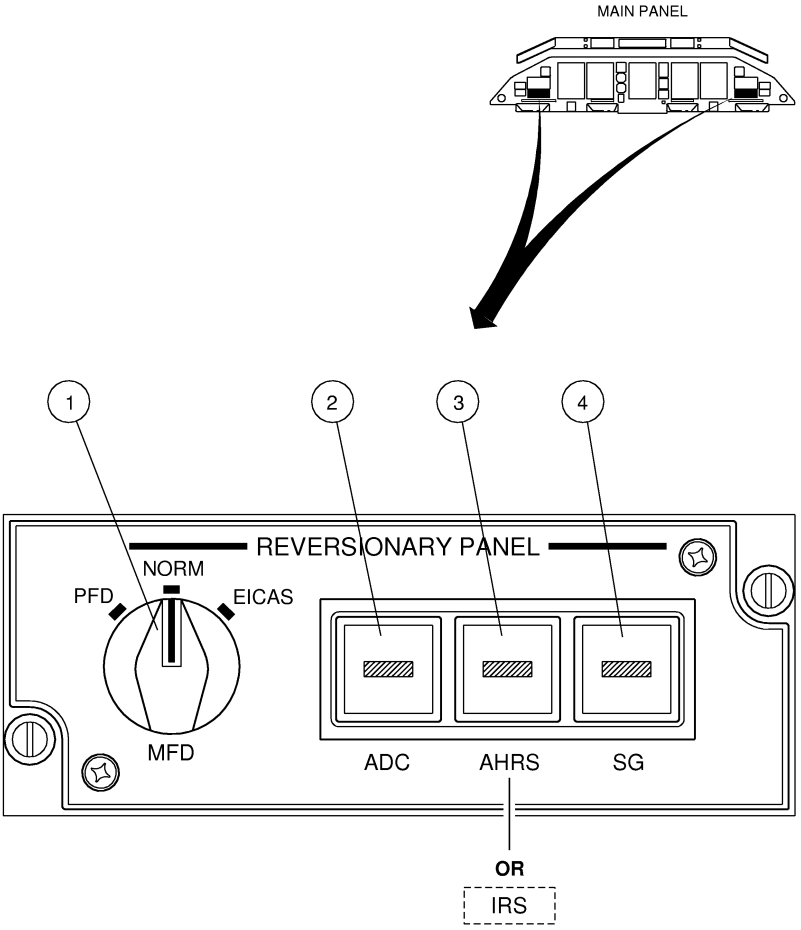

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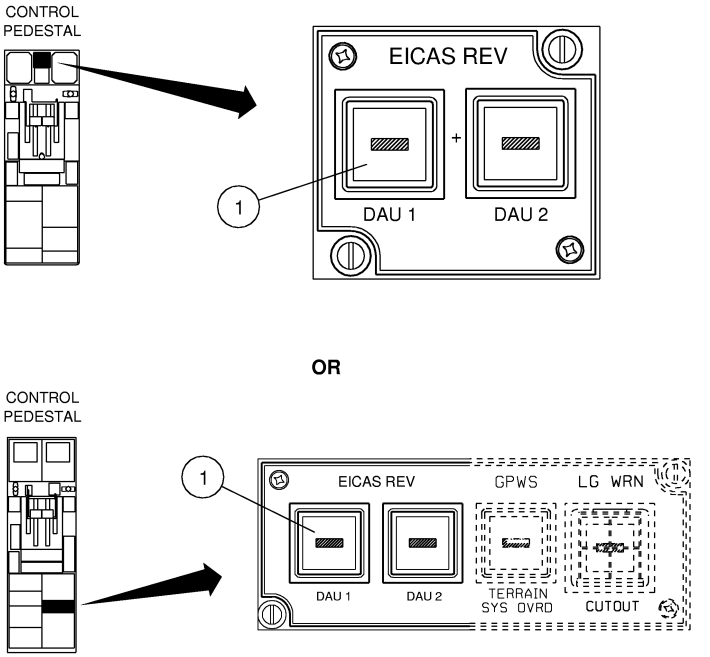
REVERSIONARY PANEL

EICAS REVERSIONARY PANEL

1 - DAU REVERSIONARY BUTTON

- Allows channel B of associated DAU to supply both IC-600s.
- A striped bar is illuminated inside the button to indicate that it is pressed and that channel B is the current data source.



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EICAS REVERSIONARY PANEL

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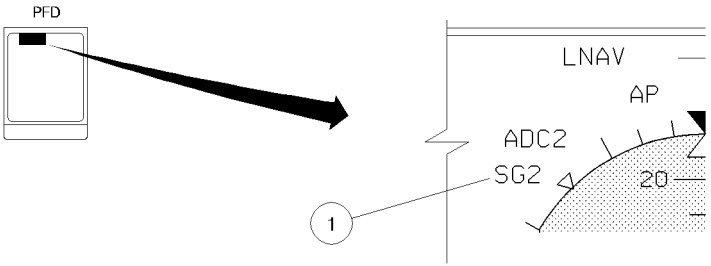
PRIMARY FLIGHT DISPLAY

1 - SYMBOL GENERATOR REVERSION ANNUNCIATION

- Indicates that a symbol generator reversion has been selected on the reversionary panel.
- Presented on both PFDs.
- Labels: SG1 for IC-600 # 1 and SG2 for IC-600 # 2.
- Color: amber



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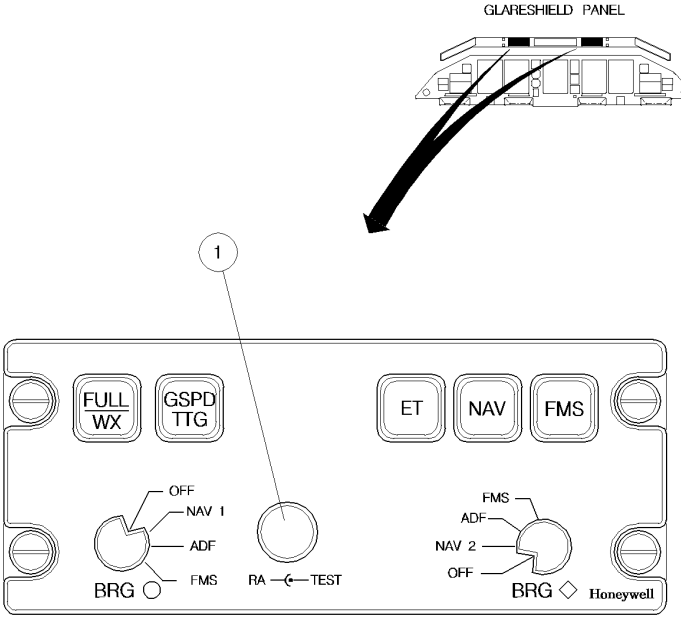
DISPLAYS CONTROL PANEL

NOTE: For further information on displays control panel, refer to Sections 2-17 – Flight Instruments and 2-18 – Navigation and Communication .

1 - TEST BUTTON

- On the ground:
  - When pressed, activates the IC-600s first level test.
  - When pressed for more than 6 seconds activates the IC 600s second level test.
  - When released, normal operation of IC-600s is resumed.

- In flight:
  Refer to Radio Altimeter description on Section 2-17 – Flight Instruments.



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BUILT-IN TEST

There are 3 kinds of Built-In-Tests (BIT) that the IC-600 may perform: power up BIT, continuous BIT and pilot initiated BIT. All of them check the software and hardware integrity and operation.

POWER UP BIT

The power up BIT checks the power supply, IC-600 interfaces, memories, autopilot engagement and disengagement, and autopilot servos.

CONTINUOUS BIT

Memories and processors tests are continuously performed after the power up BIT, as well as autopilot functions.

PILOT INITIATED BIT

A pilot initiated BIT may be commanded by pressing the TEST button in the displays control panel. This test may be commanded on the ground only and is divided into two levels. The first level is indicated on airplane displays, which present the failure mode annunciations.
The second level is activated if the TEST button is held pressed, and checks the IC-600 internal interfaces. The test results are displayed on the PFD, which alternates every 10 seconds between internal and external test results pages.
To perform the IC-600 test is necessary to press the TEST button at co-localized display control panel.

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The PFD first level test indications are as follows:

- A magenta TEST is displayed in upper left center of the PFD.
- Indications removed: all bugs, flight director information, all pointers, low airspeed awareness, take-off speed bugs and digital readouts, V_{MO}/M_{MO}, and trend vectors.
- Indications forced: all comparison monitors, all marker beacons, and windshear annunciation.
- Indications presented as invalid: pitch and roll, vertical and lateral deviations, baro correction, vertical speed set digital readout, altitude preselect, heading, distance digital readout, ground speed (or time to go or elapsed time), selected heading and course (or desired track), Mach, airspeed, airspeed set digital readout, altitude.
- If heading is valid upon test activation, its source annunciation will remain valid (DG1 or 2 or MAG1 or 2). If heading is invalid, its source annunciation will change to HDG1 or HDG2.

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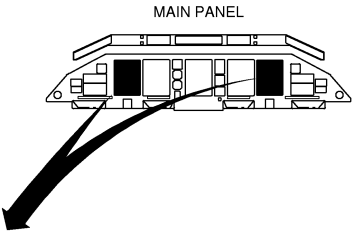

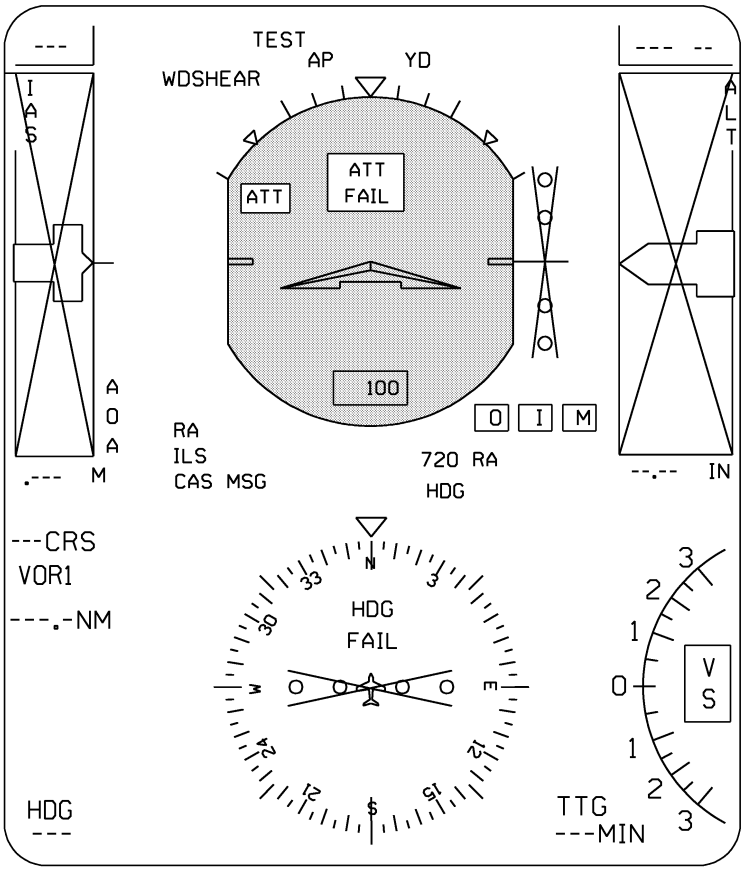

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PFD TEST INDICATIONS - FIRST LEVEL

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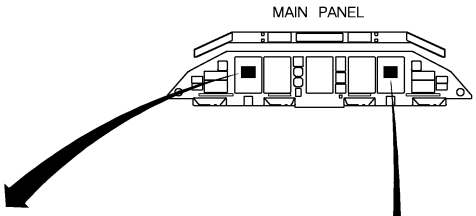

IC-600 IBIT	WAIT
FLIGHT AUTOPILOT	PASS
FLIGHT DIRECTOR	FAIL
SYMBOL GENERATOR	PASS
DYSPLAY UNIT	PASS
ATT/HDG INTERFACE	PASS
RADIO ALT INTERFACE	PASS
RADIO INTERFACE	FAIL
DYSPLAY CONTROLLER	PASS
LAMP DRIVERS	PASS
ADC DATA	PASS

IC-600 IBIT	WAIT
FLIGHT DIRECTOR	FAIL
SYMBOL GENERATOR	PASS
DYSPLAY UNIT	PASS
ATT/HDG INTERFACE	PASS
RADIO ALT INTERFACE	PASS
RADIO INTERFACE	FAIL
DYSPLAY CONTROLLER	PASS
LAMP DRIVERS	PASS
ADC DATA	PASS

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PFD TEST INDICATIONS - SECOND LEVEL

The MFD test indications are as follows:

- Indications removed: heading source, TCAS, weather patch, drift bug, wind vector, heading select bug, flight plan data, airports, navaids, designator information.
- Indications forced: TERRAIN FAIL, EICAS CHK, WX TERRAIN, MENU INOP, HDG FAIL.
- Indications presented as invalid: heading, weather radar tilt, SAT, true airspeed, ground speed, distance and time to waypoint.

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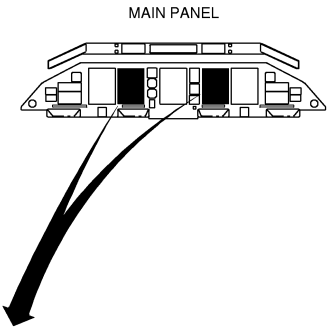

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MFD TEST INDICATIONS

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The EICAS test is commanded only from the pilot's panel, and its indications are as follows:

- Indications removed: reversion, ignition, FADEC in control, all engine and trim bugs.
- Indications forced: the crew awareness field will be filled with a "X".
- Indications presented as invalid: landing gear status, N1, N2, ITT, fuel flow and quantity, oil pressure, temperature and quantity, vibration for LP and HP, flaps, spoilers, all cabin and APU parameters, all trim values.

During IC-600 # 1 first level pilot initiated BIT, RMU 1 will display the first page of standby engine indication. The RMU 2 is not included in the IC-600 # 2 first level pilot initiated BIT.

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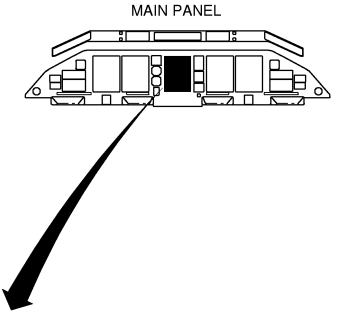

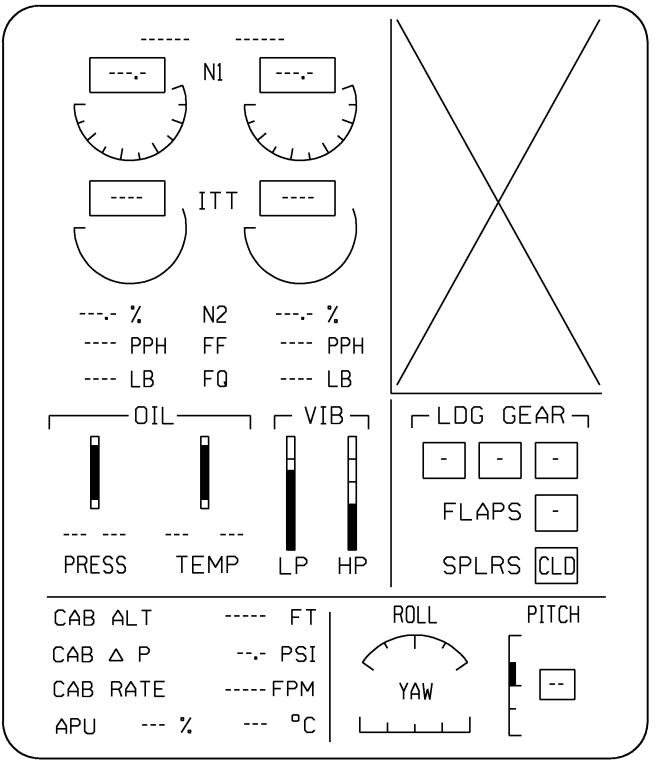

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EICAS TEST INDICATIONS

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VISUAL WARNINGS

Visual warnings are provided through lights, illuminated buttons, EICAS messages and displays indications.

WARNING LIGHTS

Some of the airplane systems are actuated by illuminated buttons. When under normal operating conditions, such buttons are not illuminated. If the pilot has commanded the button to a position that requires crew attention, a striped bar is illuminated inside the button. There are some exceptions such as the windshield heating, the GPU, the ice protection wing and stab, and the APU bleed buttons, which are illuminated under normal operating conditions.

Some systems also provide indicating lights, for system status indication. Further details on such lights are provided in the associated systems description section.

Master warning and caution lights are installed on each pilot glareshield panel. Such lights blink when any warning or caution message is presented on the EICAS or generated in the Aural Warning Unit (AWU). To stop blinking, pilots must press the associated light. To find information on illuminated buttons and any specific warning light, refer to the associated system's description.

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EICAS MESSAGES

EICAS messages are presented in the upper right corner of the EICAS display. In case of a simultaneous failure in the EICAS and MFD displays, the RMUs are capable of presenting some messages.

EICAS MESSAGES LEVELS

There are three message levels: warning, caution, and advisory:

- **Warning** messages are red colored and require immediate crew action. Warning messages are always presented on the top of the list, in the same order they are generated.
- **Caution** messages are amber colored and require immediate crew awareness. They follow warning in criticality level and in display presentation.
- **Advisory** messages are cyan and are dedicated to minor failures or system status. Advisory messages are displayed below caution messages.

A fourth level is provided for maintenance purposes, but it is not presented to the flight crew, and its access can only be made on the ground.

When the message is generated, it is displayed blinking at the top of the associated group. To stop blinking, press the associated master button on the glareshield. Advisory messages will stop blinking after 5 seconds.

EICAS MESSAGES PRIORITY LOGIC

If more than one message is simultaneously presented, warning will precede caution messages, which will precede advisories. The space is provided for the simultaneous display of up to 15 messages. An END label is provided after the last message, to indicate end of message listing. If more than 15 messages are being generated, a knob in the display bezel permits paging through the remaining messages. In this case, a status line is provided in the sixteenth line, to indicate how many messages are not being currently presented and where they are (above or below the currently presented messages). END label and warning messages can not be scrolled out of the display. Due to this characteristic, caution and advisory messages will be scrolled in the area left blank below the warning messages. If a new message is generated during a scrolling, it will be automatically displayed at the top of the associated group.

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INHIBITION LOGIC

To avoid its nuisance effect upon the flight crew, inhibition logic is provided to prevent some messages from being displayed during takeoff and approach/landing phases. The inhibition logic is as follows:

Takeoff Phase:

Inhibition is valid when the airplane crosses V_1 –15 kt. The inhibition is deactivated when one of the following conditions is accomplished:

- radio altitude is greater than 400 ft or;
- calibrated airspeed is less than 60 kt or;
- after 1 minute.

Approach/landing Phase:

Inhibition is valid from the point when airplane crosses 200 ft radio altitude. The inhibition is deactivated when one of the following conditions is accomplished:

- airplane is on the ground for 3 seconds or more;
- after 1 minute.

IC-600 RESULTS SELF-CHECK

The results of both IC-600 computations are continuously compared to check for any inconsistency between both sides. A dedicated amber annunciation, “CAS MSG”, is provided on the PFDs to indicate whenever a difference between both IC-600s has been found, thus leading to possible unreliable messages.

EICAS MESSAGE DICTIONARY

The following table presents all the EICAS messages. Type column indicates whether the message’s nature is Warning (W), Caution (C), or Advisory (A).
The number in column INHIBITION indicates the following:
- (1) Message is inhibited during takeoff;
- (2) Message is inhibited during takeoff and approach/landing;
- (3) Message is not inhibited;
- (4) Message is inhibited during approach/landing;
- (5) Message is inhibited on the ground and on all flight phases excluding takeoff.

For further information regarding each message’s logic, refer to the associated system’s description.

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SECTION	TYPE	MESSAGE	INHIBITION
2-2 EQUIPMENT AND FURNISHINGS	W	MAIN DOOR OPN	2
	W	SERVICE DOOR OPN	2
	C	ACCESS DOORS OPN	2
	C	BAGGAGE DOOR OPN	2
	C	EMERG EXIT OPN	2
	C	FUELING DOOR OPN	2
2-4 CREW AWARENESS	W	GPWS	3
	W	NO TAKEOFF CONFIG	4
	W	SPS 1 (2) INOP	3
	C	AURAL WARN FAIL	2
	C	CHECK IC 1 (2) SW	2
	C	CHECK PFD 1 (2)	2
	C	CHK IC CONFIG	2
	C	DAU AC ID MISCMP	2
	C	DAU 1 (2) A FAIL	2
	C	DAU 1 (2) ENG MISCOMP	2
	C	DAU 1 (2) SYS MISCOMP	2
	C	DAU 1 (2) WRN MISCOMP	2
	C	GPWS INOP	3
	C	IC BUS FAIL	2
	C	IC 1 (2) OVERHEAT	2
	C	IC 1 (2) WOW INOP	2
	C	SPS ADVANCED	3
	C	STICK PUSHER FAIL	3
	C	TERR INOP	3
	C	WINDSHEAR INOP	3
	A	CHECKLIST MISMATCH	2
	A	CMC FAIL	2
	A	CONFIG MISMATCH	2
	A	IC 1 (2) CONFIG FAIL	2
	A	IC 1 (2) FAN FAIL	2
	A	DAU 1 (2) B FAIL	2
	A	DAU 1 (2) REVERSION	2
	A	DU 1 (2, 3, 4, 5) FAN FAIL	2
	A	DU 1 (2, 3, 4, 5) OVHT	2
	A	SPS/ICE SPEEDS	1

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SECTION	TYPE	MESSAGE	INHIBITION
2-5 ELECTRICAL	W	BATT 1 (2) OVTEMP	3
	W	ELEC ESS XFR FAIL	3
	C	115 VAC BUS OFF	2
	C	APU CNTOR CLSD	2
	C	APU GEN OFF BUS	2
	C	APU GEN OVLD	2
	C	BATT 1 (2) OFF BUS	2
	C	BKUP BATT OFF BUS	2
	C	DC BUS 1 (2) OFF	2
	C	ELEC EMERG ABNORM	2
	C	ESS BUS 1 (2) OFF	2
	C	GEN 1 (2, 3, 4) OFF BUS	2
	C	GEN 1 (2, 3, 4) OVLD	2
	C	SHED BUS 1 (2) OFF	2
	A	GEN 1 (2, 3, 4) BRG FAIL	2
2-6 LIGHTING	C	EMERG LT NOT ARMD	2
2-7 FIRE PROTECTION	W	APU FIRE	3
	W	BAGG SMOKE	2
	W	ENG 1 (2) FIRE	3
	W	LAV SMOKE	2
	C	APU EXTBTL INOP	2
	C	APU FIREDET FAIL	2
	C	BAGG EXT BTL INOP	2
	C	E1 (2) EXTBTLA (B) INOP	2
	C	E1 (2) FIREDET FAIL	2
2-8 FUEL	W	FUEL 1 (2) LO LEVEL	2
	W	FUEL XFER CRITICAL	2
	C	APU FUEL LO PRESS	2
	C	APU FUEL SOV INOP	2
	C	E1 (2) FUEL LO PRESS	2
	C	E1 (2) FUEL SOV INOP	2
	C	FUEL IMBALANCE	2
	C	FUEL TANK LO TEMP	2
	C	FUEL XFEED FAIL	2
	C	FUELING DOOR OPN	2
	C	FUEL EQ XFEED OPN	2
	C	FUEL CONFIG DISAG	2

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SECTION	TYPE	MESSAGE	INHIBITION
2-8 FUEL	C	FUEL VENT OPEN	2
	C	FUEL XFER INOP	2
	C	FUEL XFER OVFLOW	2
	C	XFER ISOL FAIL	2
	C	DEFUEL NOT CLOSED	2
	A	APU FUEL SOV CLSD	2
	A	E 1(2) FUELSOV CLSD	2
	A	FUEL XFEED OPEN	2
	A	FUEL LR CONFIG	2
2-9 APU	C	APU FAIL	2
	C	APU OIL HI TEMP	2
	C	APU OIL LO PRESS	2
2-10 POWERPLANT	W	ATTCS FAIL	5
	W	E1 (2) ATTCS NO MRGN	2
	W	E1 (2) OIL LOW PRESS	2
	W	E1 (2) LOW N1	2
	W	ENG 1-2 OUT	1
	C	E1 (2) ATS SOV OPN	2
	C	E1 (2) CTL A (B) FAIL	2
	C	E1 (2) CTL FAIL	2
	C	E1 (2) EXCEEDANCE	2
	C	E1 (2) FPMU NO DISP	2
	C	E1 (2) FUEL LO TEMP	2
	C	ENG NO TO DATA	2
	C	ENG REF A/I DISAG	2
	C	ENG1 (2) REV DISAGREE	2
	C	E1 (2) NO DISP	2
	C	ENG 1 (2) OUT	1
	C	FADEC ID NO DISP	2
	C	ENG 1 (2) REV FAIL	2
	C	ENG 1 (2) TLA FAIL	2
	A	CHECK XXX PERF (XXX = A, A1, A1P, A3, A1/3, A1E)	2
	A	E1 (2) SHORT DISP	2
	A	E1 (2) ADC DATA FAIL	2
	A	E1 (2) FUEL IMP BYP	2
	A	E1 (2) OIL IMP BYP	2

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SECTION	TYPE	MESSAGE	INHIBITION
2-10 POWERPLANT	A	E1 (2) IDL STP FAIL	2
	A	E1 (2) CTL A (B) DEGRAD	2
2-11 HYDRAULIC	C	HYD SYS 1 (2) FAIL	2
	C	HYD SYS 1 (2) OVHT	2
	A	E1 (2) HYD PUMP FAIL	2
	A	E1 (2) HYDSOV CLSD	2
	A	HYD PUMP SELEC OFF	2
	A	HYD1 (2) LO QTY	2
2-12 LANDING GEAR AND BRAKES	W	LG/LEVER DISAGREE	3
	C	BRAKE OVERHEAT	3
	C	BRK INBD INOP	1
	C	BRK OUTBD INOP	1
	C	EMRG BRK LO PRES	1
	C	LG AIR/GND FAIL	3
	C	STEER INOP	2
	C	NLG/UPDOOR OPN	2
	C	BRAKE DEGRADED	1
2-13 FLIGHT CONTROLS	W	PIT TRIM 1 (2) INOP	2
	W	PTRIM MAIN INOP	2
	W	PTRIM BACKUP INOP	2
	C	AIL SYS 1 (2) INOP	2
	C	FLAP FAIL	2
	C	PTRIM CPT SW FAIL	3
	C	PTRIM F/O SW FAIL	3
	C	PTRIM BKP SW FAIL	3
	C	RUDDER OVERBOOST	2
	C	RUDDER SYS 1 (2) INOP	2
	C	RUD HDOV PROT FAIL	2**
	C	SPBK LVR DISAGREE	2
	C	SPOILER FAIL	2
	A	FLAP LOW SPEED	2
2-14 PNEUMATICS, AIR CONDITIONING AND PRESSURIZATION	W	BLD 1 (2) LEAK	2
	W	BLD APU LEAK	2
	W	BLD 1 (2) OVTEMP	2
	C	APU BLD VLV FAIL	2
	C	BLD 1 (2) LOW TEMP	2
	C	BLD 1 (2) VLV FAIL	2

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SECTION	TYPE	MESSAGE	INHIBITION
2-14 PNEUMATICS, AIR CONDITIONING AND PRESSURIZATION	C	CROSS BLD FAIL	2
	C	CROSS BLD SW OFF	2
	C	ELEKBAY OVTEMP	2
	C	HS VLV 1 (2) FAIL	2
	C	PACK 1 (2) OVHT	2
	C	PACK 1 (2) OVLD	2
	C	PACK 1 (2) VLV FAIL	2
	C	PRESN AUTO FAIL	2
	C	RAM AIR VLV FAIL	2
	A	BLD 1 (2) VLV CLSD	2
	A	HI ALT LDG-T/O	2
	A	CROSS BLD OPEN	2
	A	PACK 1 (2) VLV CLSD	2
2-15 ICE AND RAIN PROTECTION	W	ICE COND-A/I INOP	2
	C	A/ICE LOW CAPACITY	3
	C	A/ICE SWITCH OFF	2
	C	AOA 1 (2) HEAT INOP	2
	C	E1 (2) A/ICE FAIL	2
	C	ICE DET1 (2) FAIL	2
	C	ICE DETECTORS FAIL	2
	C	NO ICE-A/ICE ON	2
	C	PITOT 1 (2, 3) INOP	2
	C	STAB A/ICE FAIL	2
	C	TAT 1 (2) HEAT INOP	2
	C	W/S 1 (2) HEAT FAIL	2
	C	WG A/ICE FAIL	3
	A	ENG A/ICE OVERPRES	3
	A	ICE CONDITION	2
2-16 OXYGEN	C	OXYGEN LO PRESS	2
2-17 FLIGHT INSTRUMENTS	C	DFDR FAIL	2
	A	FDAU FAIL	2
	A	RAD ALT 1 (2) FAIL	1
	A	RAD ALT FAIL	1

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SECTION	TYPE	MESSAGE	INHIBITION
2-18 NAVIGATION AND COMMUNICATION	C	AHRS 1 (2) ALN FAULT	2
	C	AHRS 1 (2) FAIL	2
	C	AHRS 1 (2) OVERHEAT	2
	C	CHECK XPDR	2
	C	HGS FAIL	3
	C	IRS 1 (2) ALN FAULT	2
	C	IRS 1 (2) FAIL	2
	C	IRS 1 (2) OVERHEAT	2
	A	A III NOT AVAIL	3
	A	AHRS 1 (2) ALN	2
	A	AHRS 1 (2) ATT MODE	2
	A	AHRS 1 (2) BASIC MODE	2
	A	AHRS 1 (2) EXC MOTION	2
	A	AHRS 1 (2) NO MAG HDG	4
	A	AHRS 1 (2) NO PPOS	1
	A	AHRS 1 (2) ON BATT	2
	A	IRS 1 (2) ALN	2
	A	IRS 1 (2) ATT MODE	2
	A	IRS 1 (2) EXC MOTION	2
	A	IRS 1 (2) ON BATT	2
2-19 AUTOPILOT	W	AUTOPILOT FAIL	2
	C	AUTO TRIM FAIL	2
	C	AP ELEV MISTRIM	2
	C	AP AIL MISTRIM	2
	C	LATERAL MODE OFF	3
	C	VERTICAL MODE OFF	3
	C	YAW DAMPER FAIL	2

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DISPLAYS INDICATIONS

Many of the airplane's parameters are indicated on one of the displays, in analogic or digital format.

ANALOGIC INDICATIONS

Analogic indications are provided as pointers moving over a scale, which may be graduated or not. In both cases, if the pointer indicates a value out of the normal range for that parameter, both pointer and scale become amber or red, if the parameter goes deeply into the out of range area. Pointers are removed if the parameter signal becomes invalid. For some parameters, scale may also be removed in this condition. Scale and pointer are not presented for some parameters, when they are not required, as for EADI chevrons, V_1, V_R, V_2 speed bugs, trend vectors, etc.

DIGITAL INDICATIONS

Digital indications are provided as green characters for normal values. If the associated parameter goes outside its normal range, digits become amber, with an amber box surrounding them. Both digits and box become red if the parameter goes deeply into the out of range area. If the parameter signal becomes invalid, digits are replaced by amber dashes, without boxes.

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CONTROLS AND INDICATORS

GLARESHIELD PANEL

1 - MASTER WARNING BUTTON

- Acknowledges the warning messages and stops the associated blinking when pressed.
- A red light blinks inside the button when a new warning message is displayed on the EICAS.

2 - MASTER CAUTION BUTTON

- Acknowledges the caution messages and stops the associated blinking when pressed.
- An amber light blinks inside the button when a new caution message is displayed on the EICAS.

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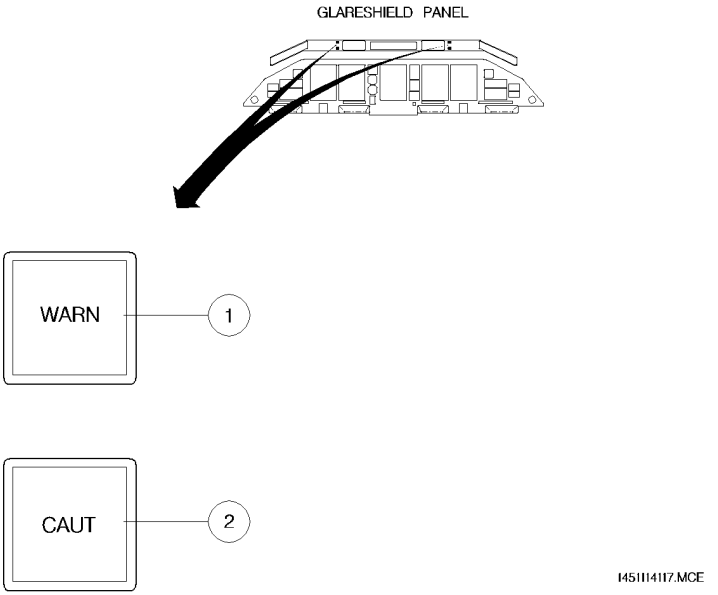
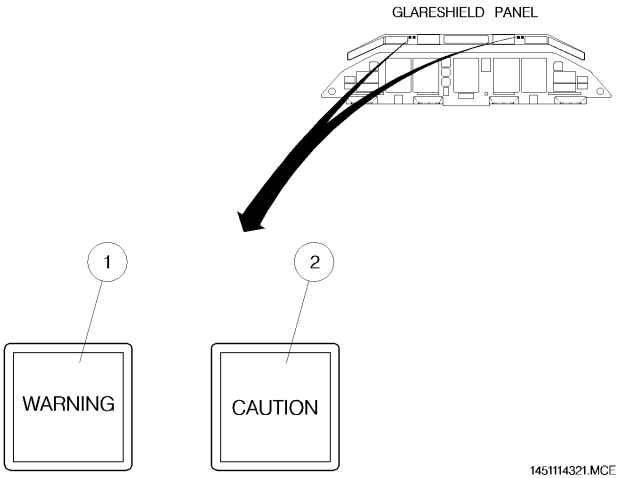


GLARESHIELD PANEL



GLARESHIELD PANEL (OPTIONAL)

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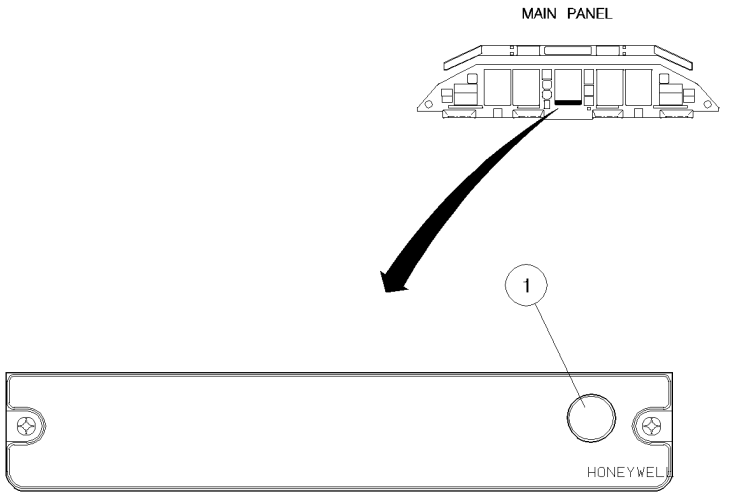
EICAS BEZEL

1 - MESSAGE SCROLLING KNOB

- To be used when displayed EICAS messages can not be presented at once.
- By rotating the knob clockwise, advances through EICAS messages. Rotated counterclockwise moves backward through EICAS messages.



145111411B.MCE

EICAS BEZEL

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PRIMARY FLIGHT DISPLAY

1 - EICAS CHECK SUM FAIL COMPARISON MONITOR DISPLAY

- Color: amber.
- Label: CAS MSG.
- Displayed when the number of active EICAS messages in each IC-600 is found to be different.

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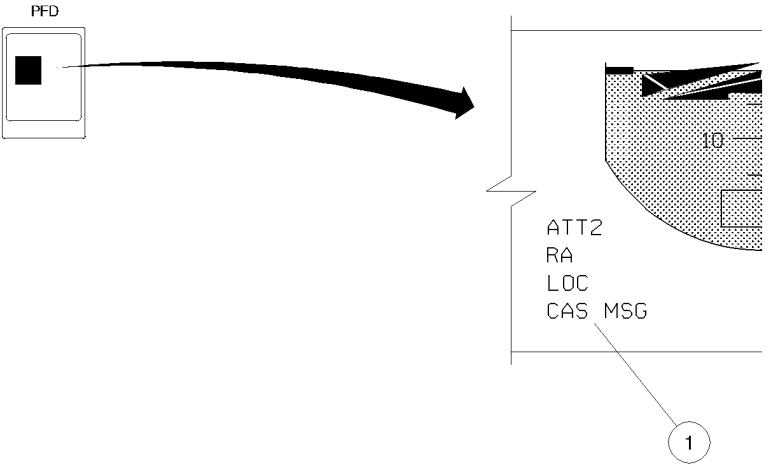

PRIMARY FLIGHT DISPLAY

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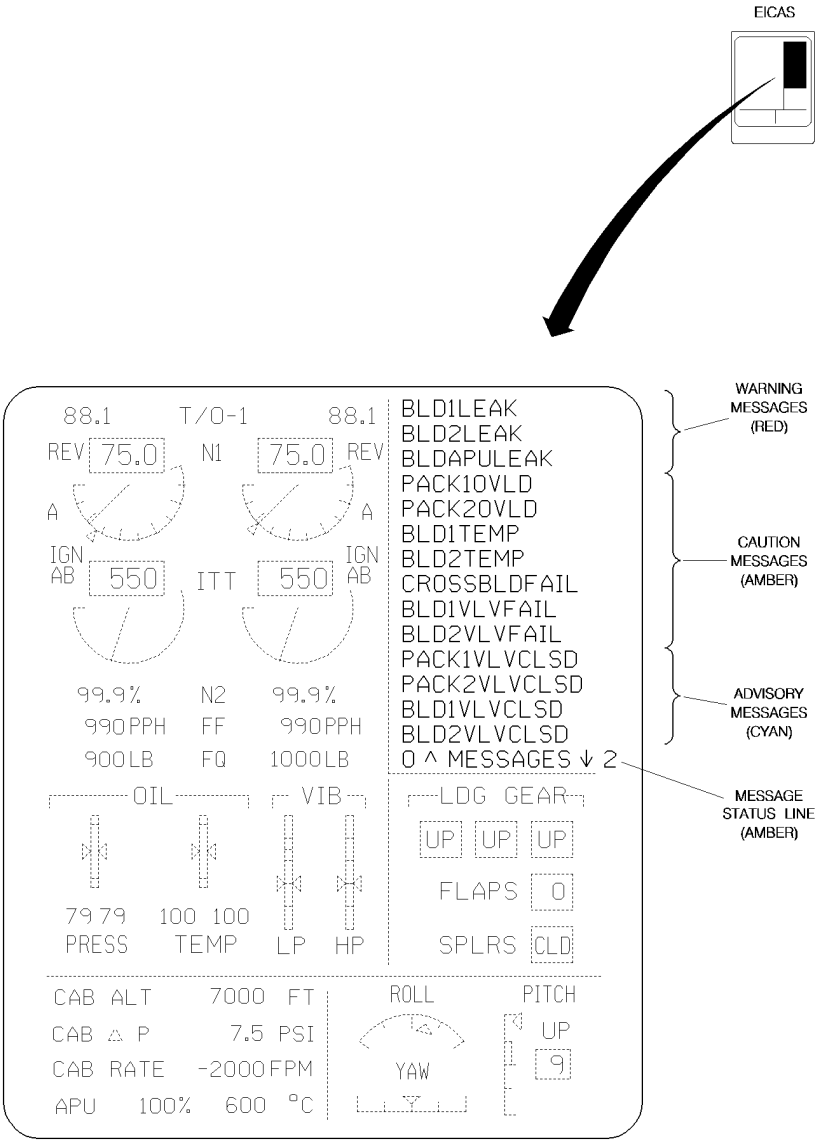
EICAS DISPLAY



EICAS MESSAGES EXAMPLE

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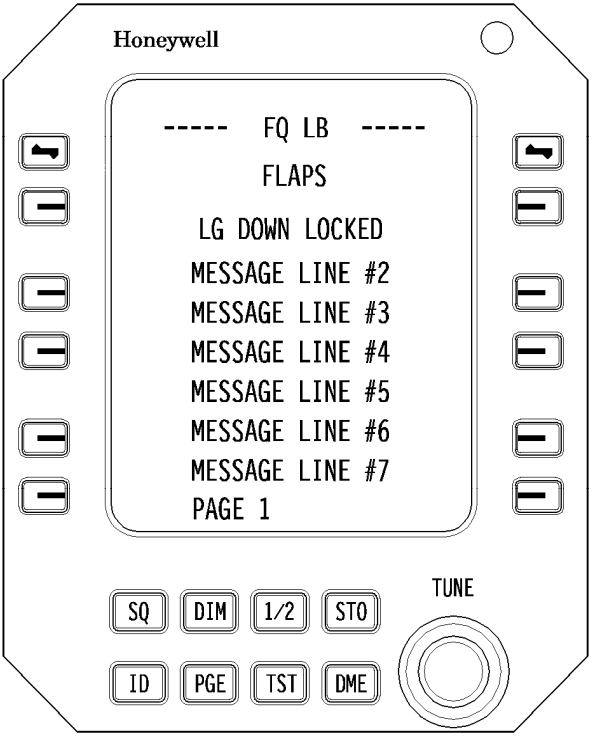
RMU DISPLAY



1451114199.MCE

RMU MESSAGES EXAMPLE

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PFD PRESENTATIONS

COMPARISON MONITORS

The left and right side area for several critical parameters is monitored by the system. If an excessive difference is detected between left and right side information, a comparison monitor annunciator for data is displayed on the PFD.

Active messages are cleared when the miscompare situation has been corrected.

Comparison monitor annunciators are displayed as follows:

1 - PIT (PITCH ATTITUDE)

- Displayed in the upper left corner of the attitude sphere when pitch attitude data differs by more than ±5º.

2 - ALT (ALTITUDE)

- Displayed in the upper right corner of the altitude tape when altitude data differs by more than ±200 ft.

3 - HDG (HEADING)

- Displayed to the upper right of the HSI compass when heading data differs by more than ±6º (level flight).

4 - LOC (LOCALIZER)

- Displayed to the lower left of the attitude sphere when localizer deviation differs by more than approximately ½ dot (below 1200 ft AGL).

5 - CAS MSG (CAS MESSAGE)

- Displayed to the lower left of the attitude sphere when a red or amber CAS message has been triggered by the on-side IAC but not the cross-side IAC.

6 - ILS (INSTRUMENT LANDING SYSTEM)

- Displayed to the lower left of the attitude sphere when both localizer and glideslope comparison monitors have been tripped.

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7 - GS (GLIDESLOPE)

- Displayed to the lower left of the attitude sphere when glideslope deviation differs by more than approximately 2/3 dot (below 1200 ft AGL).

8 - RA (RADIO ALTITUDE)

- Displayed to the lower left of the attitude sphere when radio altitude data differs by more than the amount calculated by the formula [(RA1+RA2)x0.0625]+10. Available only with two radio altimeters installed.
- An amber RA1 is displayed in the event of Radio Altimeter 2 failure. Radio Altitude source is RA1.
- An amber RA2 is displayed in the event of Radio Altimeter 1 failure. Radio Altitude source is RA2.

9 - IAS (AIRSPEED)

- If the on-side and cross-side calibrated airspeed differ by 5 kt or more for longer than 2 seconds, it is displayed in the upper left corner of the airspeed tape first flashing, for 10 seconds, and then steady.

10 - ROL (ROLL ATTITUDE)

- Displayed in the upper left corner of the attitude sphere when roll attitude data differs by more than ±6º.

11 - ATT (ATTITUDE)

- Displayed in the upper left corner of the attitude sphere when both pitch and roll comparison monitors have been tripped.

NOTE: The comparison monitor is active when the pilot and copilot have the same type of data, but different sources selected for display. For example, if the pilot and copilot both have ILS 1 selected (amber source annunciator), no comparison monitor is active on that data (localizer and glideslope).

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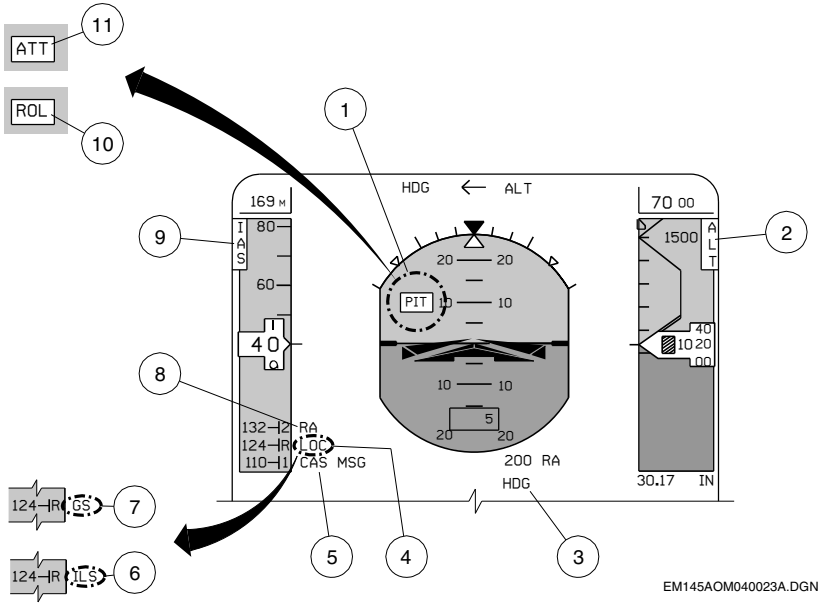

COMPARISON MONITOR ANNUNCIATORS

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CAUTION ANNUNCIATORS

The amber caution annunciators are described as follows:

1 - FD FAIL

- If a flight director fails, **FD FAIL** is displayed in the lateral mode annunciator box, and the flight director mode annunciators and command cue are removed.

2 - AP/YD

- Autopilot and yaw damper caution annunciators. **AP/YD** are displayed above the attitude sphere, below the flight director mode annunciators. Refer to PFD Additional Annunciators for more information.

3 - GND PROX

- When the EGPWS indicates a caution conditions **GND PROX** is displayed in the upper right of the ADI sphere. The following aural alerts are considered cautionary:
  - "SINK RATE";
  - "DON'T SINK";
  - "TOO LOW TERRAIN";
  - "TOO LOW FLAPS";
  - "TOO LOW GEAR";
  - "GLIDESLOPE";
  - "CAUTION TERRAIN";
  - "CAUTION OBSTACLE".

4 - MSG

- The FMS message annunciator (**MSG**) is displayed to the upper right of the HSI compass. The **MSG** annunciator flashes until the FMS message is cleared from the scratchpad.

5 - TCAS FAIL

- Amber **TCAS FAIL** caution annunciator is displayed to the upper left on the vertical speed display.
- For airplanes Post-Mod. SB 145-34-0125, the **TCAS FAIL** caution annunciator flashes for 10 s and remain steady displayed as long as the condition persists.

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6 - DISTANCE DISPLAY FAILURES

- If the DME or FMS distance signal fails, the digital readout is replaced with amber dashes.

7 - COURSE SELECT FAILURE

- If the course select signal fails, the digital readout is replaced with amber dashes and the course pointer is removed from the display. This indication is also given for an invalid heading display or FMS source.

8 - AOA

- Angle of attack information (and calibrated airspeed) are used to calculate stall speed for low speed awareness. If the angle of attack information or indicated airspeed information is invalid, AOA is displayed to the lower right of the airspeed tape.

9 - ATT1 OR ATT2

- If the pilot and copilot are using their normal onside attitude source, there is no attitude source annunciator. If the pilot and copilot have selected the same attitude source, that attitude source (**ATT1** or **ATT2**) is annunciated to the lower left of the attitude sphere on both PFDs.

10 - RA

- If a radio altimeter fails, **RA** is displayed in the digital radio window.

11 - MAX/MIN SPD

- These annunciators are displayed to the left of the attitude sphere. **MIN SPD** is displayed when the vertical speed or airspeed hold mode is engaged and the indicated airspeed drops below 80 kt. **MAX SPD** is displayed anytime indicated airspeed exceeds V_{MO}/M_{MO}.

12 - SG1 OR SG2

- When the symbol generator reversion is selected and one symbol generator is driving both pilot's and copilot's displays, that symbol generator is annunciated (**SG1** or **SG2**) to the upper left of the attitude sphere on both PFDs.

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13 - ADC1 OR ADC2

- If the pilot and copilot are using their normal onside air data source, there is no air data annunciator. If the pilot and copilot have selected the same air data source (**ADC1** or **ADC2**) is annunciated to the upper left of the attitude sphere on both PFDs.

14 - WDSHEAR

- When the windshear detection system detects windshear, **WDSHEAR** is displayed to the upper left of the attitude sphere. The annunciator flashes for 10 seconds and then goes on steady. The annunciator is **amber** (caution) if the performance is being increased, and **red** (warning) if the performance is being decreased. If the go-around button is pushed during a windshear caution or warning, the flight director vertical flight director guidance directs the airplane.

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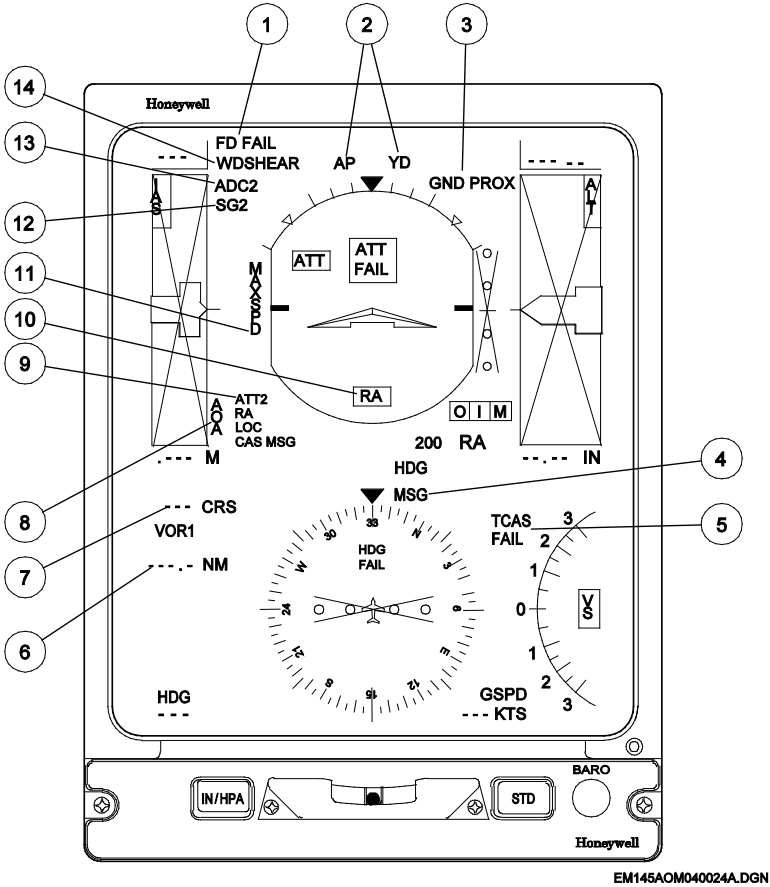

PFD WITH CAUTION ANNUNCIATORS

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WARNING ANNUNCIATORS

The red warning annunciators are described as follows:

1 - ATT FAIL

- If either the pitch or roll data fails, the pitch scale marking are removed, the attitude sphere turns cyan, and **ATT FAIL** is displayed in the attitude sphere.

2 - PULL UP

- When the EGPWS indicates a warning condition, **PULL UP** is displayed boxed in the upper right corner of the ADI sphere.

3 - AIR DATA COMPUTER FAILURE

- If the ADC fails, the rolling digit displays of airspeed and altitude are removed, the scale marking are removed and an "**X**" is drawn through the scales. If the digital Mach display fails, the digital readout is replaced with amber dashes.
- In the case of the vertical speed, the current value pointer is removed, a boxed **VS** is displayed inside the scale.

4 - VERTICAL DEVIATION FAILURE

- If the radio source driving the vertical navigation scale fails, the deviation pointer is removed and a red "**X**" is drawn through the scale. The scale and pointer are removed for invalid FMS data.

5 - COURSE DEVIATION FAILURE

- If the course deviation data fails, the CDI is removed and a red "**X**" is drawn through the scale. The course digital readout is replaced with amber dashes.

6 - HDG FAIL

- If the heading select signal fails, the heading bug is removed from the display and **HDG FAIL** is displayed inside the HSI compass. This indication is also given in the event of an invalid heading display.

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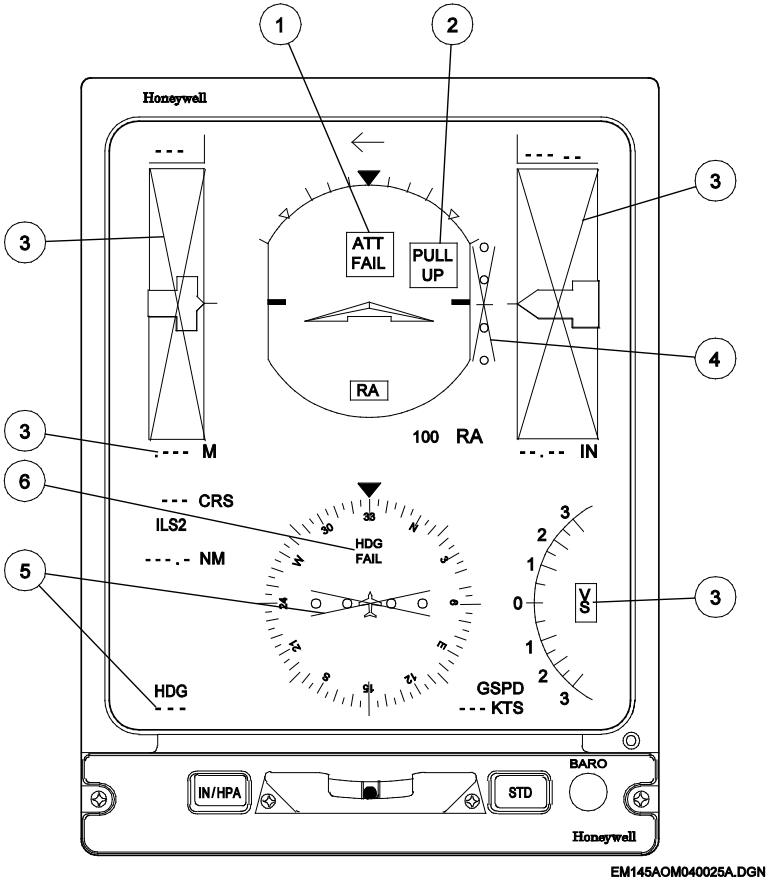

PFD WITH WARNING ANNUNCIATORS

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PFD ADDITIONAL ANNUNCIATORS

ATTITUDE DIRECTOR INDICATOR (ADI) DISPLAY AND MODE ANNUNCIATORS

1 - LATERAL FLIGHT DIRECTOR MODE ANNUNCIATORS

- The **HDG**, **VAPP**, **VOR**, **ROL**, **LOC**, **BC** and **LNAV** mode annunciators are displayed. Armed modes are displayed in white, captured modes are displayed in green and boxed in white for 7 seconds after the transition from armed to captured.

2 - VERTICAL FLIGHT DIRECTOR MODE ANNUNCIATORS

- The **VS**, **MACH**, **PIT**, **ASEL**, **TO**, **CLB**, **ALT**, **WSHR**, **SPD**, **DES**, **GS**, **IAS** and **GA** mode annunciators are displayed. Armed modes are displayed in white, while captured modes are displayed in green and boxed in white for 7 seconds after the transition from armed to captured.

3 - VERTICAL DEVIATION DISPLAY

- A **GS** in white is displayed above the vertical deviation scale when the vertical deviation is from an ILS glideslope, and a **FMS** in white is displayed when the vertical deviation is from an FMS.
- If the glideslope data is invalid, the pointer is removed and a red "X" is displayed through the scale. If the FMS data is invalid, the scale, label and pointer are removed.

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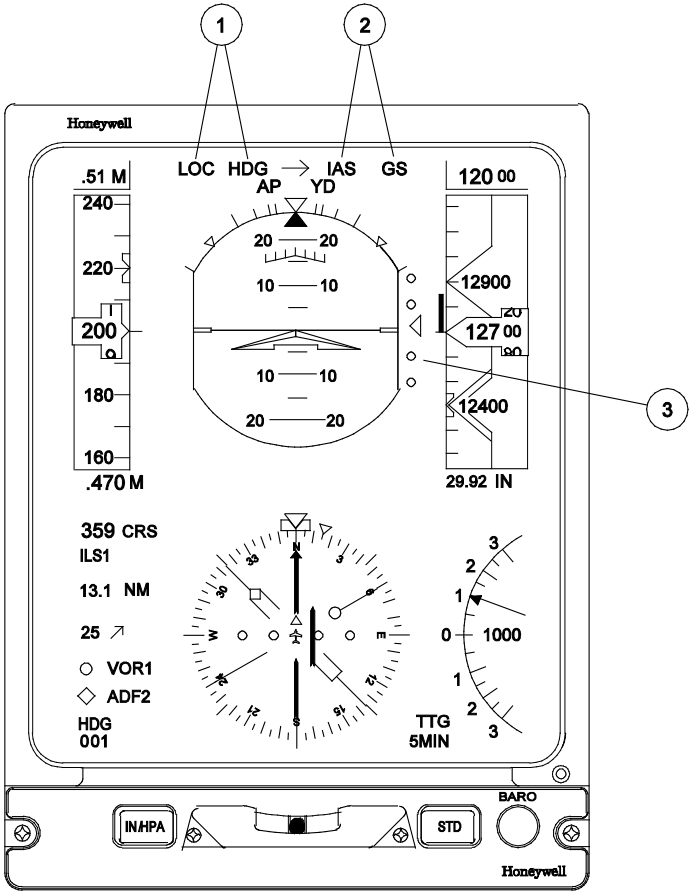

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ADI DISPLAY ON THE PFD

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1 - AUTOPILOT ANNUNCIATORS

MESSAGE	COLOR	TYPE	STATUS
AP	Green	Steady	Engaged
AP Test	Amber	Steady	Autopilot Test
AP	Amber	Flashes for 5s	Normal AP disconnect
AP	Red	Flashes for 5s then steady	Abnormal AP disconnect
AP	Red	Flashes for 5s	Abnormal AP disconnect in CAT II
TCS	White	Steady while TCS switch is pushed	Touch control steering
TKNB	Amber	Steady	TURN knob is out of detent

2 - YAW DAMPER ANNUNCIATORS

MESSAGE	COLOR	TYPE	STATUS
YD	Green	Steady	Engaged
YD	Amber	Flashes for 5s	Normal yaw damper disconnect
YD	Amber	Flashes for 5s then steady	Abnormal yaw damper disconnect

3 - FMS VERTICAL TRACK ALERT (VTA) ANNUNCIATOR

– For Universal FMS, the annunciator **VTA** is displayed in magenta flashing then steady when the FMS advisory VNAV is selected and the airplane is approaching the top of descent point.

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4 - RADIO ALTITUDE MINIMUM ALTITUDE ANNUNCIATOR

- When actual radio altitude decreases to within 100 ft of the set Decision Height value, a white box is displayed. When the actual radio altitude is equal to or less than the set value, **MIN** is displayed in amber (inside the box) and it flashes for 10s.

5 - MARKER BEACON ANNUNCIATOR

- A cyan **O** represents the outer, an amber **M** represents the middle, and a white **I** represents the inner marker. They appear inside a white box, flashing.

6 - RADIO ALTITUDE MINIMUM ALTITUDE ANNUNCIATOR

- An amber **MIN** is displayed (boxed) and flashes for 10 seconds when the actual radio altitude is equal to or less than the set value.

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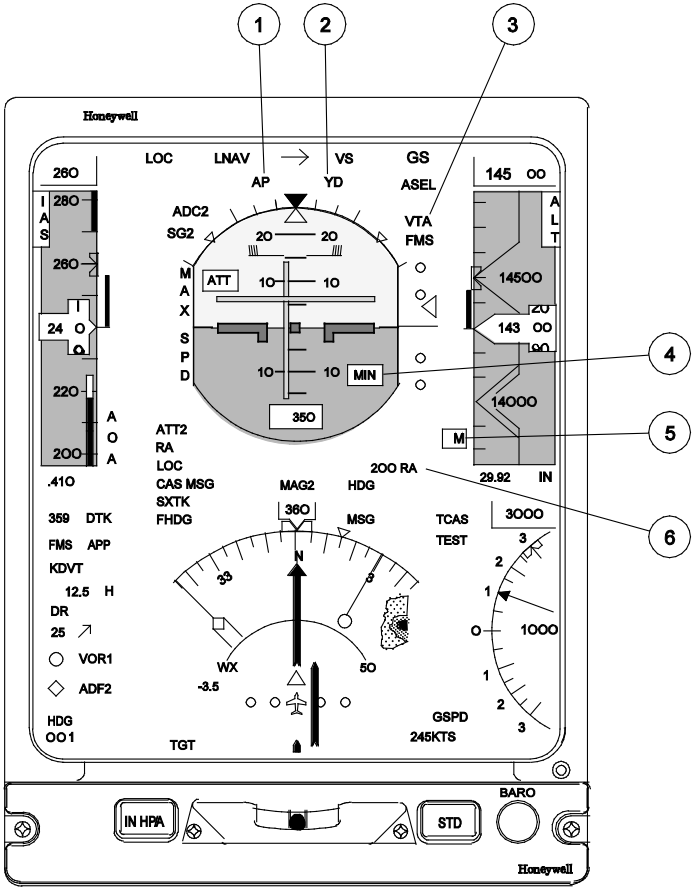

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ADI DISPLAY ON THE PFD

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1 - CAT II ANNUNCIATOR

– **CAT2** is displayed in green when the conditions for a CAT II approach are satisfied. If these conditions are met, but after lost, **CAT2** in amber flashes for 10 seconds and then goes on steady. If the localizer deviation exceeds the CAT II requirements with radio altitude less than 500 ft, the green **CAT2** turns amber and flashes.

HORIZONTAL SITUATION INDICATOR (HSI) DISPLAY

FULL COMPASS DISPLAY

The color of the course pointer, distance display, groundspeed, lateral deviation, and navigation source annunciator are green when the source selected is Short Range Navigation, magenta when FMS is selected as navigation source and yellow when the same navigation source on both sides or secondary NAV source is selected.

2 - MEASUREMENTS

– One of the annunciators **TTG** in white, **ET** in green or **GSPD** in green is displayed.

3 - BEARING POINTER ANNUNCIATORS (COPILOT)

– The **OFF**, **NAV2**, **ADF2**, **FMS** or **VOR2** bearing pointer annunciators may be displayed. If the on-side display controler fails, the default sources is VOR2 for the "◊" pointer (copilot's).

4 - BEARING POINTER ANNUNCIATORS (PILOT)

– The **OFF**, **NAV1**, **ADF1**, **FMS** or **VOR1** bearing pointer annunciators may be displayed. If the on-side display controler fails, the default sources is VOR1 for the "O" pointer (pilot's).

5 - DISTANCE DISPLAY

– The display is distance to the station for a short-range NAV and the distance to the TO waypoint for the FMS. The display range is from 0 to 409.5 NM for DME and 0 to 4096 NM for FMS. If DME hold is selected when VOR is displayed, an amber **H** is displayed.

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6 - NAVIGATION SOURCE ANNUNCIATORS

- One of the Navigation Source Annunciators **VOR1**, **VOR2**, **ILS1**, **ILS2** or **FMS** is displayed.

7 - COURSE POINTER AND DIGITAL DISPLAY

- If short range NAV is selected, the annunciator **CRS** (Course) is displayed. If long range NAV is selected, the annunciator **DTK** (Desired Track) appears.

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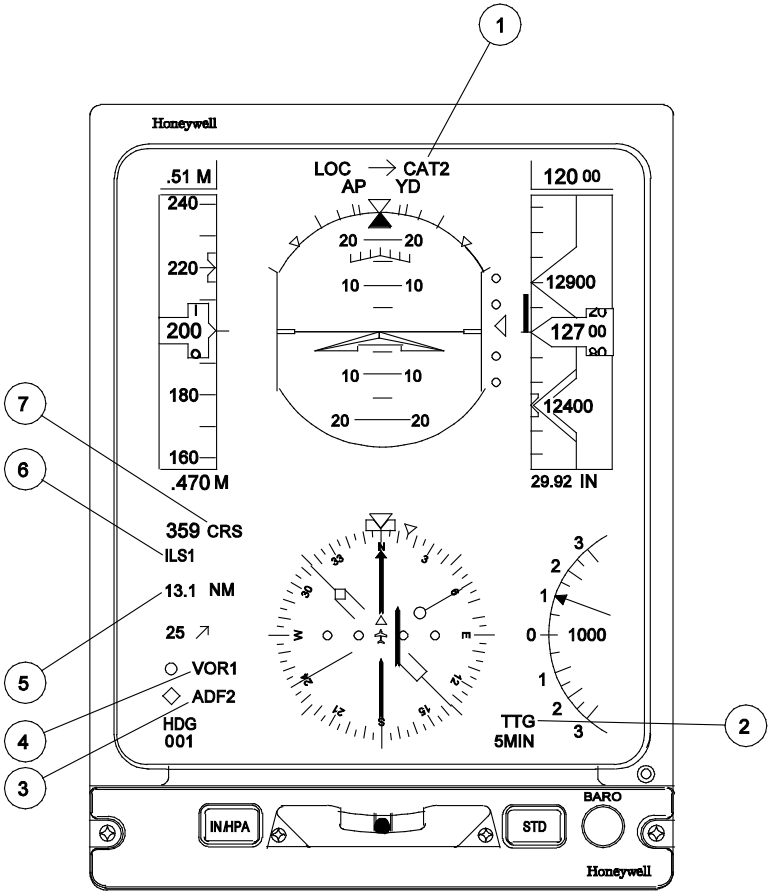

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HSI DISPLAY ON THE PFD

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COMPASS ARC DISPLAY

1 - HEADING SOURCE ANNUNCIATOR

- When the cross-side heading source is selected, or when the AHRS is in DG mode, the heading source annunciator (**FHDG**) is displayed.
- When the AHRS is in DG mode, the on-side heading source annunciators are **DG1** or **DG2** (in white). When the magnetic heading is invalid, the source annunciator is **HDG1** or **HDG2** (in amber).

2 - FMS MESSAGE AND STATUS ANNUNCIATORS

- The FMS message annunciator (**MSG**, in amber) is displayed in amber and flashes until the FMS condition is cleared.

3 - WEATHER RADAR MODE ANNUNCIATOR

The mode annunciators are described below:

ANNUNCIATOR	COLOR	R/T MODE
FPLN	green	Flight plan mode.
FSBY	green	Forced standby.
GMAP	green	Ground mapping mode.
R/T	green	RCT and turbulence (1).
RCT	green	REACT Mode.
STBY	green	Standby.
TEST	green	Test mode and no faults.
TGT	green	Target alert enabled (2).
TX	green	WX is transmitting but not selected for display, or in STBY or FSTBY (3).
WAIT	green	RTA in warm-up (4).
WX	green	Weather mode (1).
WX/T	green	Weather and turbulence (5).
FAIL	amber	RTA Fail - test mode and faults (6).
GCR	amber	Normal WX with ground clutter reduction.
STAB	amber	Stabilization off.
VAR	amber	Variable gain.

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NOTE: 1) Turbulence detection is only available on the PRIMUS® 880.

2) When target alert is enabled and a level 3 weather return is detected in the forward 15° antenna scan, **TGT** in amber is displayed.

3) **TX** is displayed in amber when the airplane is on ground and WX is transmitting, but not selected for display, or in STBY and FSTBY.

4) Early version of the P1000 annunciates **TX** in amber when the radar is in the warm up mode. In later versions the warm up is indicated by **WAIT** in green.

5) When weather radar is invalid **WX** in amber is displayed.

6) When on the ground and the weather test display is selected, weather failures are indicated by fault codes in the tilt angle field.

4 - WEATHER RADAR TGT/VAR ANNUNCIATORS

– When the target alert mode is armed, the message **TGT** in green appears. It turns amber when a potentially dangerous target is detected. This indicates that the pilot should select a higher range on the weather radar to view the target. When variable radar gain is selected, **VAR** in amber is displayed.

5 - DME HOLD ANNUNCIATOR

– If DME hold is selected when VOR is displayed, **H** in amber is displayed.

6 - FMS HEADING (FHDG) ANNUNCIATOR

– When heading guidance is supplied from the FMS, **FHDG** in magenta is displayed.

7 - FMS STATUS ANNUNCIATOR

The following FMS status annunciators are displayed in amber:

– **INTEG** (Integrity) - The GPS sensor does not meet the required integrity calculations for the current phase of flight.
– **WPT** (Waypoint) - The airplane is approaching a flightplan waypoint.
– **DR** (Dead reckoning) - The FMS is in dead reckoning mode.
– **DGR** (Degrade) - The ability of the FMS to accurately calculate airplane position is degraded.

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The following FMS status annunciators are displayed in cyan:

- **SXTK** (Crosstrack) - The airplane is off track.
- **TERM** (Terminal) - The FMS is in the terminal phase of the flightplan.
- **APP** (Approach) - the FMS is in the approach phase of the flightplan. For RNAV (FMS) approaches, the annunciator is displayed steady and for GPS approaches, the annunciator flashes for ten seconds.

The table below shows the Full-scale Deviation for FMS Terminal and Approach Modes:

ANNUNCIATOR (IN CYAN)	MODE	FULL-SCALE LATERAL DEVIATION	FULL-SCALE VERTICAL DEVIATION
APP	GPS Approach	0.3 NM	150 ft
APP (steady)	RNAV Approach	1.25 NM	150 ft
TERM	GPS Terminal	1.0 NM	500 ft

AIRSPEED DISPLAY

When the FGS enters the MAX SPEED mode, the annunciator **MAX SPEED** is displayed in amber to the left of the ADI sphere.

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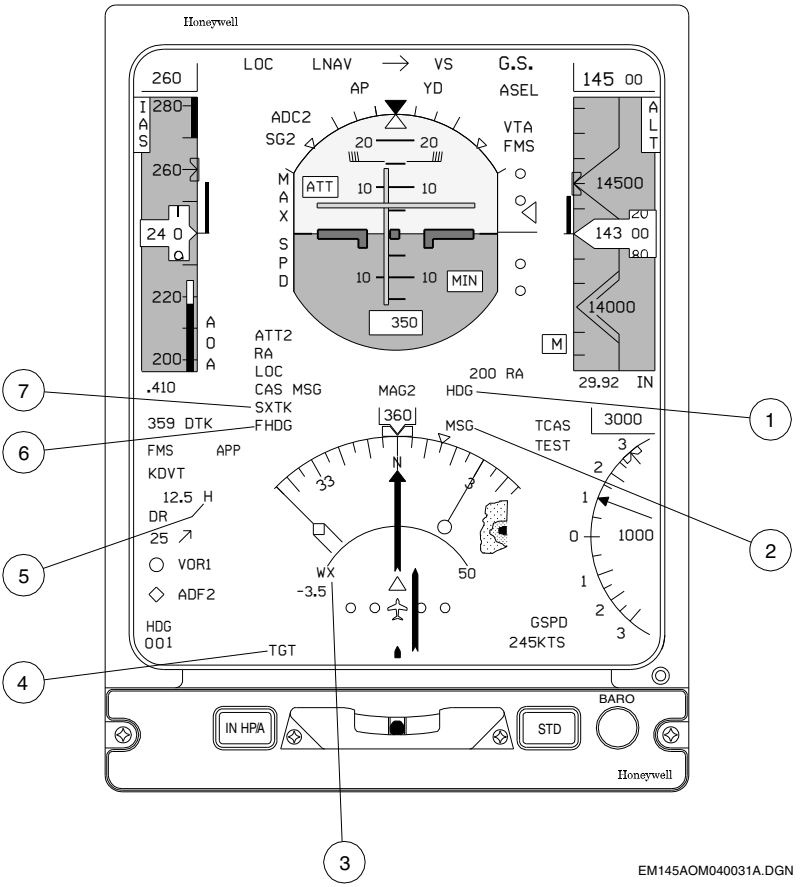

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MESSAGES ON THE PFD

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VERTICAL SPEED DISPLAY

The picture above shows the location of the annunciator described below:

1 - TCAS STATUS ANNUNCIATOR

Annunciator	Color	TCAS Status
TA ONLY	white	TCAS is in traffic advisory mode only.
TCAS OFF (1)	white	TCAS is off.
TCAS TEST	white	TCAS is in self-test.
TCAS FAIL (2)	amber	TCAS data is invalid.
RA FAIL	red	Resolution advisories are not available.

NOTE: 1) For airplanes Post-Mod. SB 145-34-0125, the TCAS OFF annunciator flashes for 10 s and remain steady displayed as long as the condition persists.

2) For airplanes Post-Mod. SB 145-34-0125, the TCAS FAIL annunciator flashes for 10 s and remain steady displayed as long as the condition persists.

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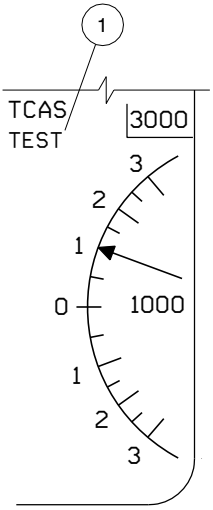

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VERTICAL SPEED DISPLAY ON THE PFD

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PFD SELF-TEST DISPLAY

To run the EFIS self-test, push and hold the TEST button on the display controller. The PFD displays the following:

- Course select, heading select, radio altitude set, distance, and groundspeed/time-to-go digital displays are replaced with amber (horizontal) dashes.
- Attitude and heading displays are flagged.
- All pointers/scales are flagged.
- All heading bugs/pointers are removed.
- Flight director command cue is removed.
- Radio altimeter digital readout displays radio altimeter self-test value.
- The comparison monitor annunciators are displayed (in amber) **ATT**, **HDG**, and **ILS** (if ILS sources are selected on both sides).
- **TEST** in magenta is annunciated to the upper left of the ADI.
- The annunciator **WDSHEAR** in red is displayed.
- Flight director mode annunciators are removed.
- Radio altitude minimum is displayed at the last set value.

NOTE: The amber annunciator **FD FAIL** is not displayed during the self test.

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AURAL WARNINGS

There are two kinds of aural warnings: voice messages and tones.

Voice messages are normally associated with warning messages on EICAS or other warning systems. They are generated whenever a potentially dangerous condition exists, as determined by the GPWS, TCAS and windshear detection system. There are some voice messages that can be cancelled, but others can only be cancelled when the cause that triggered them has been eliminated.

Tones have different forms and indicate some notable airplane events, sometimes in unison with voice messages.

AURAL WARNING UNIT

In order to generate messages and tones, the Aural Warning Unit (AWU) receives signals from the following airplane systems:

– TCAS;
– Windshear detection system;
– GPWS;
– IC-600;
– Fire detection system;
– Stall protection system;
– Trims;
– Flaps;
– Brakes;
– Spoilers;
– Radio altimeter;
– Autopilot;
– Landing gear;
– ADC;
– Pressurization;
– SELCAL.

The AWU sends the appropriate audio signal to an audio digital system, which routes the messages to the appropriate speakers.

AWU POWER SOURCE

The AWU is supplied by one DC bus and one Essential DC bus, and is provided with two channels, A and B. Channel B is kept as a backup for channel A, and is automatically activated should channel A fail.

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AWU POWER-UP TEST

An AWU power-up test is performed and generates aural warnings for one or both channels operating normally. If both channels have failed, the caution message AURAL WARN FAIL is displayed on EICAS.

AURAL WARNINGS LEVELS

The aural warnings are classified into four levels, presented below in a decreasing level order:

– **Emergency** - Associated with situations that may be hazardous. AWU generates a master warning tone (triple chime) before the warning and voice message may be generated. In any case, the aural warning is repeated every second until deactivated through the master warning button or until the condition that generated the warning has been eliminated.

– **Abnormal** - Associated with malfunctions or failures. AWU generates a master caution tone (single chime) every five seconds, until it is removed, canceled or replaced by a higher priority aural warning. Voice messages are generated after each tone.

– **Advisory** - Associated with minor malfunctions or failures that lead to loss of redundancy or degradation of the affected system's performance.

– **Information** - A remarkable event has occurred.

AURAL WARNINGS ANNUNCIATION PRIORITY

When multiple aural warnings are active, aural warnings among the highest level alert groups shall be sounded first in order and repeated. Once all alerts in the higher group are cancelled or removed, then the second tier group alerts are sounded and repeated.

An alert in process shall be immediately interrupted when an alert of a higher priority needs to be generated.

EXCEPTIONS TO AURAL WARNINGS PRIORITY

When an internal voice message is being annunciated, it shall be completed before another alert, even of a higher priority, is annunciated. This does not apply to internally generated tones which shall be interrupted within 1 second.

If an emergency arises together with a warning that generates continuous sounds, such as a fire or stall, the sound volume is reduced to avoid misunderstanding of the remaining messages, although being loud enough to still warn pilots.

The master warning tone is inhibited when any other emergency alert (internal or external) is occurring at the same time.

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LEVEL	ASSOCIATED CONDITION/EICAS MESSAGE	PRIORITY	TONE	VOICE MESSAGE	CANCEL
EMERGENCY	Stall condition.	1	Clacker	None	NO
	Windshear condition (1).	2	None	WINDSHEAR	NO
	Ground proximity condition (1).	3	(1)	(1)	NO
	Traffic proximity condition (1).	4	None (3)	(1)	NO (2)
	Fire in engine or APU. ENG 1 (2) FIRE , APU FIRE.	5	Bell	None	YES
	Airspeed above V_{MO} or M_{MO}.	6	Attenson 3	HIGH SPEED	NO
	Landing gear not locked down for landing.	7	Attenson 3	LANDING GEAR	NO
	Cabin altitude above 10000 ft (Normal Mode Operation). or Cabin altitude above 14500 ft (HI ALT Mode Operation - only for airplanes equipped with HI ALT system).	8	Attenson 3	CABIN	YES
	Associated with takeoff configuration warning.	9	Attenson 3	TAKEOFF plus one of the following: -FLAPS -TRIM -SPOILER -BRAKES	NO
	Associated with emergency failures.	10	Attenson 3	None	NO
ABNORMAL	Associated with glide slope deviation.	None	None	GLIDE SLOPE	YES
	Traffic proximity condition.	None	None (3)	TRAFFIC	YES
	Associated with abnormal failures.	None	Master Caution Tone	None	YES

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NOTE: 1) Messages are generated outside the AWU. For further details, refer to the associated system description.

2) TCAS resolution advisory warning can not be canceled.

3) For airplanes Post-Mod. SB 145-34-0046 and Post-Mod. SB 145-31-0028 or with an equivalent modification factory incorporated.

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LEVEL	ASSOCIATED CONDITION/EICAS MESSAGE	PRIORITY	TONE	VOICE MESSAGE	CANCEL
ADVISORY	Autopilot disengagement during approach.	None	None	AUTOPILOT	NO (1)
	Associated with decision height crossing.	None	None	MINIMUM	NO
	Airplane is crossing or has reached a preselected altitude.	None	(4)	None	NO
	Airplane altitude more than 200 ft above or below the selected.	1	Horn	None	Not applicable
INFORMATION	Power up test detected a failure in one channel of AWU.	Not applicable	None	AURAL UNIT ONE CHANNEL	NO
	Associated with incorrect command of pitch trim main or backup channel switches.	None	Single chime	TRIM (2)	NO
	Associated with SELCAL callings.	None	None	SELCAL	NO
	Both AWU channels are operating normally on power up test.	None	None	AURAL UNIT OK	NO
	Takeoff configuration test successful.	None	None	TAKEOFF OK	NO
	Power 1 or 2 fail.	None	None	AURAL UNIT ONE POWER	Not applicable
	When CMU receives a new message.	None	None	INCOMING CALL (3)	NO

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NOTE: 1) For Post-Mod. SB 145-22-0001 airplanes or S/N 145001 through 145003, 145041 and on, the voice message can be cancelled (refer to Section 2-19 Autopilot for further information).

2) Applicable to airplanes equipped with HSCU-1009 or -5009 and AWU-5.

3) For airplanes Post-Mod. SB 145-23-0028.

4) For airplanes equipped with AWU-5, the altitude alerter is three 2900 Hz tones.

For airplanes Post-Mod. SB 145-31-0051 (equipped with AWU-6) or with an equivalent modification factory incorporated, the tone is a single C CHORD.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
CAUTION	AURAL WARN FAIL	Both AWU channels are inoperative.

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TAKEOFF CONFIGURATION WARNING

A dedicated aural warning sounds to indicate that airplane configuration is unsuitable for takeoff. Such aural warning is activated whenever the airplane is on the ground, any thrust lever angle is above 60° and at least one of the following conditions is met:

- Flaps are not in takeoff position.
- Parking brakes are applied.
- Pitch trim is out of the green range.
- Any spoiler panel is deployed.

More than one aural warning may be generated, if more than one condition are met.

TEST BUTTON

A test button is provided to allow checking the takeoff configuration warning integrity, by simulating power levers advanced. A voice message is generated after successful tests. Unsuccessful tests will generate an EICAS message and a voice message associated with the out-of-configuration item.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
WARNING	NO TAKEOFF CONFIG	Airplane is not in takeoff configuration.

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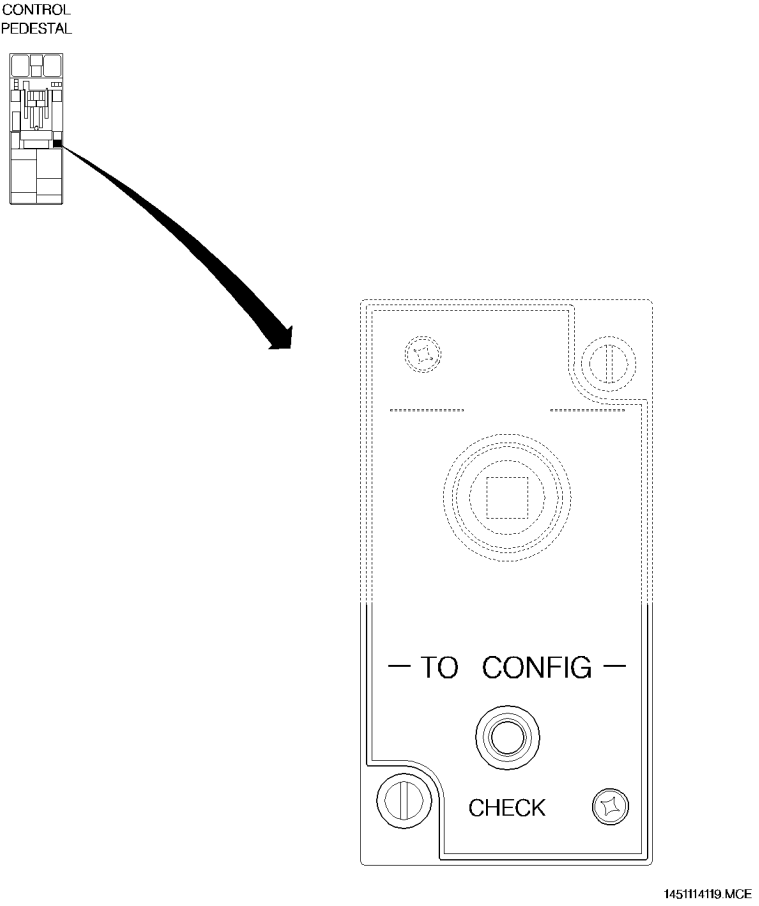
CONTROLS AND INDICATORS

1 - TAKEOFF CONFIGURATION CHECK BUTTON

– Allows checking the takeoff configuration warning.



TAKEOFF CONFIGURATION CHECK BUTTON

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STALL PROTECTION SYSTEM

GENERAL

To help detect imminent stalls and to avoid stalling the airplane, the EMB-145 is provided with a Stall Protection System (SPS). The SPS is composed of one computer box with two independent channels, the SPS panel, two Angle of Attack (AOA) sensors, two stick shaker actuators, and one stick pusher actuator. The system provides sensitive, visual and aural indications of an impending stall. To avoid spurious actuation, the SPS receives signals from many airplane systems, thus correcting its set point according to flaps and landing gear position, icing and windshear conditions and Mach number.

At higher altitudes, the stall protection system advances its set point to cope with compressibility effects. Therefore, the stall is always defined by the pusher activation, regardless of the altitude. The basic difference between lower and higher levels is that at higher altitudes the pusher and the shaker speeds are higher due to above mentioned stall protection set point advance, preserving the stall margin.

INTERFACES

Each channel receives data from the following on-side airplane systems: AHRS or IRS, ADC, flaps, landing gear, air/ground, windshear detection, ice detection and radio altimeter. Each Stall Protection Computer (SPC) channel receives information from its associated AOA sensor and sends it to the opposite channel in order to compensate side slip influence on angle of attack measurements. A locked AOA sensor signal is not considered in stall calculations and in this case the channel will be deactivated. If a stall condition is imminent, the system first actuates the stick shaker and disengages the autopilot. If no corrective action is taken and the airplane is on the verge of entering a stall, the stick pusher is actuated, which pitches the nose down. Simultaneously, a clacker is generated in the aural warning system.

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A bug in the airspeed scale on the PFD indicates the stall speed for the associated condition and a pitch limit indicator is presented on EADI to indicate the current margin to the stick shaker angle. When the airplane reaches 0.5 g, the stick pusher is inhibited, stopping its actuation over the control column. A quick disconnect button is provided in the control wheel to permit pilots to cut the system if the need arises. To disconnect the system in case of failure, the SPS panel provides one cutout button for each channel. An EICAS message is presented to indicate that the system has failed or is cutout.

EICAS displays the SPS/ICE SPEEDS message to indicate that the Ice Detection/SPS interface logic (Ice Compensation) is active, and consequently the SPS will actuate at reduced angle of attack values for flaps 9°, 18° and 22°.

NOTE: The first in-flight ice detection, by any ice detector, activates the ice compensation.
- The ice compensation is inhibited during 5 minutes after takeoff.
- The ice compensation is reset only on the ground, by pressing the SPS Test Button.

SYSTEM INHIBITION

The stick pusher does not actuate in the following conditions:
- On the ground (except during test).
- Below 0.5 g.
- If the quick disconnect button is pressed (except for JAA certification).
- Below 200 ft AGL. If radio altimeter has failed, this condition reverts to a 10-second delay after takeoff.
- If any cutout buttons are released.
- Above 200 KIAS.
- If at least one channel is inoperative.

SYSTEM TEST

A test button is provided to test the system on the ground. The system operates normally if not tested. Test button remains illuminated if the system has not been tested or after unsuccessful tests. It is not possible to test the system in flight. This inhibition is valid for 30 seconds after landing, above 70 KIAS or with landing gear not downlocked.

NOTE: Test button remains illuminated if quick disconnect button is pressed during test.

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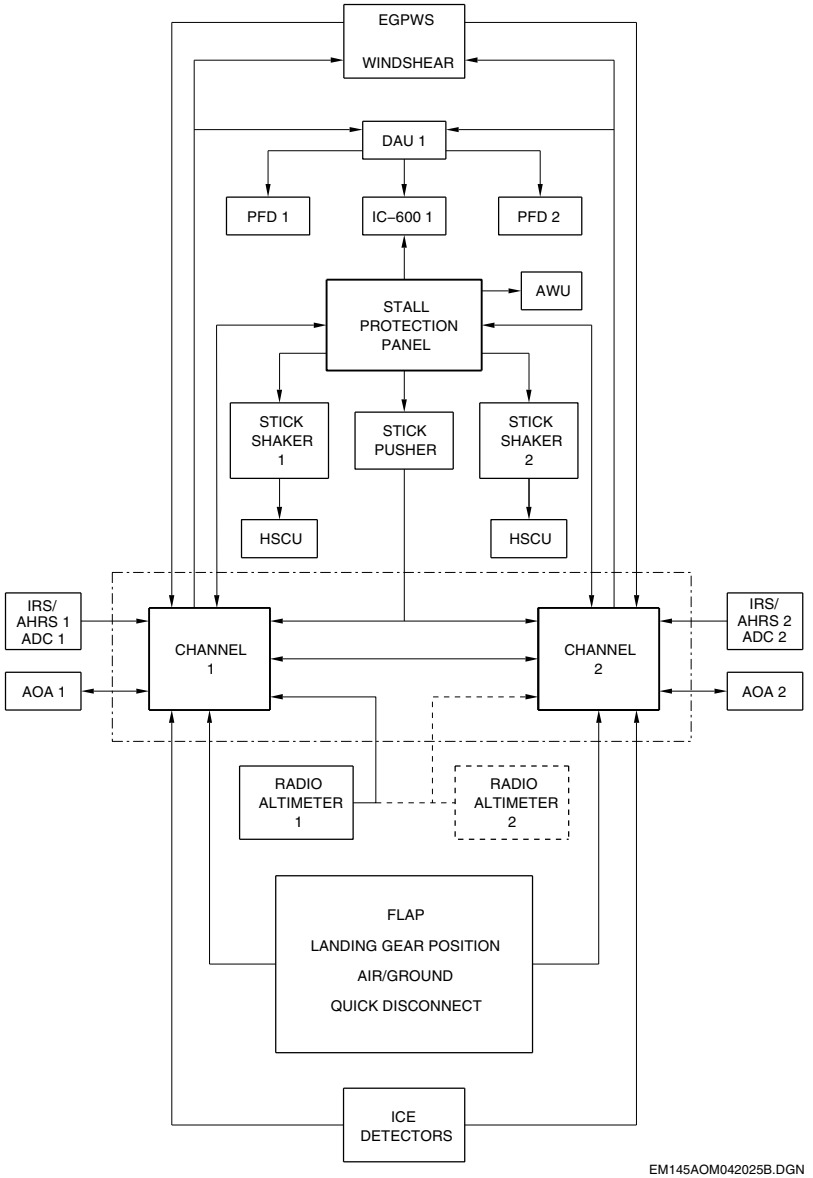

STALL PROTECTION SYSTEM SCHEMATIC

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
WARNING	SPS 1(2) INOP	Associated SPS computer channel has failed or AOA vane failed.
	SPS 1-2 INOP	Both SPS computer channels have failed or both AOA vanes have failed or stick pusher has failed or is cutout.
CAUTION	SPS ADVANCED	Stick shaker and pusher actuation is set to higher speeds due to: – Flap signal disagreement. – Failure in at least one SPS channel. – AHRS or ADC parameters disagree. – Air/Ground signs disagree. – Landing gear down and locked indications disagree.
	STICK PUSHER FAIL	Stick pusher actuator has been commanded but has not moved.
ADVISORY	SPS/ICE SPEEDS	SPS actuation angle is advanced for flaps 9°, 18° and 22°.

NOTE: Advisory SPS/ICE SPEEDS messages are inhibited for the first 5 minutes after takeoff.

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CONTROLS AND INDICATORS

STALL PROTECTION SYSTEM PANEL

1 - CUTOUT BUTTON (GUARDED)

- Cuts out the associated channel.
- A striped bar illuminates inside the button to indicate that it is in the cutout position.

2 - TEST BUTTON

- Starts the test sequence, as follows:
  - Button illuminates.
  - Both stick shakers actuate.
  - Pusher actuates.
  - Button illumination extinguishes.

  NOTE: - Test sequence is completed within a maximum of 5 seconds.
  - The TEST button must be released at the first sign of stick shaker actuation.
- Button is kept illuminated after an unsuccessful test or if the system has not been tested.

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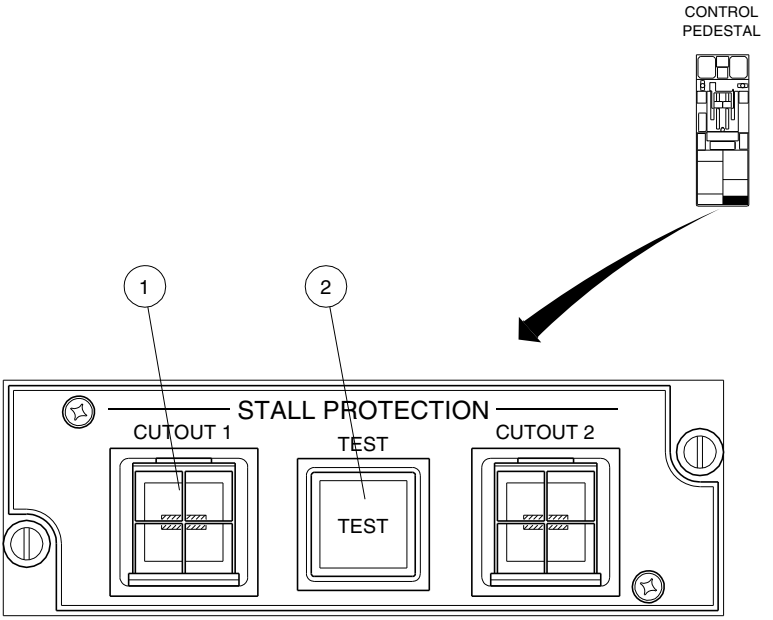

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STALL PROTECTION SYSTEM PANEL

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PFD INDICATIONS

1 – PITCH LIMIT INDICATOR

- Displayed on the EADI parallel to the airplane symbol.
- Indicates the remaining margin left for the stick shaker angle of attack set point.
- Indication is presented whenever the margin reaches 10°.
- Color:
  - green for margin from 10° up to 5°.
  - amber for margin between 5° and 2°.
  - red for margin below 2°.

Pitch Limit Indicator as well as the pusher and shaker firing angles are corrected for mach compensation at higher altitudes or excessive AOA rate.

2 - LOW AIRSPEED AWARENESS

- Displayed in the airspeed scale when airspeed is near stall speed for the current configuration.
- For further details on Low Airspeed Awareness, refer to Section 2-17–Flight Instruments.

Low speed awareness cue computation is not corrected for mach compensation at higher altitudes or excessive AOA rate.

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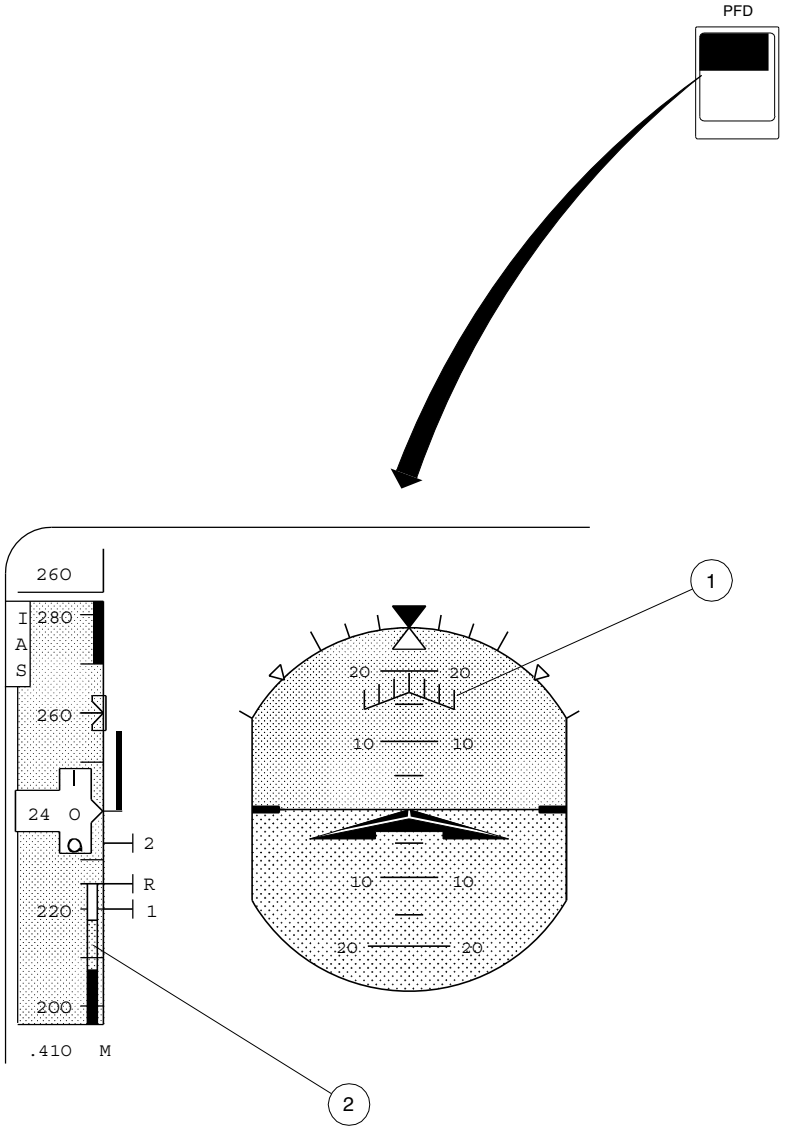

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PRIMARY FLIGHT DISPLAY

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GROUND PROXIMITY WARNING SYSTEM

The purpose of the Ground Proximity Warning System (GPWS) is to avoid accidents caused by Controlled Flight Into Terrain (CFIT) and also severe windshear.

The GPWS is based on radio altitude (“look down”) information. Some airplanes may be optionally equipped with the Enhanced Ground Proximity Warning System (EGPWS). The EGPWS incorporates GPWS functions with additional features like Terrain Clearance Floor, Terrain Look Ahead Alerting and Terrain Awareness Display. These functions use airplane geographic position, airplane altitude and an internal terrain database to predict potential conflicts between the airplane's flight path and terrain, and to provide graphic displays of the conflicting terrain.

NOTE:
- Unless otherwise indicated, the system description below is applicable to the GPWS and to the EGPWS.
- Airplanes equipped with EGPWS version 216 and on incorporates additional features like Peaks Mode, Runway Field Clearance Floor, Obstacle Alerting and Geometric Altitude.

The GPWS/EGPWS is a useful navigation aids when flying at low altitude, generally within 2500 ft above terrain. It provides voice messages, EICAS message and PFD indication (EGPWS only) to alert the flight crew, so that they may take appropriate action.

The GPWS/EGPWS interfaces with the followings systems and equipment:

- Radio Altimeter - The radio altimeter provides altitude above ground, how fast the altitude decreases as a result of airplane sinkage or ground profile change and the validity signal.
- IC-600s - The IC-600s provide glideslope deviation, localizer deviation, selected decision height, selected course, packed discrete and selected terrain range.
- ADCs - The ADCs provide uncorrected barometric altitude, corrected barometric altitude, computed airspeed, true airspeed, barometric altitude rate and static air temperature.
- AHRSs/IRS - The AHRSs/IRS provide magnetic heading, pitch and roll angle, longitudinal and normal acceleration.

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– FMS - The FMS provides latitude, longitude, ground speed, true tracking, true heading and NAV mode. The same is applicable when the airplane is equipped with dual FMS.
– GPS - The GPS provides latitude, longitude and altitude.
– Landing gear - The landing gear provides a discrete signal that indicates gear down/locked condition.
– Flap - The Flap Control Unit provides one discrete signal that indicates whether or not flaps are in landing position.
– AWU - The AWU receives the aural messages to be enunciated. It also provides a discrete signal to indicate that the glideslope advisory alert may be canceled without any restriction.
– Terrain Inhibit Switch - It is used in approach mode, in airports not covered by an EGPWS database, assuring protection against unwanted terrain alerts.

Some modes may have their associated envelopes shifted, so as to suit particular airport requirements or to avoid nuisance warnings under some flight situations. This feature is achieved either with calculations or data provided by the FMS, if installed.

The GPWS/EGPWS provides alerts associated with the following flight conditions:

– Mode 1 - Excessive descent rate.
– Mode 2 - Excessive closure rate to terrain.
– Mode 3 - Altitude loss after takeoff.
– Mode 4 - Insufficient terrain clearance.
– Mode 5 - Excessive deviation below glideslope beam.
– Mode 6 - Callouts.
– Mode 7 - Windshear (refer to Section 2-04-35).
– Terrain Awareness Alerting and Warning (EGPWS mode only).
– Terrain Clearance Floor (EGPWS mode only).

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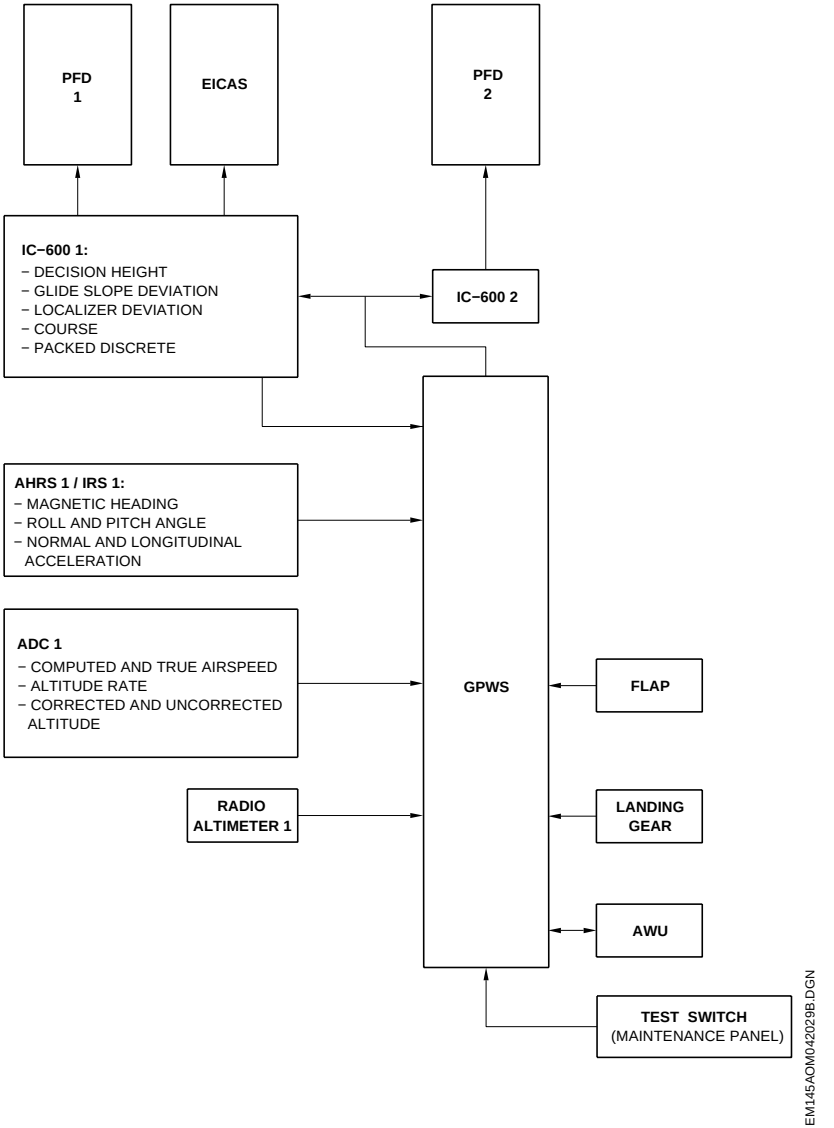

GPWS SCHEMATIC

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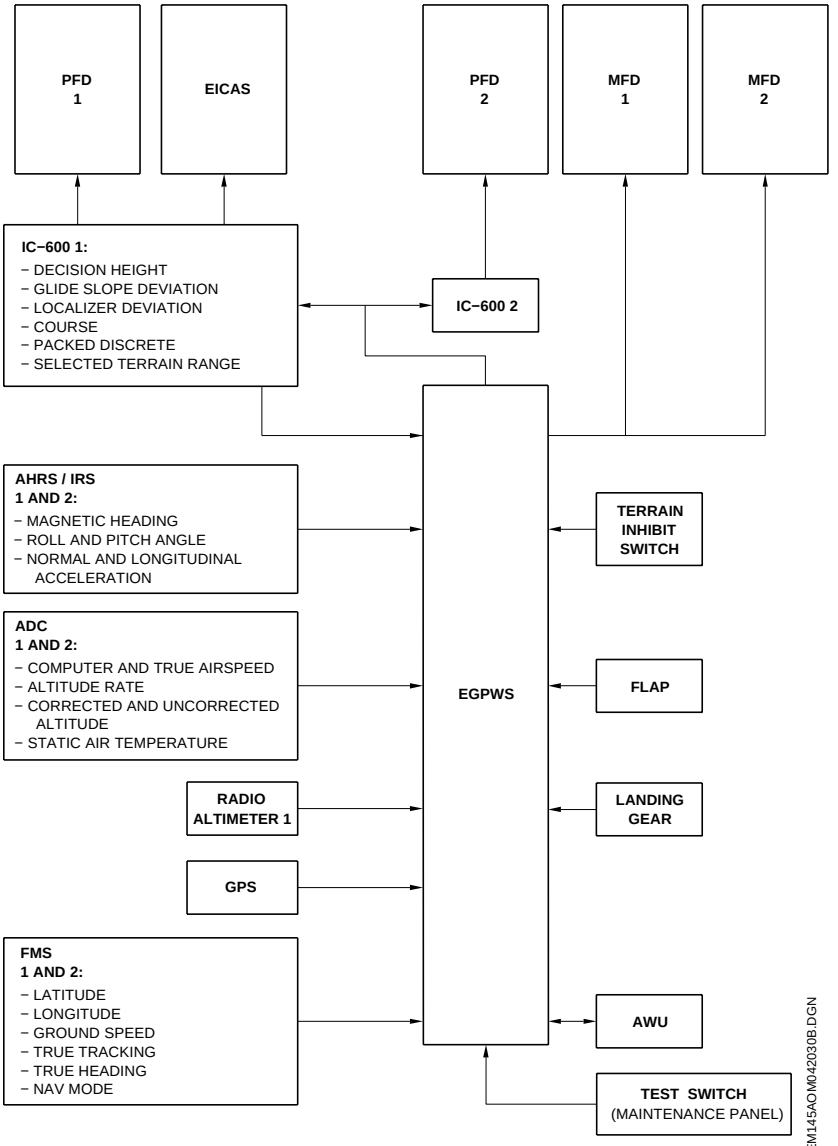

EGPWS SCHEMATIC

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MODES AND MESSAGES

MODE 1 - EXCESSIVE DESCENT RATE

Mode 1 provides alerts and warnings when the airplane has attained an excessive descent rate in respect to altitude above ground level (AGL) during the descent and approach phases of flight.

This mode has outer (sink rate) and inner (pull up) alert/warning boundaries:

Minimum Terrain Clearance (MTC) for “SINK RATE” message triggering:

- Minimum: 30 ft at 1000 ft/min of descent Altitude Rate.
- Maximum: 2450 ft at 5007 ft/min or greater of descent Altitude Rate.

Minimum Terrain Clearance (MTC) for “WHOOP WHOOP PULL UP” or “PULL UP” message triggering:

- Minimum: 30 ft at 1710 ft/min of descent Altitude Rate.
- Maximum: 2450 ft at 7125 ft/min or greater of descent Altitude Rate.

Penetration of the outer (sinkrate) boundary will result in:

- Aural message “**SINK RATE**”. The message will be repeated as long as the penetration increases; and
- "**GPWS**" warning message on EICAS for airplane equipped with GPWS; or
- Amber "**GND PROX**" indication on the PFD for airplane equipped with EGPWS.

Penetration of the inner (pull up) boundary causes the repeated aural message until the condition is cleared, as follows:

- Aural message “**WHOOP WHOOP PULL UP**” and "**GPWS"** warning message on EICAS for airplanes equipped with GPWS; or
- Aural message “**PULL UP**” and red "**PULL UP**" indication on the PFD for airplanes equipped with EGPWS.

If a valid ILS Glideslope front course signal is received and the airplane is above the glideslope centerline, the sinkrate boundary is adjusted to prevent unwanted alerts when the airplane is safely capturing the glideslope.

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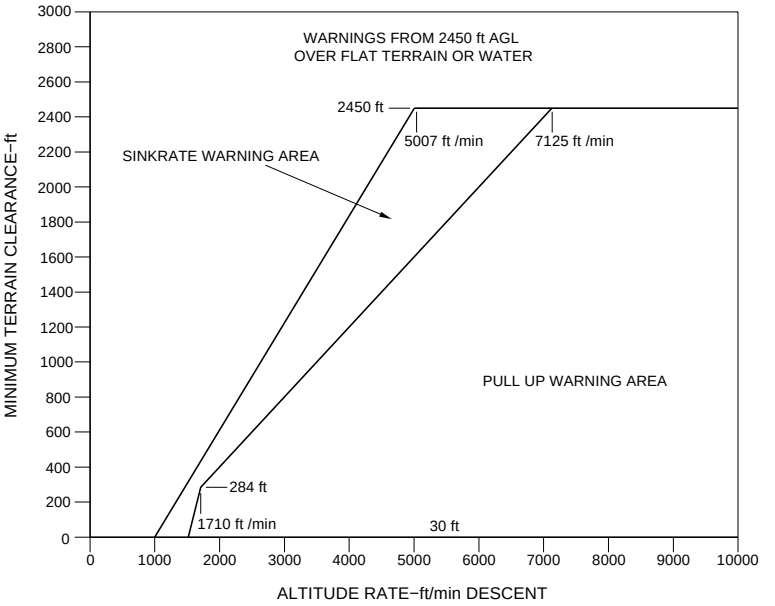
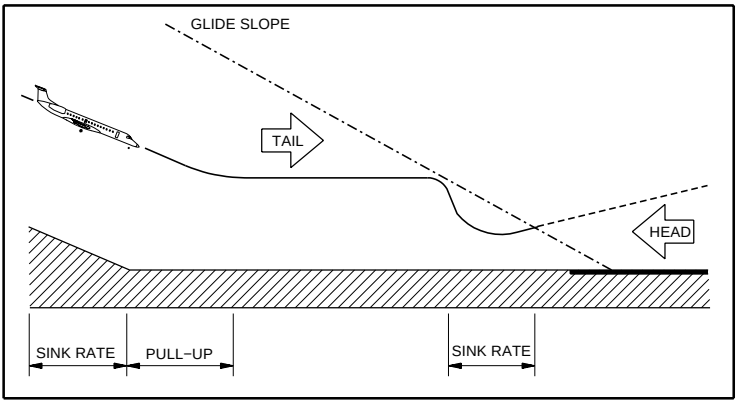
MODE 1 EXCESSIVE DESCENT RATE





GPWS/EGPWS MODE 1 SCHEMATIC

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MODE 2 - EXCESSIVE CLOSURE RATE TO TERRAIN

Mode 2 provides alerts and warnings based on airspeed, airplane gear/flap configuration, radio altitude, and excessive closure rate to terrain. Mode 2 exists in two forms: 2A and 2B.

MODE 2A

Mode 2A is selected when the flaps are not in landing configuration and the airplane is not on the glide slope beam.

Minimum Terrain Clearance (MTC) for "**TERRAIN TERRAIN"** message triggering:

- Minimum: 30 ft at 2038 ft/min of Closure Rate.
- Maximum:
  - 1650 ft at 5733 ft/min or greater of Closure Rate, for an airspeed equal or below 220 KIAS.
  - 2450 ft at 9800 ft/min or greater of Closure Rate for an airspeed equal or above 310 KIAS.

If the airplane penetrates the Mode 2A envelope, the situation results in:

- Aural message "**TERRAIN, TERRAIN**" ; and
- "**GPWS**" warning message on EICAS for airplanes equipped with GPWS; or
- Amber "**GND PROX**" indication on the PFD for airplanes equipped with EGPWS.

If the airplane continues to penetrate the envelope, the aural message switches to messages described below, until the condition is cleared:

- Aural message "**WHOOP WHOOP PULL UP**" and "**GPWS**" warning message on EICAS for airplanes equipped with GPWS; or
- Aural message "**PULL UP**" and red "**PULL UP**" indication on the PFD for airplanes equipped with EGPWS.

The visual and aural messages will remain on until the airplane has gained 300 ft of barometric altitude.

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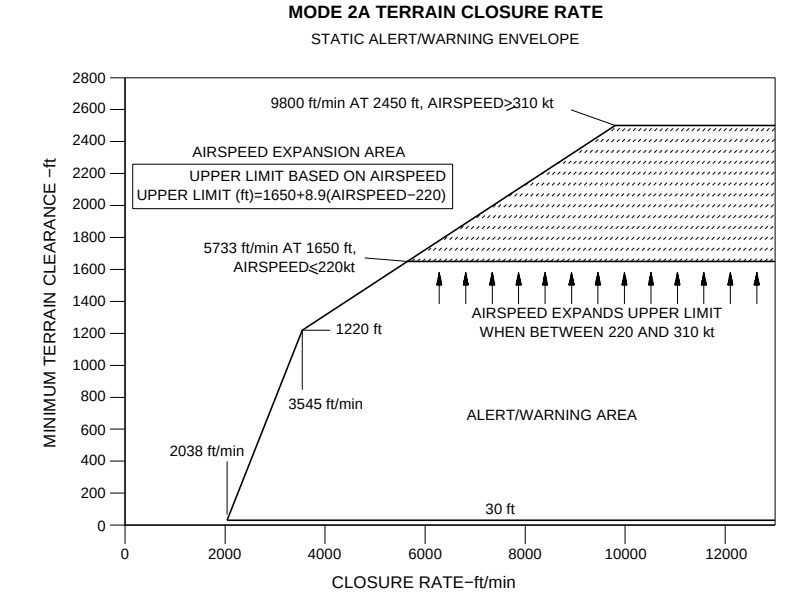

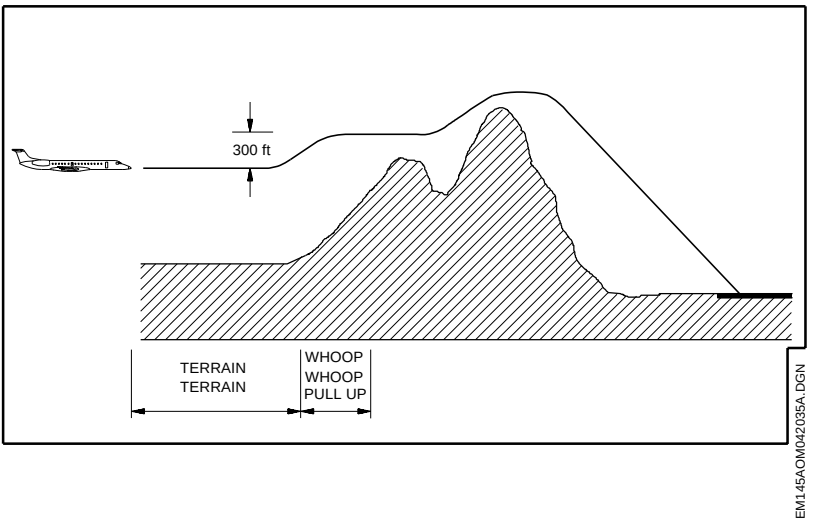

GPWS/EGPWS MODE 2A SCHEMATIC

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MODE 2B

Mode 2B is selected when the flaps are in landing configuration or when making an ILS approach with glide slope and localizer deviations below 2 dots.

Minimum Terrain Clearance (MTC) for "**TERRAIN TERRAIN"** message triggering:

- Minimum: 30 ft at 2038 ft/min of closure rate.
- Maximum:
  - 789 ft at 3000 ft/min or greater of closure rate. This steady value can also vary from 200 ft up to 600 ft for flaps set to landing configuration.

If the airplane penetrates the Mode 2B envelope with both gear and flaps in the landing configuration, the message "**TERRAIN**" is sounded.

If the airplane penetrates the mode 2B envelope with either the landing gear UP or flaps not in landing configuration will result in:

- Aural message "**TERRAIN, TERRAIN**" ; and
- "**GPWS**" warning message on EICAS for airplanes equipped with GPWS; or
- Amber "**GND PROX**" indication on the PFD for airplanes equipped with EGPWS.

If the airplane continues to penetrate the envelope, the aural message switches to messages described below, until the condition is cleared:

- Aural message "**WHOOP WHOOP PULL UP**" and "**GPWS**" warning messageon EICAS for airplanes equipped with GPWS; or
- Aural message "**PULL UP**" and red "**PULL UP**" indication on the PFD for airplanes equipped with EGPWS.

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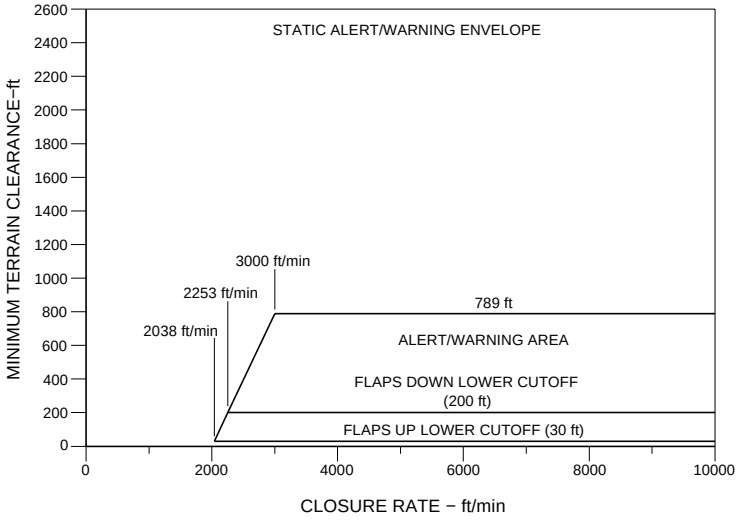
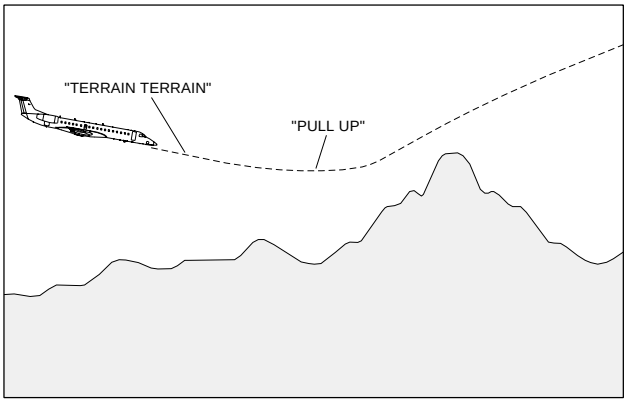
MODE 2B TERRAIN CLOSURE RATE





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GPWS/EGPWS MODE 2B SCHEMATIC

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MODE 3 - ALTITUDE LOSS AFTER TAKEOFF

Mode 3 provides alerts and warnings for a significant altitude loss after takeoff with landing gear UP or flaps in other than landing configuration. The amount of altitude loss required to trigger the warning depends on the height of the airplane above the terrain.

Minimum Terrain Clearance (MTC) for "**DON'T SINK, DON'T SINK**" message triggering:

- Minimum: 30 ft at 5 ft of altitude loss.
- Maximum: 1500 ft at 143 ft or greater of altitude loss.

Significant altitude loss after takeoff or during a low altitude go-around activates the aural message "**DON'T SINK, DON'T SINK**" and:

- "**GPWS**" warning message on EICAS for airplanes equipped with GPWS; or
- Amber "**GND PROX**" indication on the PFD for airplanes equipped with EGPWS.

The audio message is only annunciated twice, unless excessive altitude loss continues to accumulate.

Once triggered, the visual message can only be cancelled achieving a positive rate of climb relative to the original altitude. Therefore, as long as the original altitude is not crossed, any descent will trigger the aural and visual messages again. After crossing the original altitude, a new altitude value is set every moment.

NOTE: For airplanes Post-Mod. SB 145-34-0088 or equipped with an equivalent modification factory incorporated, there is a time-delay of 10 seconds to inhibit the generation of the "**DON'T SINK, DON'T SINK**" aural message in the transition from landing to take-off configuration, during a go-around maneuver.

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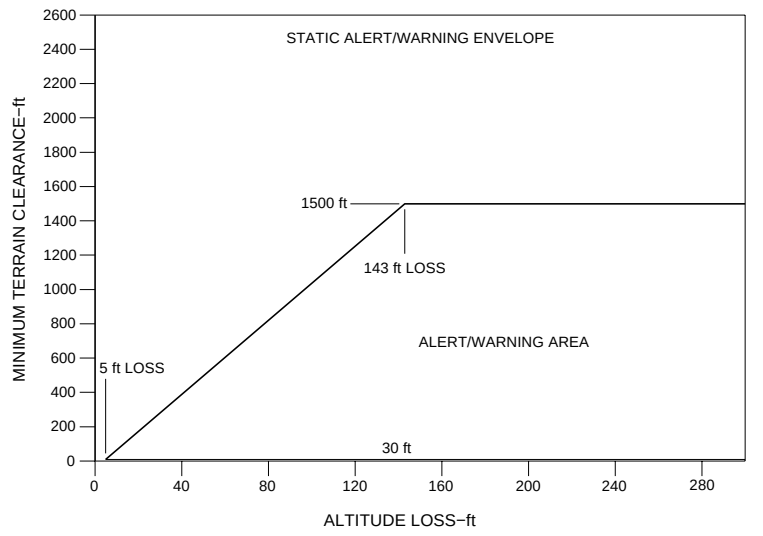

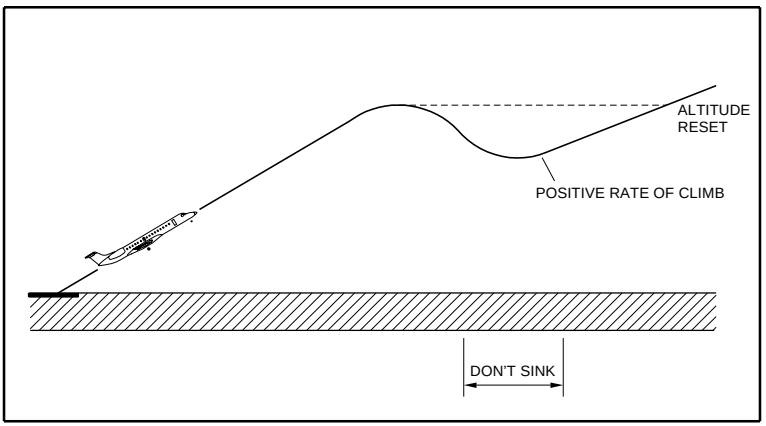

GPWS/EGPWS MODE 3 SCHEMATIC

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MODE 4 - INSUFFICIENT TERRAIN CLEARANCE

Mode 4 provides alerts for insufficient terrain clearance with respect to phase of flight and speed. Mode 4 exists in three forms, 4A, 4B and 4C.

MODE 4A

Mode 4A is active during cruise and approach with the landing gear UP.

Minimum Terrain Clearance (MTC) for "**TOO LOW GEAR**" message triggering:

- Minimum: 30 ft.
- Maximum: 500 ft for an airspeed equal or less than 190 KIAS.

Minimum Terrain Clearance (MTC) for "**TOO LOW TERRAIN"** message triggering:

- Minimum: 30 ft.
- Maximum: 1000 ft for an airspeed equal or higher than 250 KIAS.

If during cruise the ground is slowly getting closer and the airplane is not in the landing configuration or during approach with an unintentional gear up landing, the aural message "**TOO LOW TERRAIN**" will be sounded. Once the message has been issued, an additional 20% altitude loss is required for the issuing of a new message.

The "**GPWS"** warning message is displayed on EICAS for airplanes equipped with GPWS and the amber "**GND PROX"** indication on the PFD for airplanes equipped with EGPWS.

If the airplane penetrates below the 500 ft AGL boundary with the landing gear still up, the aural message will be **"TOO LOW GEAR".** Once a message is issued, an additional 20% altitude loss is required for the issuing of a new message.

The visual and aural messages cease when the mode 4A is exited.

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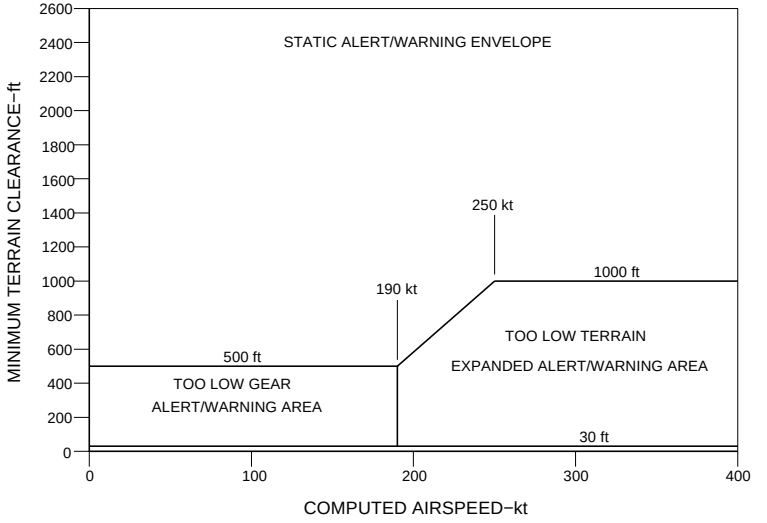
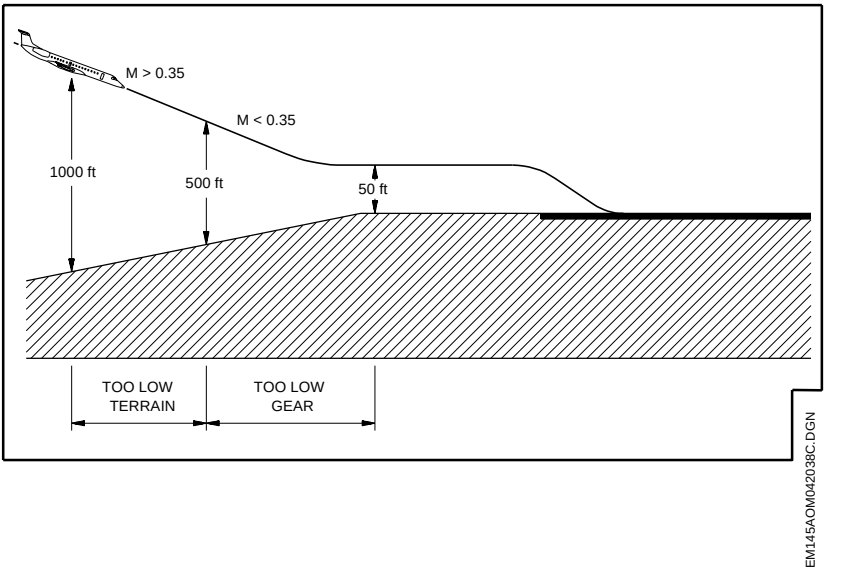
MODE 4A MINIMUM TERRAIN CLEARANCE





GPWS/EGPWS MODE 4A SCHEMATIC

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MODE 4B

Mode 4B is active during cruise and approach with the landing gear down and flaps in other than landing configuration.

Minimum Terrain Clearance (MTC) for "**TOO LOW FLAPS**" message triggering:

- Minimum: 30 ft.
- Maximum: 245 ft for an airspeed equal or less than 159 KIAS.

Minimum Terrain Clearance (MTC) for "**TOO LOW TERRAIN"** message triggering:

- Minimum: 30 ft.
- Maximum: 1000 ft for an airspeed equal or higher than 250 KIAS.

If during cruise the ground is slowly getting closer and the airplane is not in the landing configuration, or during approach with an unintentional gear up landing, the aural message "**TOO LOW TERRAIN**" will be sounded. Once the message is issued, an additional 20% altitude loss is required for the issuing of a new message.

The "**GPWS"** warning message is displayed on EICAS for airplanes equipped with GPWS and the amber "**GND PROX"** indication on the PFD for airplanes equipped with EGPWS.

If the airplane penetrates below the 245 ft AGL boundary with the landing gear down and flaps in other than landing configuration, the aural message will be **"TOO LOW FLAPS".** Once message is issued, an additional 20% altitude loss is required for the issuing of a new message.

The visual and aural messages cease when the mode 4B is exited.

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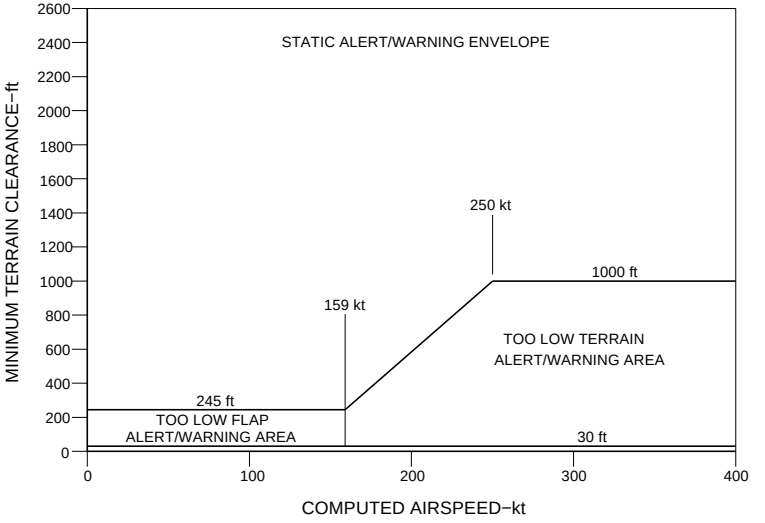
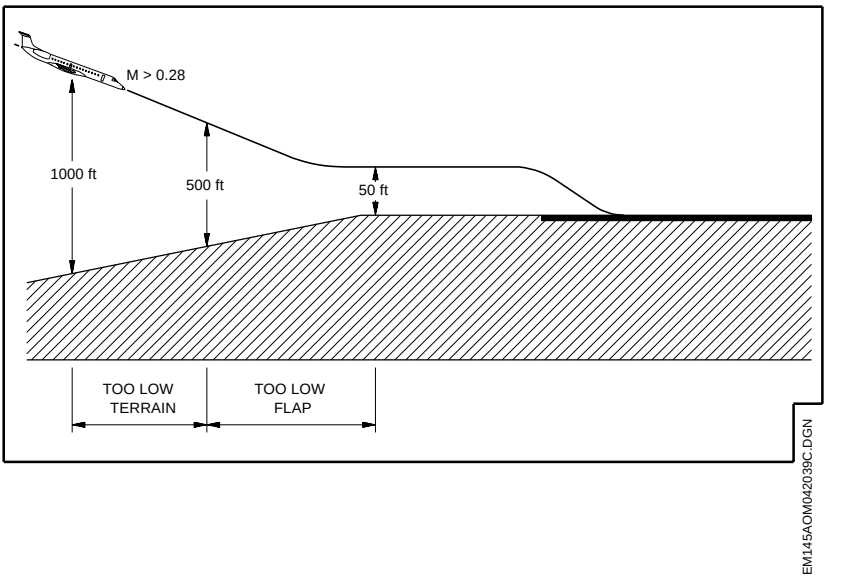
MODE 4B MINIMUM TERRAIN CLEARANCE





GPWS/EGPWS MODE 4B SCHEMATIC

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MODE 4C

Mode 4C is active during takeoff phase or low altitude go-around with either the landing gear or flaps in other than landing configuration, when the terrain is rising closer than the airplane is climbing.

Only in this case, the Minimum Terrain Clearance is a function of the Radio Altitude of the airplane.

Minimum Terrain Clearance (MTC) for "**TOO LOW TERRAIN**" message triggering:

- Minimum: 30 ft.
- Maximum:
  - 500 ft at 667 ft or greater of radio altitude for an airspeed less or equal or less than 190 KIAS.
  - 1000 ft at 1333 ft or greater of radio altitude for an airspeed equal or above 250 KIAS.

If during takeoff or low altitude go-around with either the landing gear or flaps in other than landing configuration, when the terrain is rising more steeply than the airplane is climbing, the aural message "**TOO LOW TERRAIN**" will be sounded.

The "**GPWS"** warning message is displayed on EICAS for airplanes equipped with GPWS and the amber "**GND PROX"** indication on the PFD for airplanes equipped with EGPWS.

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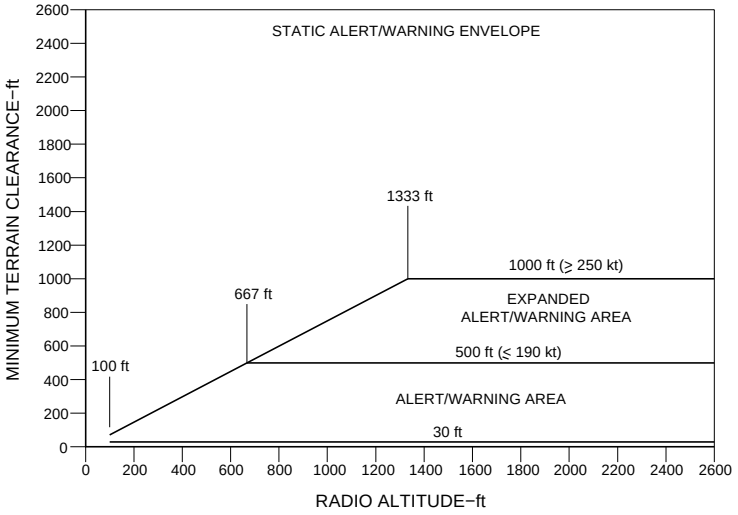
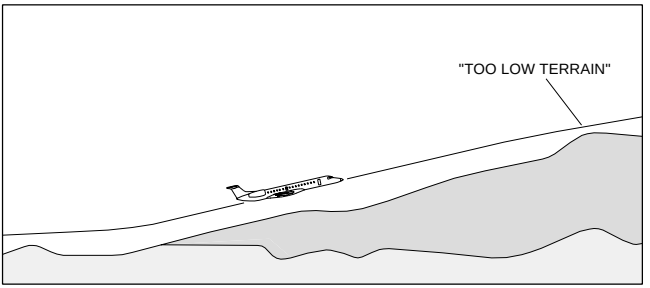
MODE 4C MINIMUM TERRAIN CLEARANCE





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GPWS/EGPWS MODE 4C SCHEMATIC

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MODE 5 - EXCESSIVE DEVIATION BELOW GLIDESLOPE BEAM

Mode 5 provides two levels of alerting if the airplane's flight path descends below the glideslope on ILS approaches.

Minimum Terrain Clearance (MTC) for "**GLIDESLOPE**" message triggering:

- Minimum:
  - For the Soft Alert Area, 30 ft at 2.98 dots of glideslope deviation.
  - For the Hard Alert Area, 30 ft at 3.68 dots of glideslope deviation.
- Maximum:
  - For the Soft Alert Area 1000 ft.
  - For the Hard Alert Area 300 ft.

The first alert occurs whenever the airplane is more than 1.3 dots below the beam and is called a "soft alert" because the volume level is reduced. A second alert occurs below 300 ft radio altitude with greater than 2 dots deviation from glideslope and is louder or "hard".

The aural message "**GLIDESLOPE**" is sounded once. Follow-on alerts are only allowed when the airplane descends lower on the glideslope beam by approximately 20%. Aural messages are sounded continuously once the airplane exceeds 2 dots.

The "**GPWS"** warning message is displayed on EICAS for airplanes equipped with GPWS and the amber "**GND PROX"** indication on the PFD for airplanes equipped with EGPWS.

The glideslope warning can be canceled by pressing the Master Caution Button.

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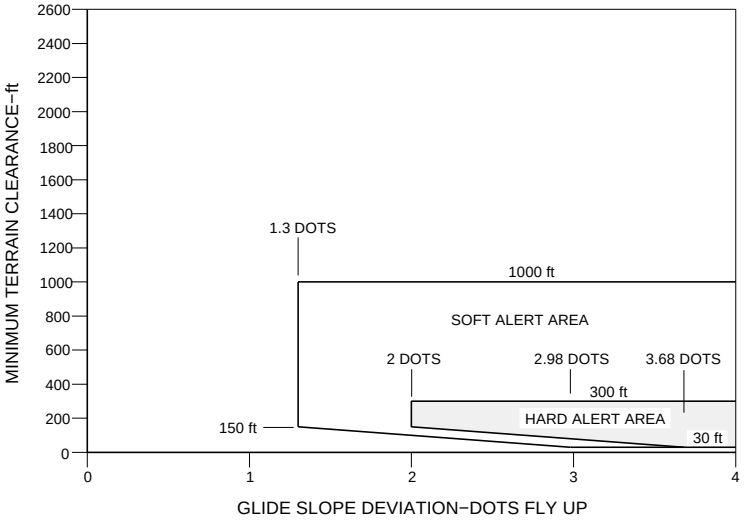
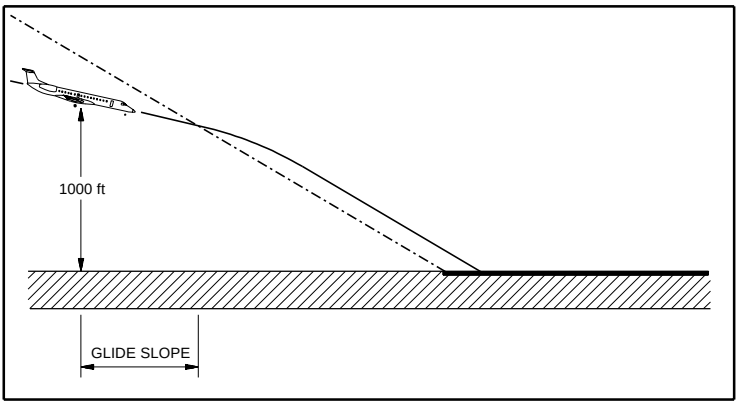
MODE 5 EXCESSIVE GLIDE SLOPE DEVIATION





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GPWS/EGPWS MODE 5 SCHEMATIC

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MODE 6 - CALLOUTS

Mode 6 provides aural messages for descent below predefined altitudes, decision height, a minimums setting and approaching minimums. Alerts for excessive roll or bank angle are also provided.

There are two configurations of EGPWS callouts certified for the EMB-145 family.

	MINIMUMS CALLOUTS	ALTITUDE CALLOUTS
CONFIGURATION 1	"APPROACHING MINIMUMS" "MINIMUMS MINIMUMS"	"FIVE HUNDRED" "TWO HUNDRED" "ONE HUNDRED"
CONFIGURATION 2	"APPROACHING MINIMUMS" "MINIMUMS"	"ONE THOUSAND" "FIVE HUNDRED" "FOUR HUNDRED" "THREE HUNDRED" "TWO HUNDRED" "ONE HUNDRED" "FIFTY" "FORTY" "THIRTY" "TWENTY" "TEN"

NOTE: Any altitude callout above 200 ft is inhibited when the absolute value of DH or MDA is set within 30 ft from the subject callout altitude.

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MINIMUMS CALLOUTS

The message "**APPROACHING MINIMUMS**" is sounded only once when the airplane is 80 ft above the decision height or another target has been reached, with the landing gear down.

- Radio altitude for message triggering:
  - Minimum: 90 ft.
  - Maximum: 1000 ft.

The message "**MINIMUMS MINIMUMS**" or "**MINIMUMS**" is sounded only once when the airplane is at decision height or another target has been reached, with the landing gear down.

- Radio altitude for message triggering:
  - Minimum: 10 ft.
  - Maximum: 1000 ft.

Visual indication of minimum target is presented on PFD.

ALTITUDE CALLOUTS

The messages will be sounded when associated radio altitude has been reached, with the landing gear down.

For the Configuration 1, the "**FIVE HUNDRED**" message will only be sounded whether one or more of the following conditions are satisfied:

- ILS is not tuned or not available.
- ILS is tuned in a valid signal, but with a deviation greater than 2 dots of localizer or glideslope.
- If a backcourse approach is detected.

Radio altitude for message activation:

- Minimum: 50 ft.
- Maximum: 1000 ft.

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BANK ANGLE CALLOUT

Minimum Terrain Clearance (MTC) for message triggering for GPWS:

– Minimum: 0 ft.

– Maximum: Increases linearly from 30 ft at 10° of bank angle to 150 ft at 40° then from 150 ft at 40° up to 2450 ft at 40°.

Minimum Terrain Clearance (MTC) for message triggering for EGPWS:

– Minimum: 5 ft.

– Maximum: Increases linearly from 30 ft at 10° of bank angle to 150 ft at 40° then from 150 ft at 40° up to 2450 ft at 55°, remaining constant at 55° above 2450 ft.

The aural message "**BANK ANGLE, BANK ANGLE**" is sounded when the airplane bank angle is too high or roll rate exceeds 1°/sec during all phases of flight.

The message is generated again if bank angle increases by 20%.

For airplanes equipped with EGPWS, when roll attitude increases to 40% above the initial callout angle, the callout will repeat continuously.

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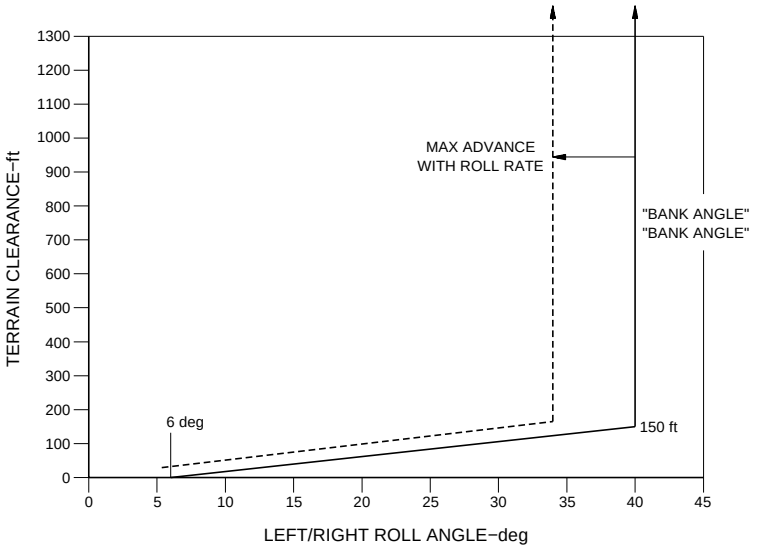
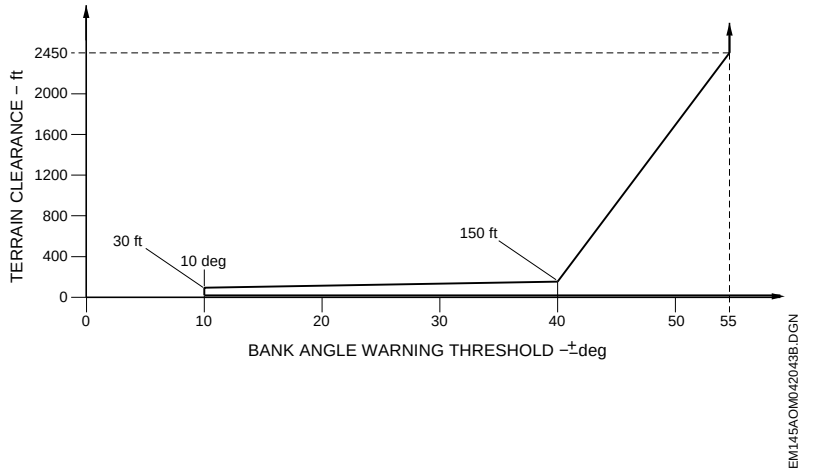


GPWS MODE 6 - SCHEMATIC
BANK ANGLE CALLOUT



EGPWS MODE 6 - SCHEMATIC
BANK ANGLE CALLOUT

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EGPWS FEATURES

The EGPWS incorporates GPWS functions with added features including the Terrain Clearance Floor, Terrain Look Ahead Alerting and Terrain Awareness Display. Airplanes equipped with EGPWS version 216 incorporates additional features like Peaks Mode, Runway Field Clearance Floor, Obstacle Alerting and Geometric Altitude.

TERRAIN CLEARANCE FLOOR

The Terrain Clearance Floor (TCF) provides a terrain clearance circular envelope around the airport runway, alerting the pilot of a possible premature descent for non-precision approaches regardless of the airplane's configuration. The TCF is active during takeoff, cruise and final approach and is based on current airplane position, nearest runway and radio altitude.

This alert mode complements the Mode 4 by providing an alert based on insufficient terrain clearance even when the airplane is in the landing configuration.

TCF alerts display "**GRND PROX**" on the PFD and the aural message "**TOO LOW TERRAIN**" sounds. This message sounds once when initial envelope penetration occurs and will repeat at every additional 20% decrease in radio altitude. The "**GRND PROX**" annunciator remains on until the TCF envelope is exited.

In the EGPWS version 216, the TCF alert provides an envelope extension for runway sides, which is limited to a minimum value of 245 ft beside the runway, within 1 NM to 2.5 NM from runway end. This feature provides improved alerting when it is determined that the airplane is landing to the side of the runway.

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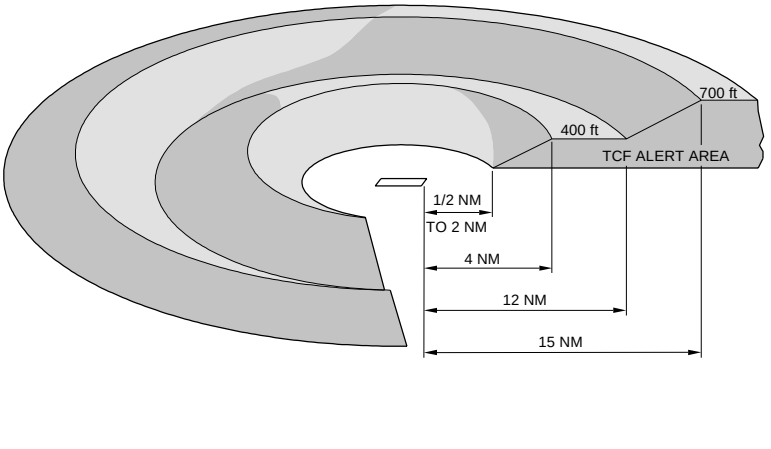

TCF ALERT ENVELOPE

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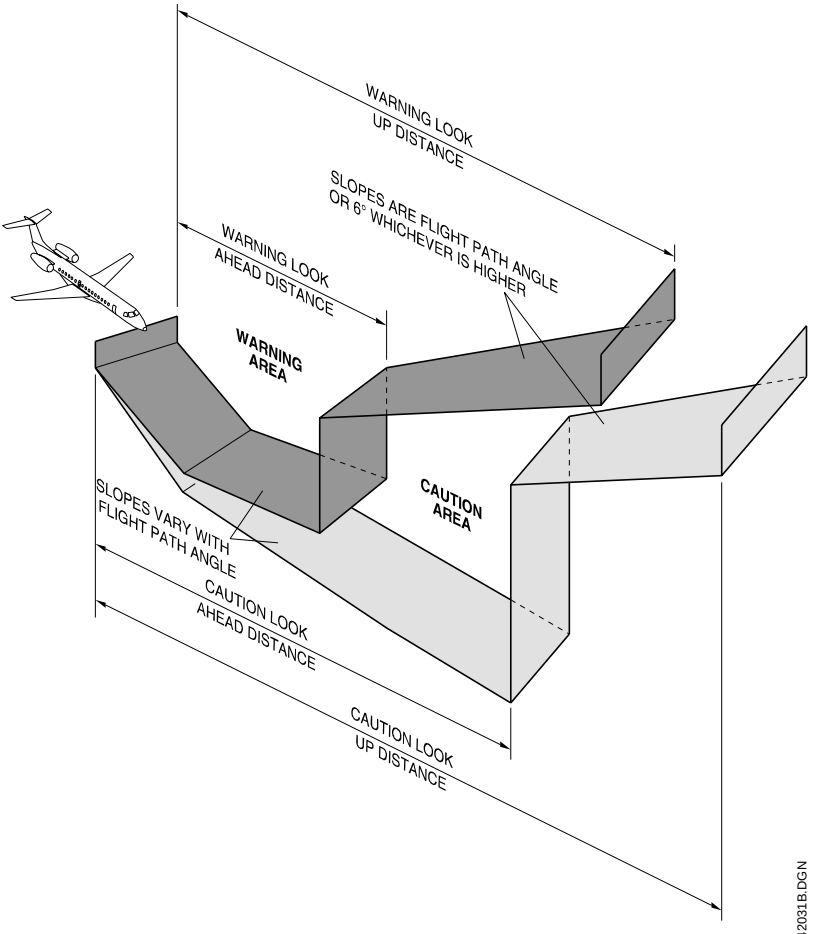
TERRAIN LOOK AHEAD ALERTING

The Terrain Look Ahead Alerting provides a caution/warning level to alert the flight crew about potential terrain conflicts. The alerts are based mainly on the airplane's current position and barometric altitude information. In the event of terrain caution or warning conditions, a specific audio alert and visual alert are triggered and the terrain display image is enhanced to highlight each of the types of terrain threats.



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TERRAIN WARNING AND CAUTION AREAS

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When conditions are such as to generate a Terrain Caution alert (approximately 60 seconds prior to potential terrain conflict), the aural message "**CAUTION TERRAIN, CAUTION TERRAIN**" is sounded and the amber "**GND PROX"** indication is displayed on the PFD. This is repeated every seven seconds as long as the airplane is still in the caution envelope.

When conditions have been met to generate a Terrain Warning alert (approximately 30 seconds prior to potential terrain conflict), the aural message "**TERRAIN, TERRAIN, PULL UP**" is sounded and the red "**PULL UP"** indication is displayed on the PFD.

The terrain image will appear automatically on the MFD when a terrain threat event occurs.

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TERRAIN AWARENESS DISPLAY

The EGPWS terrain display is designed to increase flight crew awareness of the surrounding terrain in varying density dots patterns of green, yellow and red. These dot patterns represent specific terrain separation with respect to the airplane. The following table relates the color that the terrain is displayed with its meaning:

COLOR	MEANING
Solid red	Warning Terrain (Approximately 30 sec from impact).
Solid yellow	Caution Terrain (Approximately 60 sec from impact).
High density red dots	Terrain that is more than 2000 ft above airplane altitude.
High density yellow dots	Terrain that is between 1000 and 2000 ft above airplane altitude.
Medium density yellow dots	Terrain that is between 500 ft (250 ft with gear down) below and 1000 ft above airplane altitude.
Medium density green dots	Terrain that is between 500 ft (250 ft with gear down) to 1000 ft below airplane altitude.
Light density green dots	Terrain that is 1000 to 2000 ft below airplane altitude.
Black	Terrain below 2000 ft.

NOTE: - Terrain is not shown if its elevation is within 400 ft of runway elevation of the nearest airport.

- To reduce clutter on the display, any terrain more than 2000 ft below the airplane is not displayed.
- Terrain that is not covered in the EGPWS database will be displayed in magenta.

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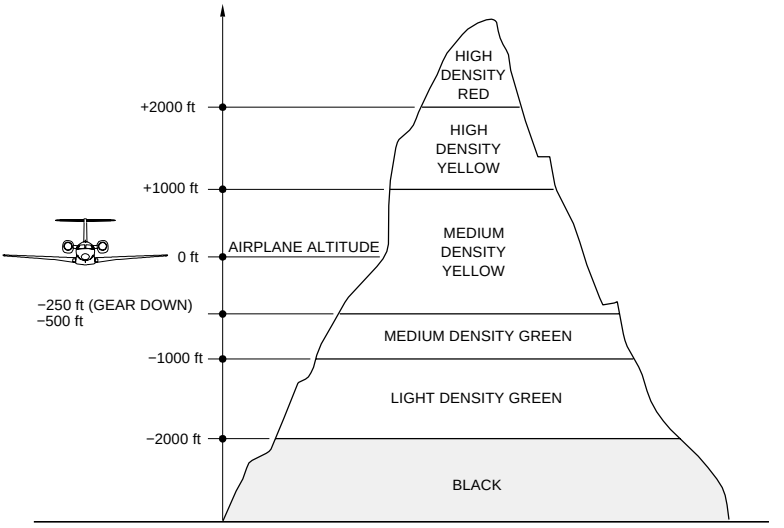
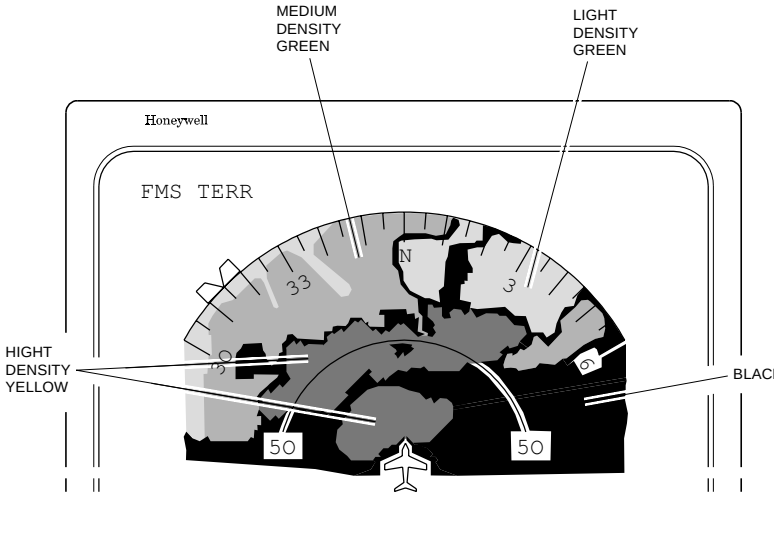


EGPWS DISPLAY COLOR CODING



EXAMPLE OF EGPWS DISPLAY ON MFD

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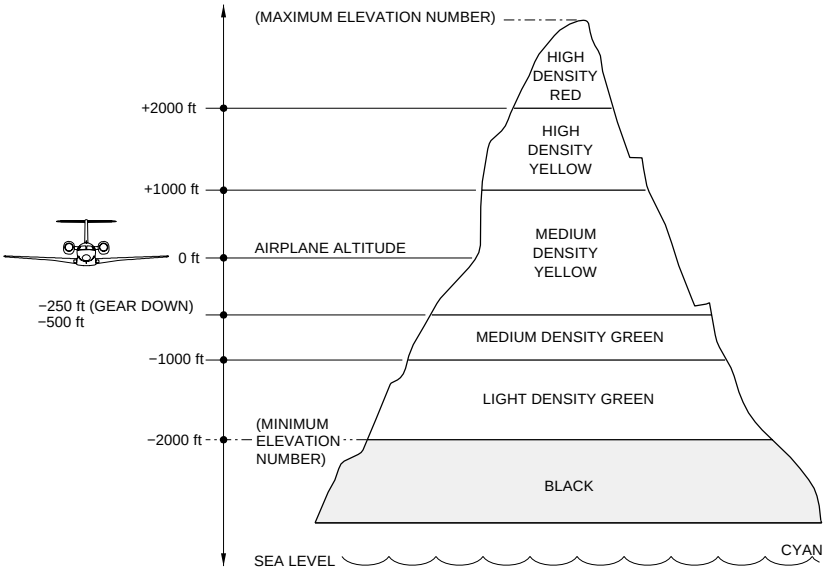
PEAKS MODE

This is a feature provided only by EGPWS version 216 and, when selected, adds additional density patterns and level thresholds to the standard mode display levels and allows the terrain to be displayed during the cruise phase even if it is more than 2000 ft below the airplane.

When the Peaks display is on, elevation numbers indicating the highest and lowest terrain/obstacle currently being displayed are shown on the display. These elevations are expressed in hundreds of feet above sea level (MSL) with the highest elevation on top and the lowest on the bottom. In the event that there is no appreciable difference in the terrain/obstacle elevations, only the highest value is displayed.

The color of the elevation value displayed matches the color of the terrain displayed.

If the airplane is 500 ft (250 ft with landing gear down) or less above the terrain in the displayed range, the peaks color displayed will be identical to the terrain awareness display mode, with the exception of sea level displayed as cyan.



PEAKS PROFILE AT A LOW RELATIVE ALTITUDE

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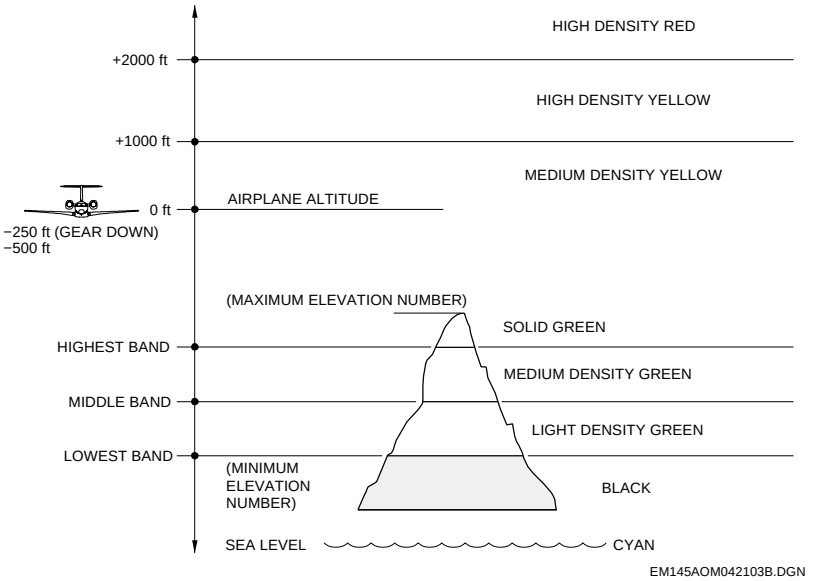
When the airplane is greater than 500 ft (250 ft with landing gear down) above all terrain in the displayed range, no yellow or red bands are displayed and low density green, medium density green and solid green will be displayed as a function of the highest and lowest elevations in view. Moreover, sea level elevations can be displayed as cyan to simulate water.



PEAKS PROFILE AT A HIGH RELATIVE ALTITUDE

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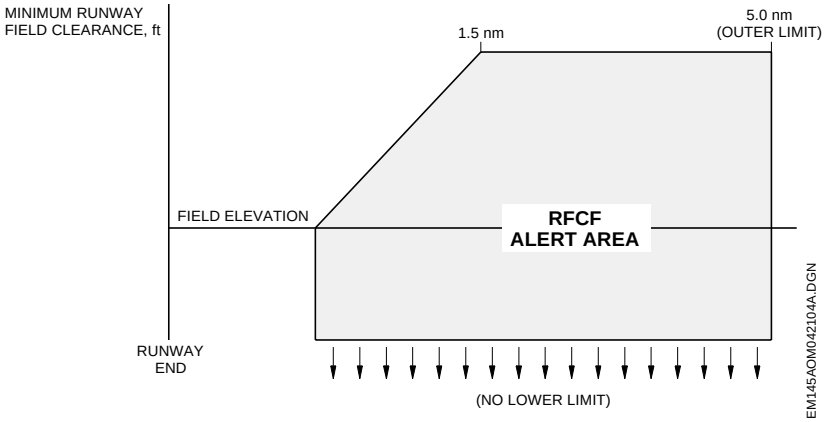
RUNWAY FIELD CLEARANCE FLOOR

Runway Field Clearance Floor (RFCF) is a second clearance floor in addition to TCF in EGPWS version 216. While TCF uses radio altitude, RFCF determines the airplane height above the runway using geometric altitude by subtracting the elevation of the selected destination runway from the current altitude (MSL). This feature provides improved alerting for cases where the runway is at a high elevation compared to the terrain below the approach path.



RFCF ALERT ENVELOPE

RFCF alerts display “**GRND PROX**” on the PFD and the aural message "**TOO LOW TERRAIN**" sounds. This message sounds once when initial envelope penetration occurs and will repeat at every additional 20% decrease in radio altitude.

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OBSTACLE ALERTING

A database of man-made obstacles is stored internal to the EGPWS version 216. The terrain "cell" on which the obstacle resides is coded as an obstacle with an elevation equal to the obstacles MSL height.
The same software algorithms that detect and display terrain conflict are used to detect and display obstacle conflict. If any obstacle is "seen" in the database by the algorithms, annunciators are illuminated and voice "**CAUTION OBSTACLE**" sounds approximately 45 seconds prior to potencial terrain conflict and the aural "**OBSTACLE OBSTACLE PULL UP**" sounds approximately 30 seconds prior to potencial terrain conflict.

GEOMETRIC ALTITUDE

EGPWS version 216 and on uses Geometric Altitude algorithm to determine airplane altitude. The Geometric Altitude computation uses an improved pressure altitude calculation, GPS altitude, radio altitude, terrain and runway elevation data to reduce or eliminate errors potentially induced in corrected barometric altitude by temperature extremes, non-standard altitude conditions and altimeter miss-sets. Geometric Altitude also allows continuous EGPWS operations in QFE environments without custom inputs or special operational procedures.

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WARNING PRIORITIES

The GPWS/EGPWS warning priorities are listed below. Messages at the top will start before or override a lower priority message even if it is already in progress.

MESSAGE	MODE
PULL UP	1 and 2
TERRAIN TERRAIN	2 and Terrain Look-Ahead
PULL UP	Terrain Look-Ahead
TERRAIN	2
MINIMUMS MINIMUMS	6
CAUTION TERRAIN	Terrain-Look Ahead
TOO LOW TERRAIN	4 and Terrain Clearance Floor
ALTITUDE CALLOUTS	6
TOO LOW GEAR	4
TOO LOW FLAPS	4
SINKRATE	1
DON'T SINK	3
GLIDESLOPE	5
APPROACHING MINIMUMS	6
BANK ANGLE	6

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EICAS MESSAGES

GPWS

TYPE	MESSAGE	MEANING
WARNING	GPWS	One GPWS envelope, associated to Modes 1 to 4, has been penetrated.
CAUTION	GPWS INOP	GPWS monitor has detected an internal failure.

EGPWS

TYPE	MESSAGE	MEANING
WARNING	GPWS	One GPWS envelope, associated to Modes 1 to 4, has been penetrated.
CAUTION	GPWS INOP	GPWS monitor has detected an internal failure.
	TERR INOP	Terrain mode is not available.

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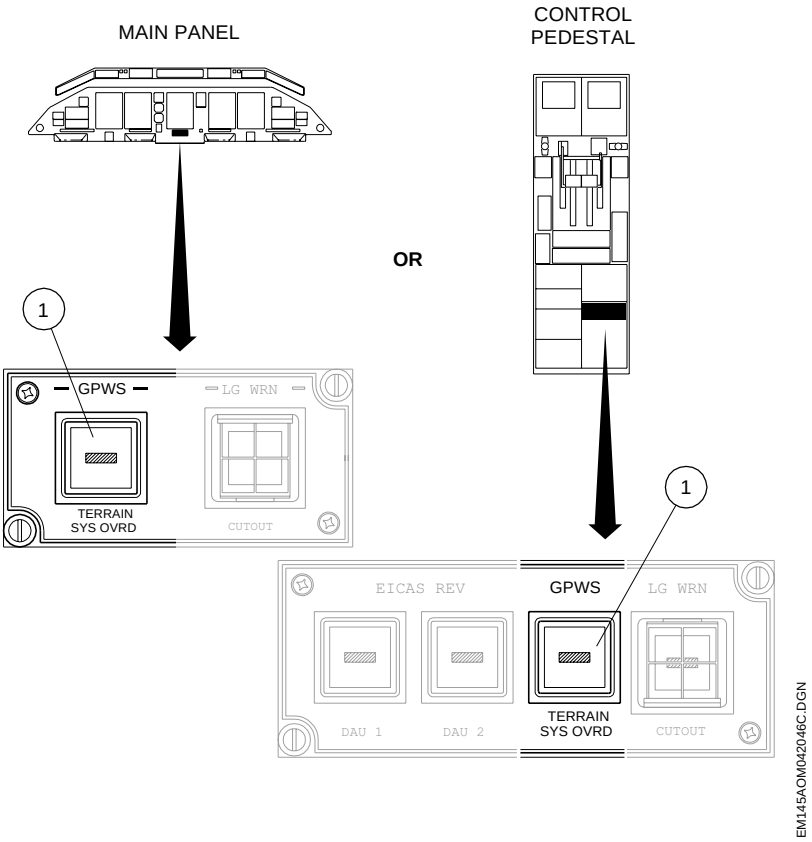
CONTROLS AND INDICATORS

1 - EGPWS TERRAIN SYSTEM OVERRIDE BUTTON

– When pressed, inhibits EGPWS in approach mode, thus avoiding unwanted terrain alerts in airports not covered by EGPWS database.



EGPWS TERRAIN SYSTEM OVERRIDE BUTTON

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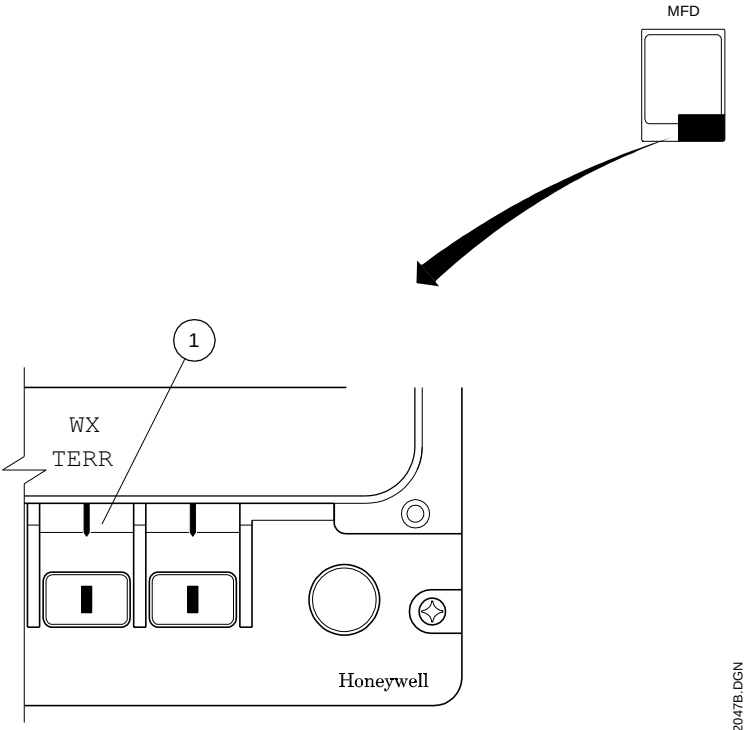
MFD BEZEL PANEL

1 - EGPWS DISPLAY SELECTOR BUTTON

- Alternate pressing will cause the MFD to toggle between the weather radar or terrain to be displayed.
- The ranges allowed are: 5 NM, 10 NM, 25 NM, 50 NM, 100 NM, 200 NM, 300 NM, 500 NM and 1000 NM.
- When a terrain warning/caution condition exists and the terrain is not selected on the MFD, the terrain will be automatically displayed on the MFD with a range of 10 NM.



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MFD BEZEL PANEL

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EGPWS DISPLAY ON MFD

1 - TERRAIN ANNUNCIATIONS

LABEL	COLOR	CONDITION
TERR (Upper left corner)	Cyan	Lit when terrain mode is selected.
TERR FAIL	Amber	Lit when terrain mode is inoperative.
TERR INHIB for Terrain Inhibition	White	Lit when the EGPWS terrain system override button is pressed in approach mode.
TERR N/A	Amber	Lit when EGPWS is uncertain of the airplane's position.
TERR TEST	Red	Lit when the self test is activated.
TERR (Center)	Amber	Lit when terrain picture bus fails (Airplanes equipped with EICAS version 15).

2 - TERRAIN INDICATION

– Displays an image of surrounding terrain in varying density dot patterns of green, yellow and red. These dot patterns represent specific terrain separation with respect to the airplane. The display is generated from airplane altitude compared to terrain data.

3 - TERRAIN ALERT INDICATION

– Indicates a terrain warning or caution condition.

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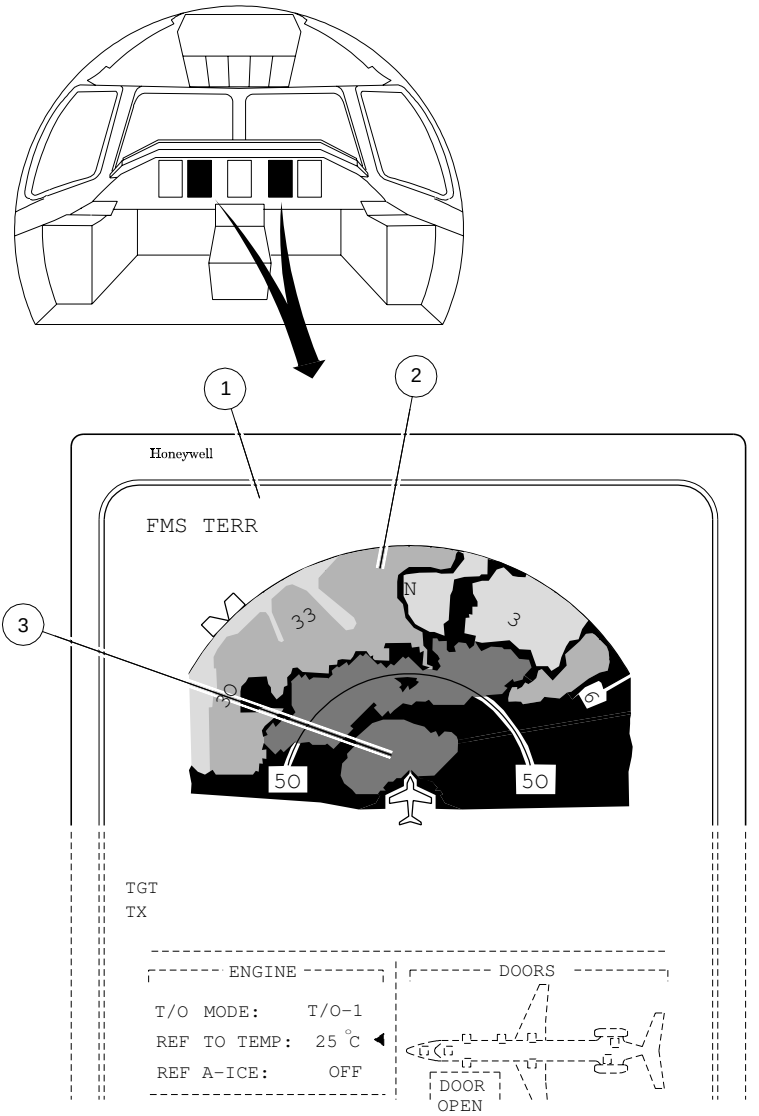

EGPWS DISPLAY ON MFD

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DISPLAY ON PFD

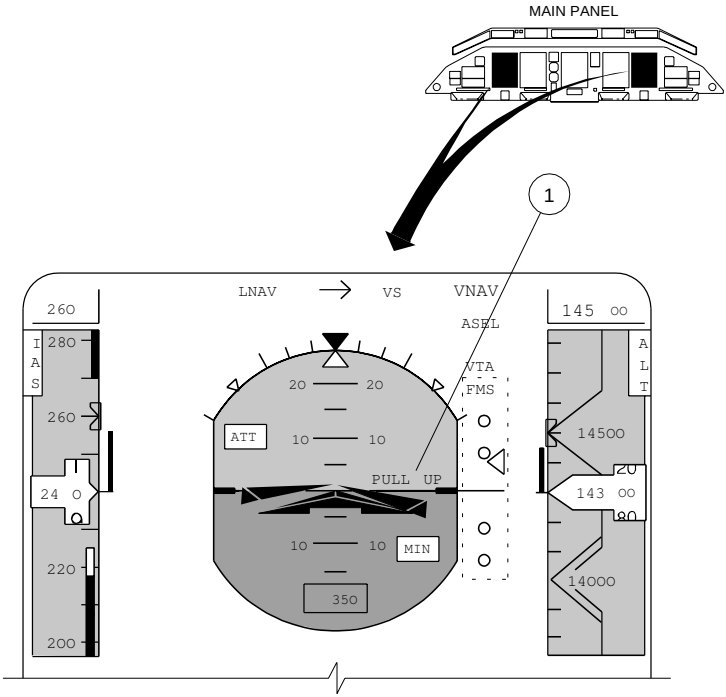
GPWS

Refer to Section 2-17 - Flight Instruments.

EGPWS

1 - PULL UP/GROUND PROXIMITY ANNUNCIATIONS

- Label: PULL UP (red)
  GND PROX for Ground Proximity (amber).
- PULL UP is lit when either modes 1 or 2 have been activated in their more critical situation.
- GND PROX is lit when ground is getting closer too fast.



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EGPWS DISPLAY ON PFD

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STEEP APPROACH OPERATION

Some airplanes may be optionally equipped with Steep Approach function. Steep approaches are approach operations performed with glide slope angle equals to or above 4.5°. This kind of operation implies to the airplane a vertical speed higher than the normal, requiring means to change the range of the EGPWS Mode 1 envelope in order to avoid nuisance messages.

The Steep Approach mode is selected by means of two pushbuttons installed on the glareshield panel, one at each side. When either pushbutton is pressed, an internally preset mode of the EGPWS changes the references to sound the SINK RATE and PULL UP aural warnings.

When the airplane is in flight and the flaps are selected to 45°, the STEEP white light illuminates on the Steep Approach pushbutton indicating that the Steep Approach mode is available. When either the flaps are retracted to a position other than 45° or airplane lands, the STEEP white light extinguishes indicating that the Steep Approach mode is no longer available.

The pushbutton lower portion has two status lights, amber and green. The green light indicates that the Steep Approach mode is engaged and the amber light indicates a failure condition.

If the amber light turns on, it indicates that the Steep Approach mode is failed and steep approach operations must not be performed. In this situation, the Steep Approach mode is not engaged and the airplane must land in an airport that does not require steep approach operation.

In flight, with the STEEP inscription illuminated, if the Steep Approach pushbutton is pressed, the green light illuminates to indicate that the Steep Approach mode is engaged. If the green light does not illuminate, the Steep Approach mode is not engaged and the steep approach operation must not be performed.

The Steep Approach mode is deselected pressing the pushbutton or through automatic deselection. An automatic deselection of the Steep Approach mode is performed when:

– Airplane is on the ground;

– Flaps are set to a position other than 45°.

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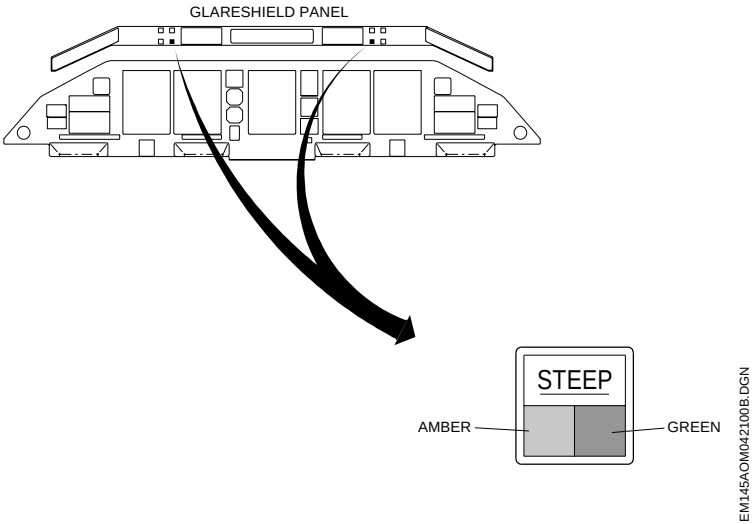

STEEP APPROACH MODE PUSHBUTTON

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CONTROLS AND INDICATORS

STEEP APPROACH PUSHBUTTON

LIGHT INDICATION	MODE DESCRIPTION
STEEP	Illuminates in white color when the airplane is in the air and the flaps are in 45°. This means that the Steep Approach mode is available.
GREEN LIGHT	Illuminates when the button is pressed with the STEEP light illuminated. This means that the Steep Approach mode is engaged. With the STEEP light illuminated, if the green light does not illuminates when the pushbutton is pressed, means that the Steep Approach is not engaged; in this case, do not perform Steep Approach operations.
AMBER LIGHT	The Steep Approach mode is failed. Do not perform Steep Approach operations. In this situation, the Steep Approach mode is not engaged and the airplane must land in an airport that not requires steep approach operation.

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WINDSHEAR DETECTION AND ESCAPE GUIDANCE SYSTEM

The EMB-145 is equipped with an additional warning system dedicated to windshear detection. The system provides visual and aural alarms to warn pilots of a windshear occurrence, as well as the most appropriate maneuver to recover from such phenomenon.

The Windshear Detection function is performed by the EGPWS computer, which also performs ground proximity warning functions. The Windshear Escape Guidance is a Flight Director mode provided by the avionics package.

WINDSHEAR GENERAL INFORMATION

Windshear is a sudden change in wind direction or speed, normally caused by thunderstorms, frontal systems or any topographical feature that may affect the wind flow (e.g. hills, mountains, lakes, seas etc...).

Due to ground proximity, the most hazardous phases of flight regarding windshear encounters are takeoff, approach and landing. On a windshear, wind may shift from a tailwind to a headwind or to a downdraft or updraft. The consequences may be an abrupt change in airspeed, lift and altitude, upwards or downwards, according to shifting direction. Although quick, windshear is not instantaneous, which may lead pilots to correction attempts in the wrong manner. For instance, an airplane facing a headwind after takeoff, appears to have good performance, characterized by high airspeed, which drives the pilot into rotating the airplane to a pitch higher than usual. When the thunderstorm core is reached, wind shifts to a downdraft and airspeed decreases, as well as vertical speed. The pilot's natural reaction is to lower the airplane's nose in an attempt to maintain airspeed. Further ahead, wind shifts to tailwind component, resulting in a dramatic airspeed reduction with the nose already down. Under such scenario, it is very difficult to maintain a positive rate of climb.
If the takeoff or landing can not be delayed, the correct action is to increase airspeed before being subjected to windshear encounter and to consider flying near stall speeds with high angle of attack if necessary to regain altitude.

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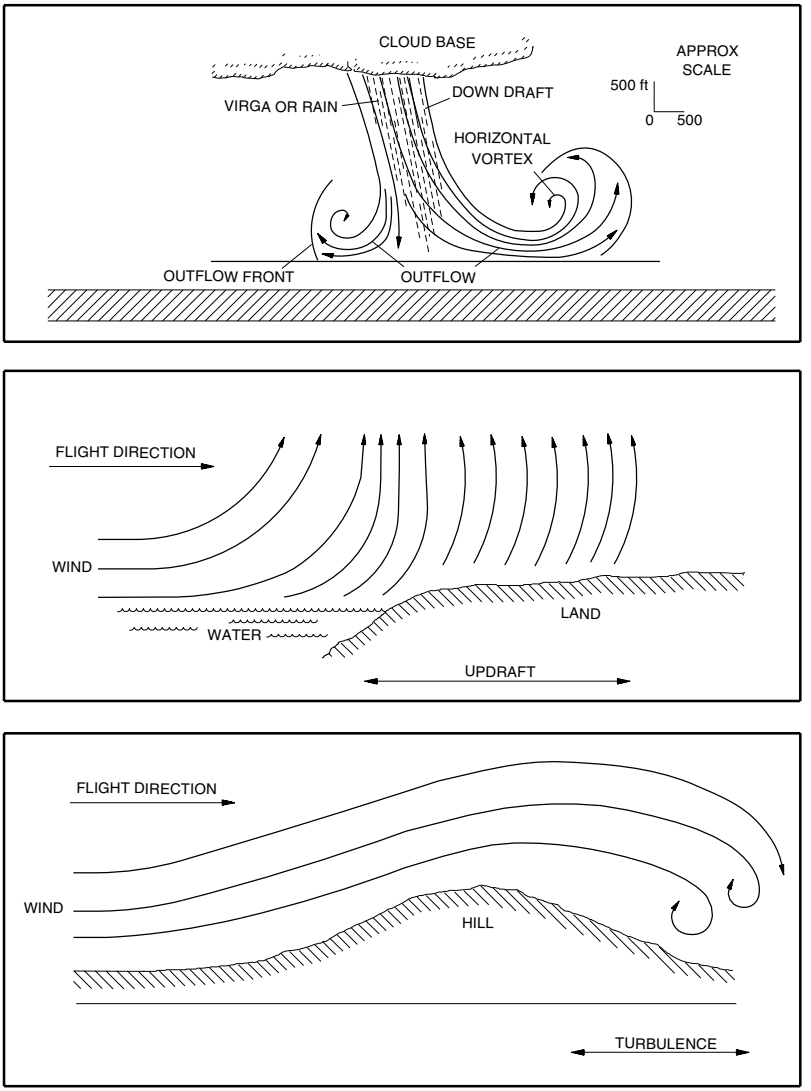

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KINDS OF WINDSHEAR

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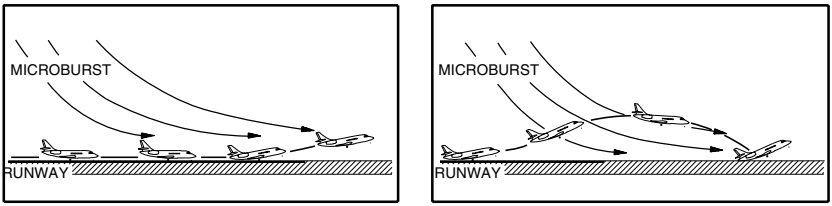
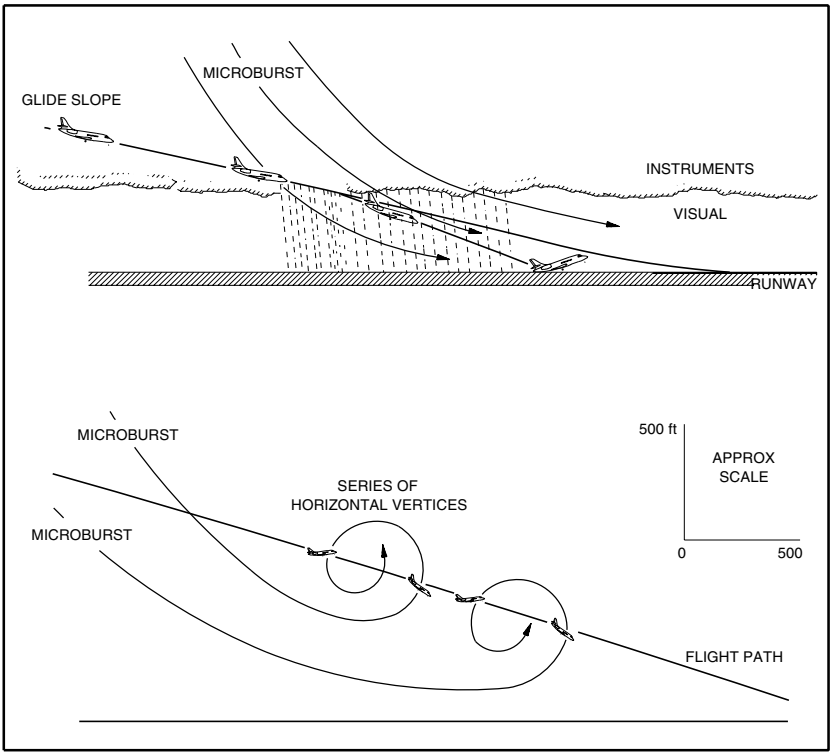


WINDSHEAR EFFECT DURING TAKEOFF



WINDSHEAR EFFECT DURING LANDING

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WINDSHEAR EFFECTS

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WINDSHEAR DETECTION

The windshear detection system is designed to identify the presence of severe windshear phenomenon and to provide timely warnings and adequate flight guidance for approach, missed approach, takeoff and climb out.

The windshear computer exchanges data with AHRS, ADC, SPS, Radio Altimeter and IC-600s. The system continuously searches for any windshear clue, and then signals the PFD and aural warning unit to provide the appropriate indications.

Windshear Caution alerts are given if the windshear consists of an increasing headwind (or decreasing tailwind) and/or severe updraft, which may precede an encounter with a microburst. Windshear cautions activate the Windshear Caution (WDSHEAR) amber indications on the upper left corner of both PFDs. On airplanes equipped with EGPWS, an aural message “CAUTION WINDSHEAR” is also triggered. Windshear Caution indications remain on for as long as the airplane remains exposed to an increasing headwind and/or updraft condition in excess of the alert threshold.

Windshear Warnings are given if the windshear consists of a decreasing headwind (or increasing tailwind) and/or severe downdraft. Windshear warnings activate the Windshear Warning (WDSHEAR) red indication on both PFDs and trigger an aural message “WINDSHEAR, WINDSHEAR, WINDSHEAR”. This message will not be repeated unless another, separate, severe windshear event is encountered. Windshear Warning indications remain on for as long as the airplane remains exposed to a decreasing headwind and/or downdraft in excess of the alert threshold. The threshold is adjusted in function of available climb performance, flight path angle, airspeeds significantly different from normal approach speeds and unusual fluctuations in Static Air Temperature (typically associated with the leading edges of microbursts).

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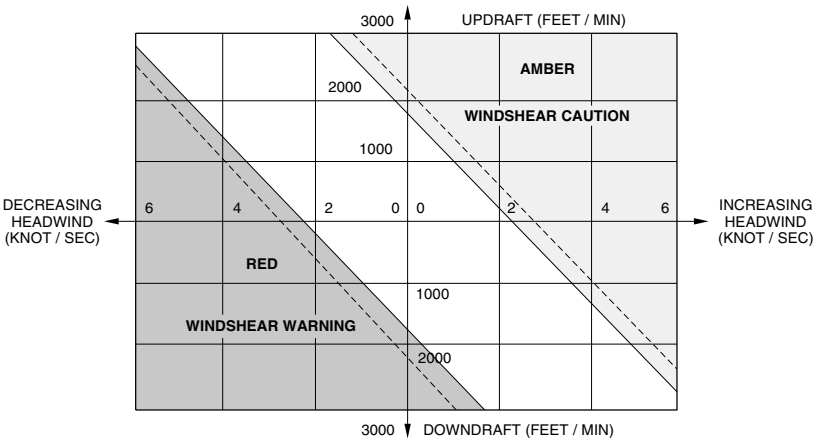

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WINDSHEAR DETECTION

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WINDSHEAR ESCAPE GUIDANCE MODE

The Windshear Escape Guidance mode is used to minimize altitude and speed loss during a windshear encounter. The strategy is to keep the airplane airborne until the windshear conditions subside or are exited.
The Windshear Escape Guidance Mode provides pitch command to recover from a windshear encounter. The amplitude of the pitch command will depend upon the airplane's performance and windshear severity and phase.

The Windshear Escape Guidance is a Flight Director mode engaged under the following conditions:

- Manually, by pressing the Go Around Button while a windshear condition (increasing/decreasing performance) is detected;
- Automatically, when in Go Around or Takeoff Mode and a windshear condition (increasing/decreasing performance) is detected;
- Automatically, when Thrust Levers Angle is above 78° and a decreasing performance windshear is detected (windshear warning).

When the windshear escape guidance mode is engaged a green "WSHR" indication is displayed on both PFDs in the Vertical Mode field and a "ROLL" indication is displayed in the Lateral Mode field. Whenever the Windshear Escape Guidance mode is engaged, the Pitch Limit Indicator (PLI) symbol is drawn directly on the Attitude Display Indicator portion of the PFD. The PLI represents the remaining angle of attack margin before Stick Shaker triggering.

All other Flight Director modes are canceled and the following vertical modes are inhibited when a caution or warning windshear condition is presented:

- Altitude Preselect Mode, Go Around and Takeoff.

No lateral modes are inhibited while in the vertical mode of WSHR.

The Windshear Escape Guidance mode is designed to meet the following requirements, in the listed order of priorities:

- Prevent the airplane from stalling;
- Prevent the airplane from descending;
- Prevent the airplane from exceeding V_{MO}.

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The Windshear Escape Guidance Mode incorporates three control sub-modes:

- Alpha Sub-mode - The airplane can be commanded to descend in order to maintain airspeed when approaching stall conditions. If the flight path angle control results in an angle of attack beyond the stick shaker triggering angle, the windshear control law can keep the airplane angle of attack below the stick shaker threshold.
- Gamma Sub-mode - The airplane can be prevented from descending by commanding a positive flight path angle. A nominal flight path angle is used to allow an airspeed raise during an increasing performance windshear, in anticipation of a decreasing performance windshear, and also to minimize altitude loss during a decreasing performance windshear.
- Speed Target Sub-mode - The airplane is allowed to climb in order to exchange excessive kinetic energy for potential energy. If the control of the flight path angle results in an excessive speed increase, the windshear control law maintains the airplane indicated airspeed at the target speed.

The Windshear Escape Guidance mode will be canceled if any of the following conditions occur:

- FLC, VS, SPD or ALT Mode is selected;
- Invalid AHRS data;
- Invalid ADC data;
- Invalid Stall Protection Computer (SPC);
- Radio Altitude greater than 1500 ft.

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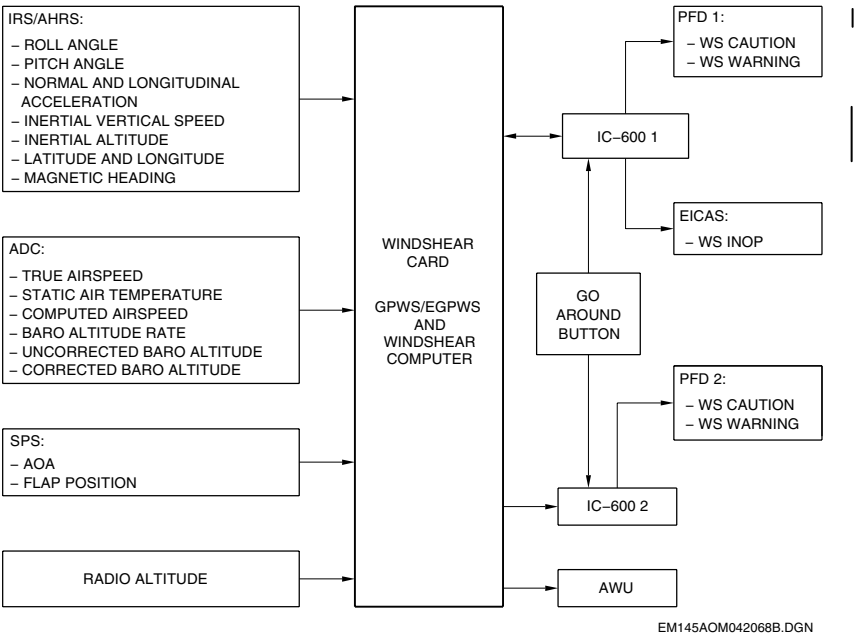

WINDSHEAR DETECTION AND ESCAPE GUIDANCE SYSTEM SCHEMATIC

NOTE: Inertial vertical speed, inertial altitude, latitude and longitude are provided only for airplanes equipped with EGPWS.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
CAUTION	WINDSHEAR INOP	Windshear detection and escape guidance system is inoperative.

CONTROLS AND INDICATORS

PRIMARY FLIGHT DISPLAY

1 - WINDSHEAR INDICATION

- Indicates that a windshear has been detected.
- Color: amber or red depending on windshear severity.

2 - ESCAPE GUIDANCE MODE ENGAGEMENT ANNUNCIATION

- Indicates the Windshear Flight Guidance Escape Mode engagement.

3 - PITCH LIMIT INDICATOR

- Refer to Stall Protection System indicators in section 2-04-25.

4 - FLIGHT GUIDANCE INDICATION

- Indicates the appropriate pitch to be attained, during a windshear occurrence.

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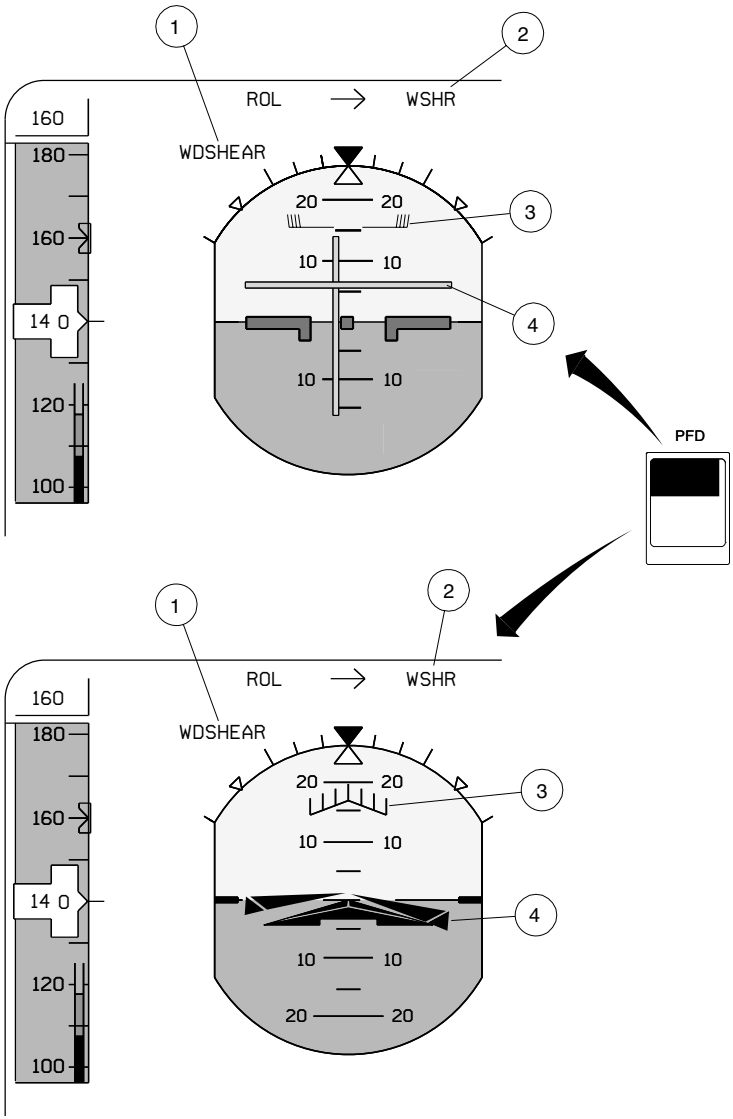

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PRIMARY FLIGHT DISPLAY (CROSS-BAR AND V-BAR FORMAT)

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TRAFFIC AND COLLISION AVOIDANCE SYSTEM

GENERAL

The EMB-145 is equipped with a Traffic and Collision Avoidance System (TCAS), which provides the flight crew with an indication of possible in-flight traffic conflict. The system is based upon transponder signals and provides visual and aural warnings, as well as recommended evasive action.

The EMB-145 may be equipped with TCAS software version 6.04A, with TCAS software version 7.0 or with TCAS software version 7.1.

The TCAS 2000 presents the same operational characteristics of the TCAS II.

The TCAS software version 7.0 presents the following differences when compared to the TCAS software version 6.04:

- The altitude separation thresholds for issuing Traffic Advisory (TA) and Resolution Advisory (RA) between FL300 and FL420 are reduced for compatibility with RVSM flight operations.
- The thresholds for issuing RA for airplanes closing in altitude are reduced between the FL200 and FL420.
- Reduction in the numbers of RA eliminating those airplanes that are expected to pass with sufficient horizontal range separation.
- Allows RA direction reversion, i.e., change a CLIMB to a DESCENT and vice-versa in coordination with another TCAS equipped airplane.
- Introduction of three additional RA.
- Different set points and range of actuation, as presented in the following text.

The difference presented by TCAS software version 7.1 when compared to the TCAS software version 7.0 is the replacement of the corrective RA voice message “Adjust Vertical Speed, Adjust” with a single “Level Off, Level Off” RA.

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SYSTEM DESCRIPTION

The TCAS was developed to provide crew awareness regarding possible conflicting air traffic situations. Besides providing awareness, TCAS also displays to the flight crew the recommended vertical maneuver to avoid conflicting traffic. TCAS does not provide recommendations for horizontal maneuvers.

CAUTION: PRIMARY RESPONSIBILITY FOR EVASIVE ACTION LIES WITH THE FLIGHT CREW AND ANY ACTION MUST ALWAYS BE PRECEDED BY A VERY CAREFUL EVALUATION OF THE SITUATION.

The TCAS computer receives data from the installed transponders, radio altimeters and air-ground sensor. The signals transmitted by surrounding airplanes inform their altitude, bearing and identification, thus making it possible to track any traffic that could enter the airplane's protection zone. Based on such data, the TCAS calculates the predicted path of each intruder airplane, determining whether or not it may become a target. To determine that, an alert zone is established, based on separation and speeds of both airplanes. The size of the alert zone is not distance-based but, rather, is based on time. Therefore, the caution area corresponds to the volume in space where a conflict is expected to occur in 35 to 45 seconds, if no action is taken. A warning area corresponds to an imminent conflict in the following 20 to 30 seconds. Such time is calculated by dividing distance between airplanes by their closure rate.

To inhibit the issuing of undesired warnings that constitute a nuisance effect, the system incorporates a series of protections. These apply during approaches to crowded airports, to increase protection against slow closure rates, and to prevent airplanes below 180 ft (380 ft for TCAS software version 7.0), which are about to land or have just taken-off, from creating a nuisance.

When an airplane is tracked by the TCAS, the system periodically interrogates the intruder's transponder. The exchange of data between two subsequent transmissions makes it possible to obtain the distance to the intruder and its altitude, and to predict its path.

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If the predicted path of the intruder enters the airplane's alert area, two kinds of alerts may be generated. If the area to be penetrated is the caution area, a Traffic Advisory (TA) is generated. Pilots are then requested to visually locate the intruder and perform the required preventive action.

If the warning area is penetrated a Resolution Advisory (RA) is generated, as well as the corrective action that must be taken to permit the greatest possible separation at the Closest Point of Approach (CPA). Sometimes, the recommended action may lead to crossing of the intruder's flight level or may change during the maneuver. This situation may occur when the calculation indicates that this is the best way to achieve the greatest possible separation at the CPA. For both advisory cases, a symbol is presented in the MFD to indicate the intruder's relative position, altitude and danger level. A voice message is generated to help the pilots in taking the most suitable action. The PFD provides indication of the recommended vertical speed to clear the conflict. A voice message may be generated to warn the pilot into monitoring the VSI on the PFD. When TCAS computations indicate that the traffic has been cleared, a voice message advises pilots that there is no longer a conflicting situation. In this condition, if no other TA or RA is on course, the intruder's indication changes, indicating that it is a safe nearby traffic.

If the intruder is also equipped with a TCAS, maneuvers are coordinated between both airplanes. If the intruder is only equipped with a transponder, the system may still indicate its position, provided its transponder is at least mode C. For airplanes equipped with mode A transponder, only Traffic Advisories may be generated.

NOTE: For airplanes Post-Mod SB 145-34-0106 the TCAS will send a "CLIMB" command in RA condition only up to 36000 ft. Above this altitude the TCAS will not send a "CLIMB" command in RA condition.

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CAUTION: THE TCAS CAN ONLY GENERATE RESOLUTION ADVISORIES FOR INTRUDERS EQUIPPED WITH RESPONDING MODE S OR MODE C TRANSPONDERS. TRAFFIC ADVISORIES CAN BE GENERATED FOR AIRPLANE WITH OPERATIVE MODE S, MODE C OR MODE A TRANSPONDERS. THE TCAS PROVIDES NO INDICATION OF AIRPLANE WITHOUT OPERATING TRANSPONDERS.

System options may be monitored and set through the RMU. A dedicated window is provided, presenting which TCAS display is being controlled, its range and altitude band. A RMU page permits toggling between options. Controls allow selection of different ranges, either horizontal and vertically, as well as changing the way some parameters are presented.

For airplanes Post-Mod. SB 145-34-0089 or Post-Mod. SB 145BAF-34-0006 or equipped with an equivalent modification factory incorporated, the Mode S Elementary Surveillance Transponder transmits the following parameters:

- Airplane Identification (Call Sign);
- Capability Report;
- Flight Status (airborne/on the ground);
- Pressure Altitude with 25 ft of resolution.

For airplanes equipped with Mode S Enhanced Surveillance Transponder (Post-Mod. SB 145-34-0096 or Post-Mod. SB 145BAF-34-0007 or equipped with an equivalent modification factory incorporated), in addition to the characteristics of the Mode S Elementary, the following Downlink Airplane Parameters (DAP) are transmitted automatically to be used by the ground Air Traffic Management:

- Magnetic Heading;
- Indicated Airspeed and/or Mach Number;
- Vertical Rate;
- Roll Angle;
- True Airspeed;
- True Track Angle;
- Ground Speed;
- Selected Altitude.

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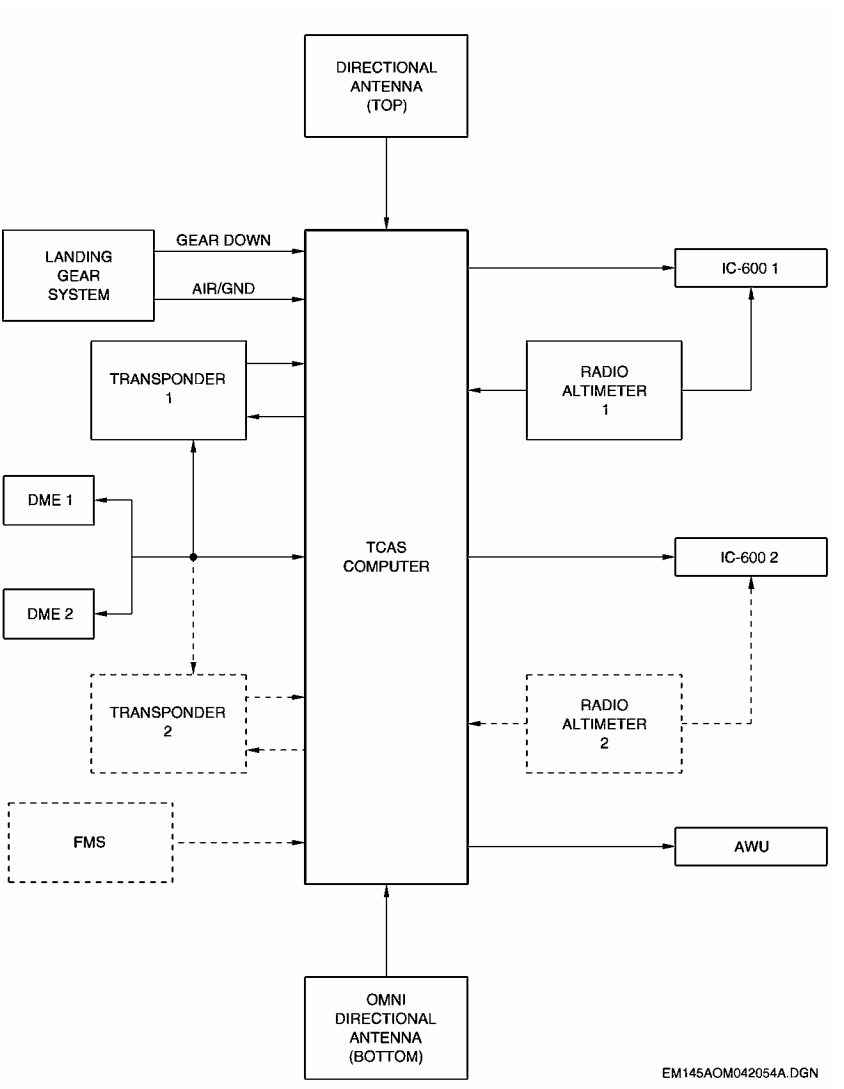

TCAS SCHEMATIC

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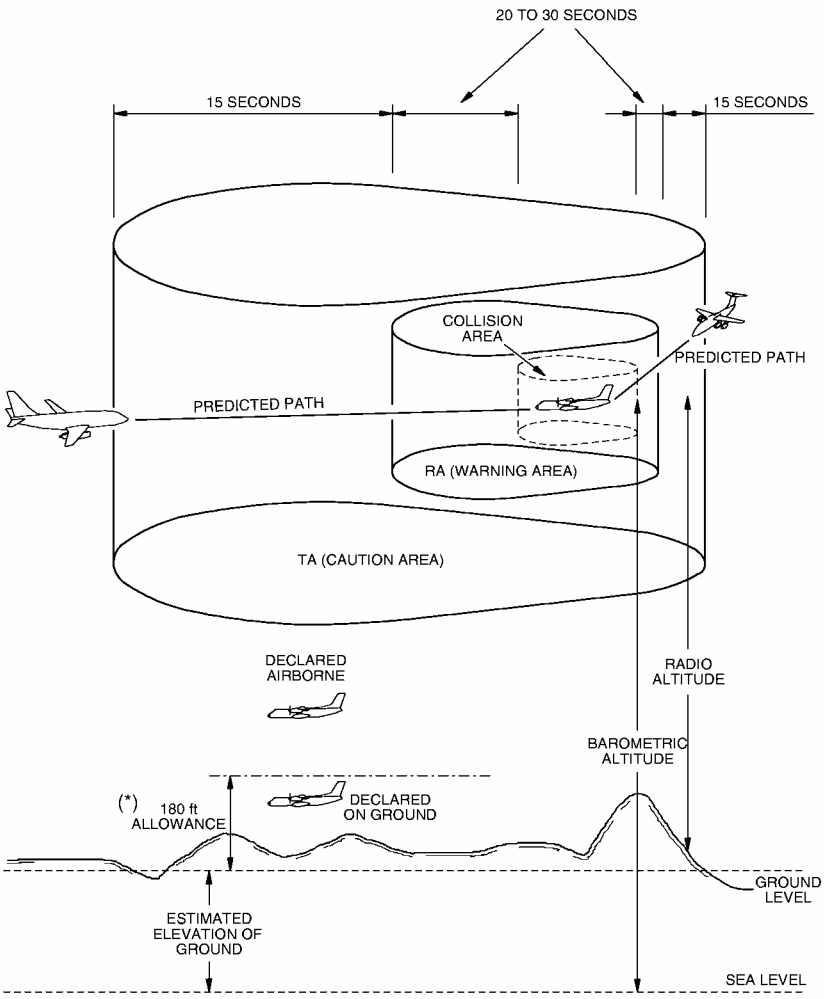

(*) 380 ft FOR TCAS SOFTWARE VERSION 7.0 .

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TCAS PROTECTED AREAS

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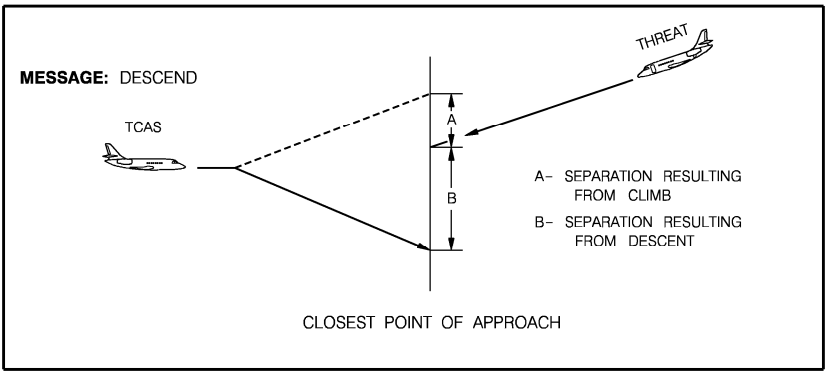

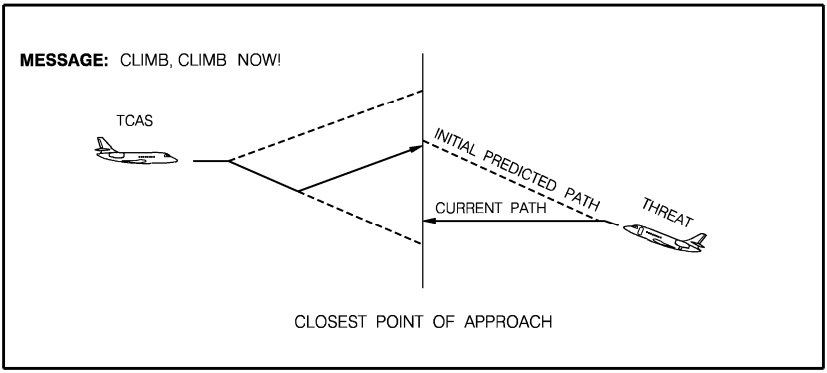

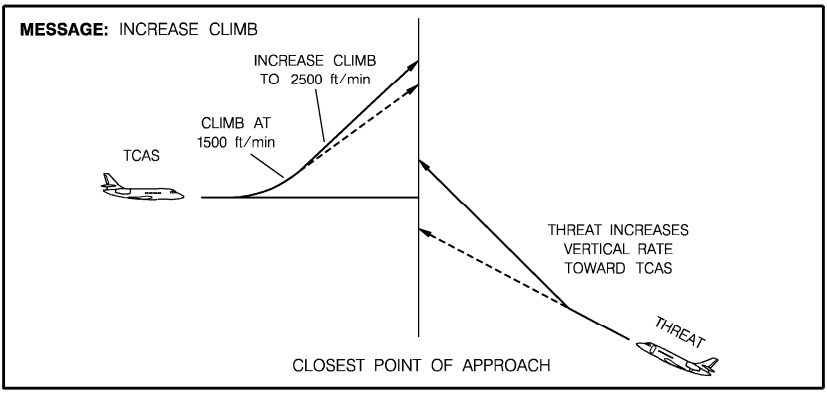

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TCAS SITUATIONS

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TCAS VOICE MESSAGES

NOTE: For airplanes Post-Mod. SB 145-34-0046 and Post-Mod. SB 145-31-0028, or with an equivalent modification factory incorporated, the Master Warning and Master Caution lights illumination associated to a TA/RA are not presented.

TYPE	MESSAGE	MEANING	REMARKS
TA	TRAFFIC, TRAFFIC	An intruder is expected to enter the collision area in 35 to 45 seconds. An indication of it has just been displayed on the MFD.	– For TCAS software version 6.04, see NOTE 1. – For TCAS software version 7.0, all TA are inhibited below 500 ft AGL.
PREVENTIVE RA	MONITOR VERTICAL SPEED	Vertical speed is changing to a non-recommended value.	–
CORRECTIVE RA	ADJUST VERTICAL SPEED, ADJUST	Vertical speed has to be adjusted to the recommended value indicated on the VSI.	TCAS software version 7.0 only.
	MAINTAIN VERTICAL SPEED, MAINTAIN	Maintain the vertical speed indicated on the VSI.	TCAS software version 7.0 and 7.1.
	MAINTAIN VERTICAL SPEED, CROSSING MAINTAIN	Maintain the vertical speed indicated on the VSI. During climb or descent, airplane will cross intruder's flight level.	TCAS software version 7.0 and 7.1.
	LEVEL OFF, LEVEL OFF	Vertical speed has to be reduced to 0 fpm.	TCAS software version 7.1 only.
	CLIMB	Climb at the vertical speed indicated on the VSI to clear the possible conflict.	–
	DESCEND	Descend at the vertical speed indicated on the VSI to clear the possible conflict. Vertical Speed will be 1500 ft/min or greater.	See NOTE 1.
	REDUCE CLIMB	Reduce climb speed to clear the possible conflict.	Not valid for TCAS software versions 7.0 and 7.1.
	REDUCE DESCENT	Reduce descent speed to clear the possible conflict.	– See NOTE 1. – Not valid for TCAS software versions 7.0 and 7.1.
	CLIMB, CROSSING CLIMB	Climb at the indicated vertical speed on the VSI to clear possible conflict. During climb, airplane will cross intruder's flight level.	–

(Continued)

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TYPE	MESSAGE	MEANING	REMARKS
CORRECTIVE RA	DESCEND, CROSSING DESCEND	Descend at the indicated vertical speed on the VSI to clear possible conflict. During descend, airplane will cross intruder's flight level.	See NOTE 1.
	INCREASE CLIMB	Climb speed has to be increased to the recommended value to clear the possible conflict.	Vertical Speed must be 2500 ft/min or greater.
	INCREASE DESCENT	Descent speed has to be increased to the recommended value to clear the possible conflict. Vertical Speed must be 2500 ft/min or greater.	– For TCAS software version 6.04, this message is inhibited below 1450 ft AGL. – For TCAS software version 7.0, this message is inhibited below 1450 ft AGL while descending and below 1650 ft AGL while climbing.
	CLIMB, CLIMB NOW!	After a descent advisory, TCAS detected a changing situation that requires the need to climb.	–
	DESCEND, DESCEND NOW!	After a climb advisory, TCAS detected a changing in situation that requires the need to descend.	See NOTE 1.
	CLEAR OF CONFLICT	The possible conflict has been cleared. Message is presented only if intruder's transponder signal is valid.	Not presented if the intruder track or altitude information is lost.

NOTE:
1) Inhibited below 1000 ft AGL while descending and below 1200 ft AGL while climbing.
2) All RAs are inhibited below 400 ft AGL while descending and below 600 ft AGL while climbing.
3) For TCAS software version 6.04, RA messages are repeated three times (one-word messages) and twice (two-word messages).
   For TCAS software version 7.0, all RAs are repeated twice.
4) TA message sounds once.
5) The bearing indication on the TCAS display does not affect the TA/RA triggering logic.

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CONTROLS AND INDICATORS

RMU RADIO PAGE - ATC/TCAS WINDOW

Refer to Section 2-18 - Navigation and Communication for further details on RMU controls.

Refer to RMU ATC/TCAS Control Page in this Section for further details on TCAS controls.

1 - TRANSPONDER OPERATING MODE

- Allows selection of TCAS modes:
  - TA ONLY - TCAS traffic advisory mode is selected.
  - TA/RA - TCAS traffic advisory and resolution advisory modes are selected.
- Refer to Section 2-18 - Navigation and Communication for further details.

2 - TCAS CONTROL SIDE IDENTIFICATION

- Indicates which TCAS display (MFD 1 or 2) is being controlled through that RMU. The selection of TCAS DSPY 1 or 2 is accomplished through the cross-side transfer button when the yellow cursor box is placed on this field.
- Color: white for on-side TCAS display and magenta for cross-side.

3 - TCAS RANGE DISPLAY

- Displays the selected TCAS range value.
- Color: green
- Possible selections are 6, 12, 20, 40 NM. Airplanes equipped with TCAS software version 7.0 also allow 80 and 100 NM selection.

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4 - TCAS ALTITUDE BAND INDICATION

- Indicates the TCAS altitude band according to selected TCAS mode.
  - NORMAL (green) - With the TA display set to AUTO the operational TCAS altitude band will be from 1200 ft below to 1200 ft above the airplane. With the TA display set to MANUAL the operational TCAS altitude band will be from 2700 ft below to 2700 ft above the airplane.
  - ABOVE - The operational TCAS altitude band will be –2700 ft to +7000 ft.
  - BELOW - The operational TCAS altitude band will be –7000 ft to +2700 ft.

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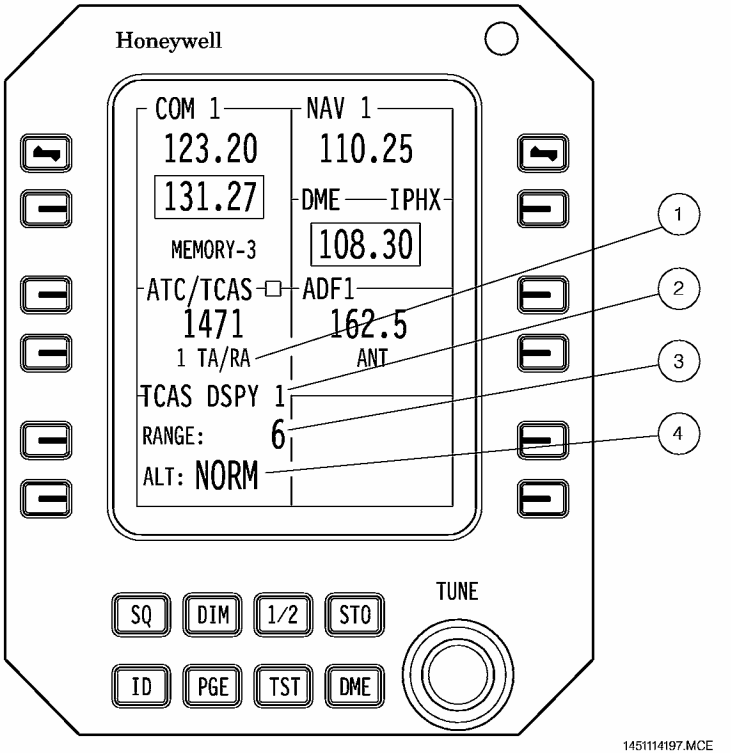

RMU RADIO PAGE

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RMU ATC/TCAS CONTROL PAGE

1 - INTRUDER ALTITUDE

REL (green) - Intruder's altitude is displayed as a relative altitude to the airplane. Value is preceded by a plus or a minus signal, depending on whether the intruder is above or below the airplane.

FL (cyan) - Intruder's altitude is displayed as its flight level. This selection automatically reverts to REL after 20 seconds.

2 - TA DISPLAY

AUTO - Traffic is displayed only when a TA or RA condition exists.

MANUAL - All traffic detected by the system is displayed.

3 - FLIGHT LEVEL 1/2

– Displays the transponder-encoded altitude and the air data source.
Refer to transponder description (Section 2-18 – Navigation and Communication).

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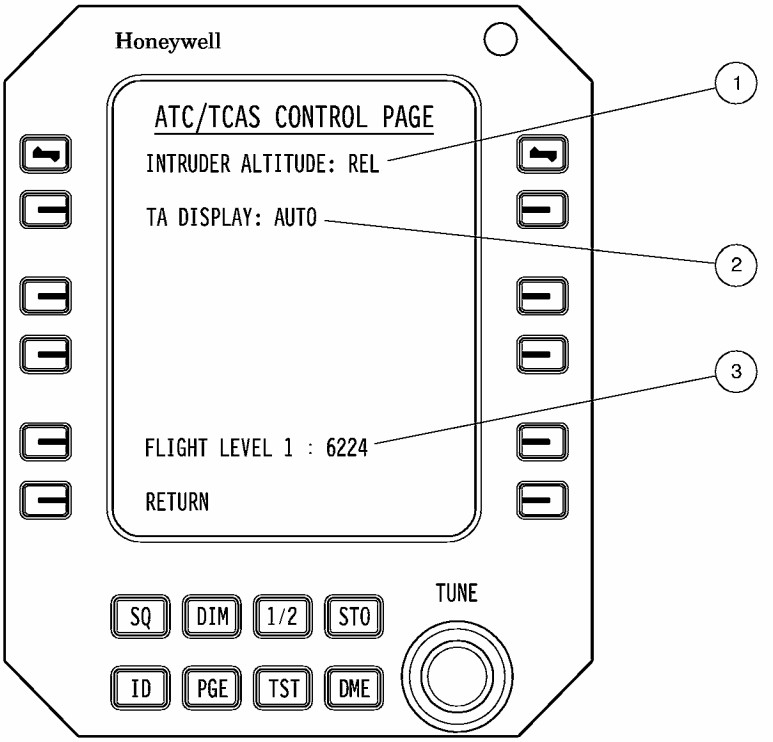

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RMU ATC/TCAS CONTROL PAGE

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TCAS TEST

The TCAS self-test is activated through the RMU TST button and may be performed on the ground or in flight. TCAS operates normally if not tested.

To test the system proceed as follows:

- On the RMU radio page, place the yellow cursor box in the ATC/TCAS window. On the MFD, set TCAS mode.
- Press and hold for 7 seconds the RMU TST button.
- A white TCAS TEST message is presented on the MFDs and PFDs.
- A TCAS TEST aural warning sounds.
- The Master Warning lights flash.

  NOTE: Some airplanes don't have the Master Warning light flashing during the test.
- The MFDs show a traffic test pattern, which permits the checking of each of the existing intruder symbols, i.e., a hollow blue diamond, a solid blue diamond, a solid amber circle and a solid red square.
- On the PFDs, the VSI shows red and green arc zones.
- At the end of the test, the RMU shows a green TCAS PASS message and a TCAS TEST PASS aural warning will sound.

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MULTI FUNCTION DISPLAY

1 - INNER RANGE RING

- Displayed around airplane symbol to indicate a 2 NM range.
- Removed if outer range indicates distance above 20 NM.

2 - OUTER RANGE RING

- May be selected up to 40 NM. Airplanes equipped with TCAS software version 7.0 allow selection up to 100 NM.

3 - NO BEARING ADVISORIES INDICATION

- Indicates data related to a detected intruder, whose bearing cannot be determined.
- Up to two lines may be displayed indicating the kind of advisory, its distance, relative altitude and whether it is climbing or descending in excess of 500 ft/min.
- Colors:
  - No bearings RAs: red.
  - No bearings TAs: amber.

4 - PROXIMATE TRAFFIC INDICATION

- Indicated by a solid cyan diamond.
- Represents any airplane within 6.5 NM horizontally and 1200 ft vertically, but whose path is not predicted to penetrate the Collision Area.

5 - INTRUDER'S VERTICAL MOVEMENT

- Indicated by an arrow next to the symbol that indicates if the intruder is climbing or descending in excess of 500 ft.
- Color: Same as of the associated symbol.

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6 - INTRUDER'S ALTITUDE

- Indicated by a solid two-digit number below or above the intruder's symbol.
- Color: Same as of the associated symbol.
- Normal presentation is relative altitude, which displays the intruder's relative altitude in hundreds of feet. A plus or minus signal indicates if the intruder is above (+) or below (–) the airplane.
- Two question marks ("??") are displayed if the intruder's relative altitude is greater than 9900 ft, below or above.
- If intruder is below the airplane, intruder's altitude is displayed below its symbol.
- If intruder is above the airplane, intruder's altitude is displayed above its symbol.

7 - RESOLUTION ADVISORY INDICATION

- Indicated by a solid red square.

8 - TRAFFIC ADVISORY INDICATION

- Indicated by a solid amber circle.

9 - OTHER TRANSPONDER REPLYING TRAFFIC INDICATION

- Indicated by a hollow cyan diamond.
- Indicates other airplanes equipped with transponder within the specified range and 2700 ft of vertical separation.
- Not displayed if a TA or RA is in process.

10 - OUT OF RANGE INTRUDER

- Indicates detected intruders that are out of display range.
- Indicated as half the associated symbol.

11 - INTRUDER'S ALTITUDE MODE INDICATION

- Indicates whether the selected intruder's altitude is relative or flight level.

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12 - TCAS BAND SELECTED

- Indicates whether the selected band for TCAS is below or above.

13 - TCAS MODE ANNUNCIATIONS

- Indicates current TCAS mode.
- Colors and labels are as follows, in the order of priority:
  - TCAS TEST - white
  - TCAS OFF (1) - white
  - TCAS FAIL (2) - amber
  - TA ONLY - white
  - TCAS - white
  - TCAS AUTO - white

NOTE: 1) For airplanes Post-Mod. SB 145-34-0125, the TCAS OFF annunciator flashes for 10 s and remain steady displayed as long as the condition persists.

2) For airplanes Post-Mod. SB 145-34-0125, the TCAS FAIL annunciator flashes for 10 s and remain steady displayed as long as the condition persists.

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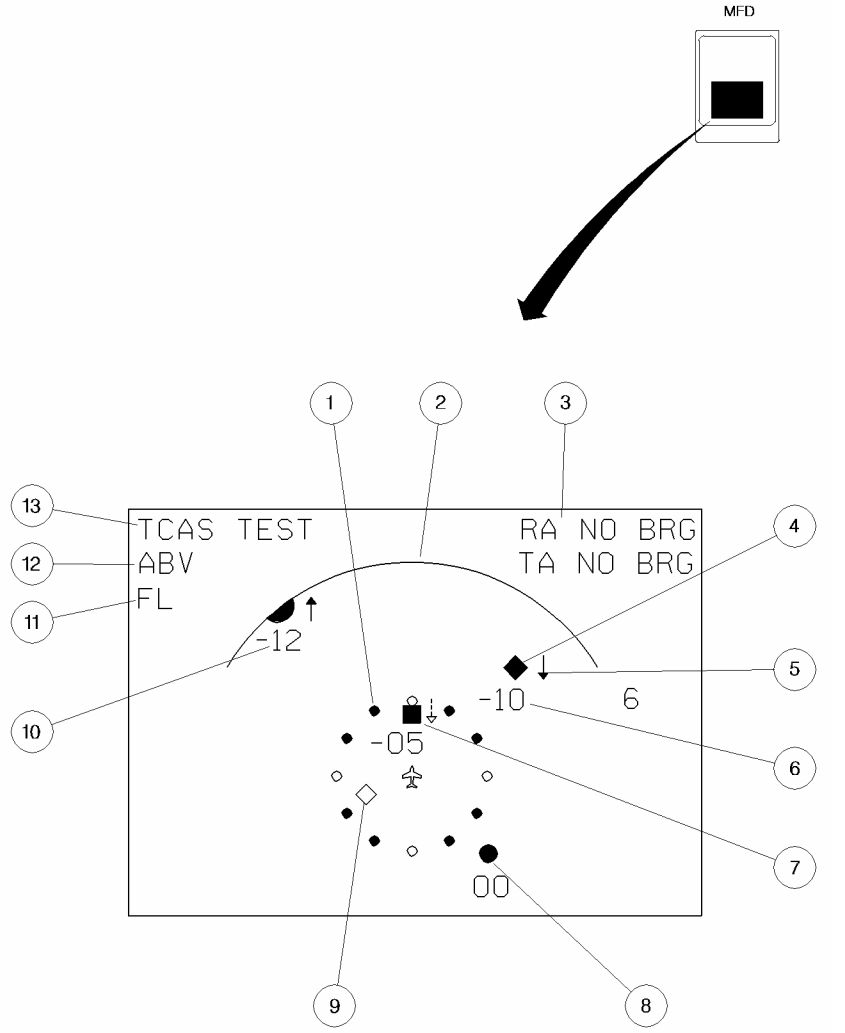

MULTI FUNCTION DISPLAY

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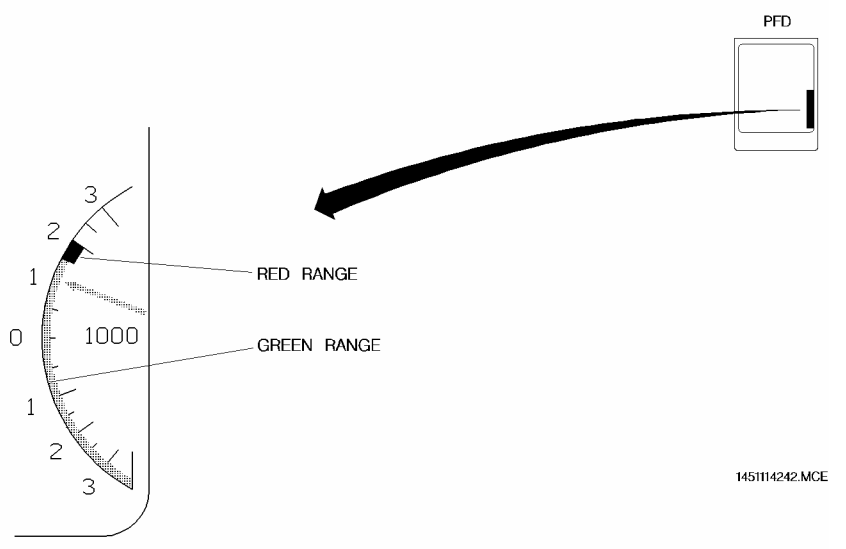
PRIMARY FLIGHT DISPLAY

For further information on Vertical Speed Indicator, refer to Section 2-17 – Flight Instruments.

VSI

- Indicates the recommended vertical speed to avoid a possible conflict.
- Green range - displayed along the scale, indicates the range of vertical speeds to be attained to avoid a conflict situation.
- Red range - displayed along the scale, indicates the range of vertical speeds prohibited for the current situation.
- Green range may be displayed together with the red range or split in two parts, depending on situation.
- Red range may be displayed alone, together with the green range, or split in two parts, depending on the situation.



PRIMARY FLIGHT DISPLAY

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SECTION 2-05

ELECTRICAL

TABLE OF CONTENTS

Block Page

General ..... 2-05-05...01
DC System ..... 2-05-05...02
DC System Protection ..... 2-05-05...04
External Power Source ..... 2-05-05...05
Batteries ..... 2-05-05...06
Backup Battery ..... 2-05-05...07
Generators ..... 2-05-05...07
APU Starter-Generator ..... 2-05-05...08
Electrical Distribution Logic ..... 2-05-05...09
Ground Service Bus ..... 2-05-05...10
Avionics Master ..... 2-05-05...11
AC System ..... 2-05-05...12
EDL Configurations and Diagrams ..... 2-05-10...01
Abnormal Operation Configurations ..... 2-05-10...01
Normal, Abnormal and Emergency Operation Diagrams ..... 2-05-10...13
EICAS Messages ..... 2-05-15...01
Controls and Indicators ..... 2-05-15...03
Electrical System Panel ..... 2-05-15...03
MFD Electrical Page ..... 2-05-15...06
Circuit Braker Panel and Load Distribution ..... 2-05-20...01
Circuit Breaker Panel ..... 2-05-20...01
DC Bus Load Distribution ..... 2-05-20...04

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GENERAL

The electrical power system supplies AC and DC voltage for all loads during normal or emergency operation.

Two different types of sources provide electrical power supply:

- DC Power
- AC Power

The DC power system supplies 28 V DC for all airplane electrical loads and recharges the batteries. It is the primary electrical power supply system. The DC power system is comprised of:

- Four independent generators (28 V DC/400 A/engine driven).
- One APU starter-generator (28 V DC/400 A).
- Two Nickel-Cadmium batteries (24 V DC/44 Ah/1 hour rate).
- One lead-acid backup battery (24 V DC/5 Ah/10 hour rate).
- External power source.

AC power is supplied by one 250 VA/400 Hz single-phase static inverter, which converts 28 V DC into 115 V AC.

A dedicated page on the MFD (electrical page) provides, on request, information regarding system configuration, load and voltage conditions as well as battery temperatures. Furthermore, warning and caution messages are presented on the EICAS to indicate an electrical system failure.

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DC SYSTEM

The 28 V DC electrical power system automatically controls power contactors, fault protection, load shedding and emergency system operation. This reduces pilot workload during normal operation, external power supply or system failures. The Electrical Distribution Logic (EDL) and Generator Control Units (GCU) perform system management. Detected system failures are automatically isolated, causing some bus(es) to be deenergized.

Under normal operation, the electrical DC system is divided into isolated left and right electrical networks. The left network includes generators 1 and 3, driven by engine 1. Operated in parallel, generators 1 and 3 are connected to DC BUS 1 to supply ESSENTIAL DC BUS 1, SHED DC BUS 1 and HOT BUS 1. Battery 1 is charged by the generators connected to DC BUS 1. Similarly, generators 2 and 4 power the right network and are driven by engine 2.

Both networks are interconnected through Bus Tie Contactors (BTC) in case of operation with less than four generators. APU generator may replace any inoperative generator, or may be used before engine starting when the APU generator or Ground Power Unit (GPU) may supply the electrical system.

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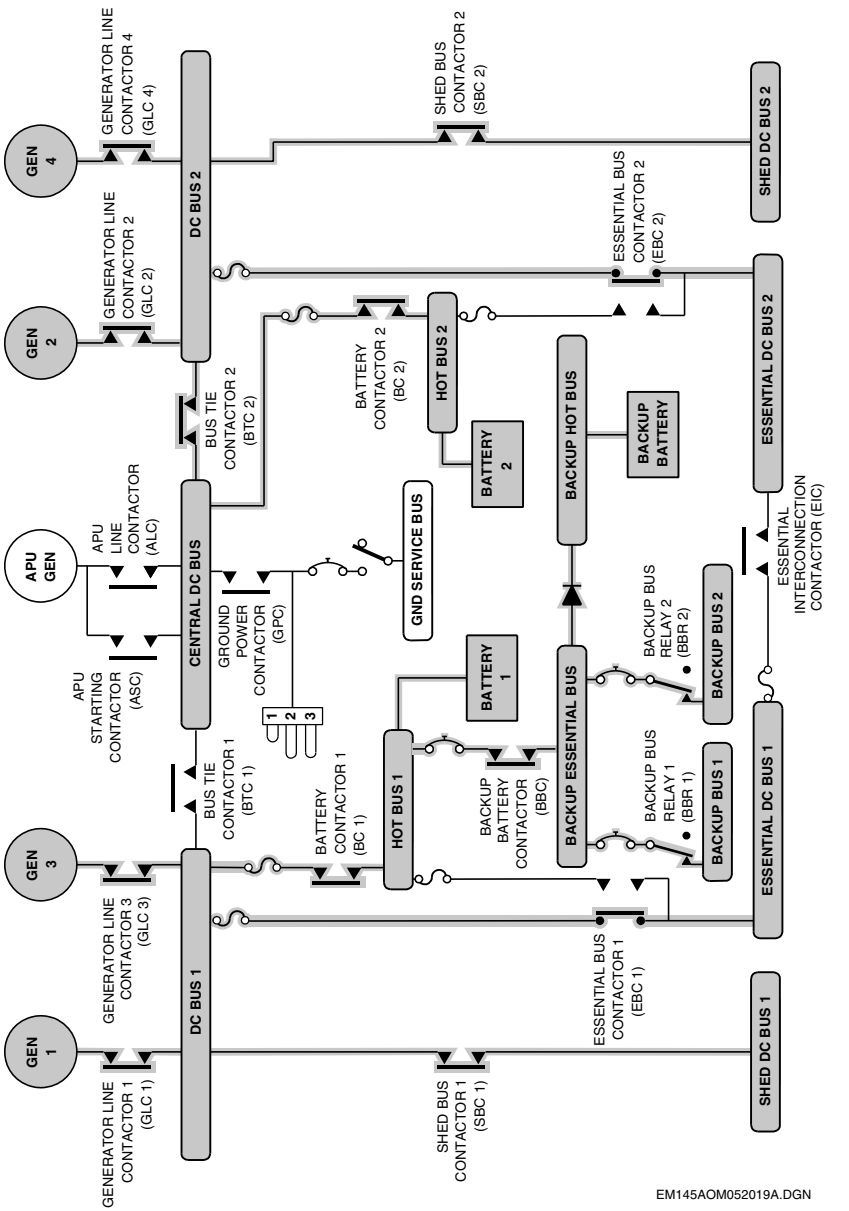

DC ELECTRICAL DISTRIBUTION SYSTEM SCHEMATIC

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DC SYSTEM PROTECTION

The system monitors generators current and voltage to the electrically supplied equipment to protect it from a control unit failure, such as an overvoltage or a bus failure. If an overvoltage is detected, the associated GCU deenergizes the generator, disconnecting it from the bus.

A bus failure produces an overcurrent condition to one or more generators. Upon sensing this overcurrent, the GCU isolates the system networks, opening the BTCs. If any generator remains overloaded due to the failure, it is then deenergized and disconnected from the bus.

As long as the generator current exceeds 400 A, a caution message is presented on the EICAS, indicating that manual load shedding is required. If no action is taken, the system will be isolated and some buses may be deenergized.

System protections are designed so that normal transients will not cause generators to be disconnected from the bus inadvertently.

Resetting of the generator after a failure is accomplished by releasing the associated Generator Button and then pressing it again.

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EXTERNAL POWER SOURCE

The Ground Power Unit (GPU) is connected to the airplane through an external receptacle. The GPU supplies 28 V DC to the load buses for ground operation and APU starting, independently of the internal batteries.

The GPU has priority over any battery and generator when energizing the airplane. Thus, the generators and the batteries cannot operate in parallel with the GPU.

The GPU Button, located on the overhead panel, controls the External power supply. As soon as the Ground Power Unit is energized, properly connected to the airplane receptacle, ready to supply power but not connected to the buses, the GPU AVAIL inscription illuminates on the GPU Button. An identical inscription above the GPU receptacle simultaneously illuminates.

When GPU AVAIL is illuminated and the batteries are not connected to the buses, only the GROUND SERVICE BUS is supplied through the external power supply. When the GPU Button is pressed, the Ground Power Contactor (GPC) will close, allowing the external power to feed the load buses. When the external power comes on line, the GPU AVAIL inscription on the GPU Button extinguishes itself and the white stripe on the button lower half illuminates.

An overvoltage circuit isolates the GPU from the airplane's electrical buses if the GPU voltage is incorrect. External power inverse polarity protection is also provided. To reset the system, release the GPU button and then press it again. If the GPU overvoltage persists, GPC will be kept open.

The external power voltage can be monitored through the electrical page, on the MFD. The electrical system page shows the GPU box and its voltage. The GPU voltage indication is removed in flight.

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BATTERIES

Two 24 V DC, 44 Ampere-hour, nickel-cadmium batteries supply essential loads in case of an in-flight failure of all generators or if both engines are shut down simultaneously and the APU is not available. Both batteries can supply at least 40 minutes of power for essential loads in an all-generator-failure condition.

During normal operation, Battery 1 is connected in parallel with generators 1 and 3 (network 1). Battery 2 is connected in parallel with generators 2 and 4 (network 2). Battery 2 also supplies power for APU starting.

During APU starting, battery 1 is isolated from the load buses. While battery 2 provides power for APU start, battery 1 provides stable electrical power to the equipment that can be adversely affected by voltage transients.

A selector switch on the overhead panel controls each battery. When set to the AUTO position, battery contactors (BC 1 or BC 2) actuation is controlled according to the Electrical Distribution Logic (EDL). When the GPU is connected, the battery contactors open so that only the GPU can supply the load buses. When on the ground, with the batteries as the only electrical power source, EDL deenergizes the shed buses for battery conservation. When the battery selector knob is switched to the OFF position, the battery contactor opens, isolating the battery from the system.

The batteries are installed in the battery compartment, on the left side of the airplane nose section. They are ventilated in flight by forced airflow to prevent overheating. Temperature sensors installed in each battery provide temperature indication to the MFD. If battery internal temperature rises above 70°C, a warning message is presented on the EICAS. If a battery is isolated from the load buses, a caution message is displayed on the EICAS.

In case of Loss of All Generators battery duration is 40 minutes, considering three APU start attempts. However, be attentive to the following condition: On ground, after starting the APU, batteries voltage must be checked with all Generators disconnected. If batteries voltage is below 24.0V, they must be recharged. The minimum time for battery recharging is 30 minutes. Be aware that while GPU is ON, batteries will not be recharged.

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BACKUP BATTERY

A 24 V DC, 5 Ampere-hour sealed lead-acid battery provides stabilized power for operation of the GCUs protective function, even in case of short-circuit, when system voltage may drop near zero volts.

The Backup Battery Button, on the overhead panel controls the backup battery. Pressing the button when the Battery 1 or 2 Selector Knob is set to the AUTO position connects the backup battery to the electrical system for charging. If the Backup Battery Button is released, a caution message is displayed on the EICAS.

GENERATORS

The primary source of electrical power are the four 28 V DC, 400 Amperes, independent engine-driven brushless generators, two installed on each engine accessory gearbox.

Each generator is automatically controlled and protected by a dedicated Generator Control Unit (GCU), provided the Generator Control Button on the overhead panel is pressed.

The generators will come on line when engine speed stabilizes above 56.4% N2. If a failure occurs and the Generator Line Contactor (GLC) opens, a reset may be attempted once by releasing the associated Generator Control Button and then pressing it again.

Anytime the Generator Line Contactor is inadvertently opened or generator current is above 400 A, a caution message is displayed on the EICAS. The generator voltage and current can be monitored through the electrical page, on the MFD.

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APU STARTER-GENERATOR

A 28 V DC, 400 Amperes, APU-driven starter-generator supplies electrical power during ground operation or in flight, as an alternative source of electrical power. The APU starter generator is controlled and protected by its dedicated GCU.

The APU Generator Button, on the Electrical System Panel, must be pressed for normal operation. The APU line contactor is actuated on and off by APU speed. If a failure occurs on the APU generator, a reset may be attempted releasing the APU Generator Button and pressing it again. Only one reset may be attempted.

The APU generator, when operating, is connected in parallel with the generators supplying DC Bus 2. If needed, the APU generator can replace an inoperative left network generator. After starting, and with an engine driven generator inoperative, the APU generator automatically replaces the inoperative generator.

Three electrical sources may be used to power an APU start: ground power unit, battery 2 or battery 2 assisted by the main generators. Battery 1 cannot be used for APU starting. Instead, it is isolated from the load buses to provide stable electrical power to supply equipment that may be affected by voltage fluctuation.

During starting, the APU Starting Contactor (ASC) is closed, allowing the APU starter-generator to operate as a starter, energized through the Central DC Bus. When the APU starting cycle is completed, the ASC opens. A caution message is displayed on the EICAS if the ASC does not open.

At 95% RPM plus seven seconds, the APU starter generator is available to supply electrical power to the system. In this condition, the APU Line Contactor (ALC) is closed, connecting the APU starter generator to the load buses. If the ALC does not close due to contactor failure or button not pressed, a caution message is displayed on the EICAS.

The APU starter generator voltage and current may be monitored on the MFD.

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ELECTRICAL DISTRIBUTION LOGIC

Many different configurations are available in the Electrical Distribution Logic (EDL) to suit any particular situation. The EDL's architecture is symmetrical and the operational logic sequence for EDL 1 is the same as for EDL 2. EDL 1 is composed of DC Bus 1, Shed DC Bus 1, Essential DC Bus 1 and Hot Bus 1. The EDL 2 is composed of DC Bus 2, Shed DC Bus 2, Essential DC Bus 2 and Hot Bus 2.

The Central DC Bus primary function is to connect the APU generator or GPU to the load buses through the Bus Tie Contactors (BTC). The Central DC Bus also provides bus interconnections in case of asymmetrical configuration, such as generators failure or engine shutdown.

The Electrical Distribution Logic (EDL) differs depending on whether the airplane is on the ground or in flight. In flight, some buses are deenergized, depending on the power source available.

On the ground, all the DC buses are energized if at least one of the following conditions occurs:
- At least three generators are on.
- The GPU is on and connected to the airplane.
- At least one generator is on, and the Shed Buses Selector Knob is set to OVRD position.

The DC distribution table below shows the Electrical Distribution Logic configuration according to the conditions of the generators.

DC DISTRIBUTION TABLE

CONDITION	RESULTS
4 or 5 Generators On	Two isolated left and right electrical networks with all buses energized.
3 Generators On	Both electrical networks interconnected through Bus Tie Contactors with all buses energized.
1 or 2 Generators On	Both electrical networks interconnected through Bus Tie Contactors with shed buses deenergized.
Loss of all Generators	Batteries to supply the Essential Buses (in-flight condition only).

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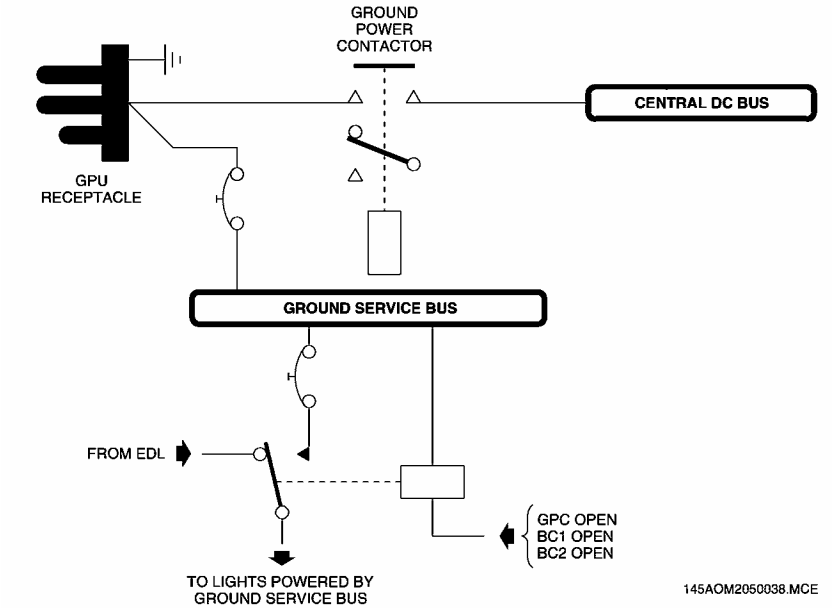
GROUND SERVICE BUS

The Ground Service Bus is energized by connecting the GPU connector to the airplane receptacle, provided the batteries and generators are not connected to the buses (GPC, BC 1 and BC 2 are open).

The Ground Service Bus supplies electrical power for airplane servicing and maintenance while on the ground. It functions independently of the Electrical Distribution Logic and does not energize all electrical distribution buses.

The following lights will be powered by the Ground Service Bus:

- Passenger cabin lights;
- Lavatory lights;
- Galley lights;
- Courtesy/stairs lights;
- Cockpit dome lights;
- Baggage/service compartment lights.



GROUND SERVICE SCHEMATIC

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AVIONICS MASTER

The avionics master system allows manual disconnection of some navigation and communication equipment from the load buses. This prevents undesirable voltage transients during APU starting on the ground.

The avionics master system consists of six buses: Avionics Switched DC Buses 1A, 1B, 2A, 2B and Avionics Switched Essential DC Buses 1 and 2. These buses are supplied by their associated DC buses. Two Avionics Master Buttons, located on the overhead panel, control switching the buses.

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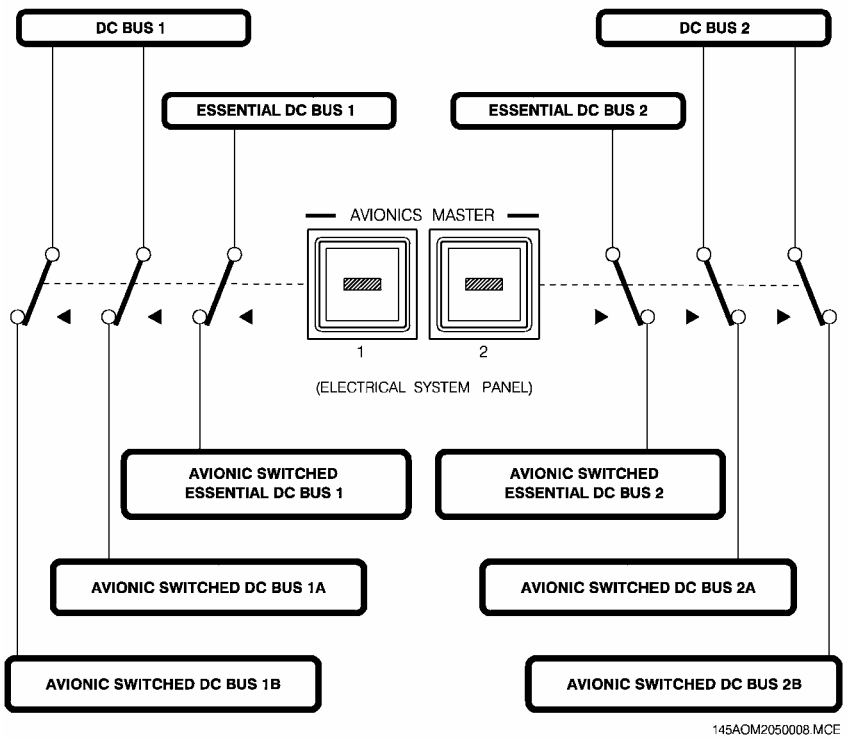

AVIONICS MASTER SCHEMATIC

AC SYSTEM

One 250 VA/400 Hz single phase static inverter converts 28 V DC electrical power into 115 V AC for airplane systems requiring AC power. The avionics system is the primary user of AC power.

The inverter is power supplied by the DC Bus 1 and controlled by the AC Power Button, on the overhead panel. If DC Bus 1 is energized and the AC Power Button is pressed, the 115 V AC BUS is automatically energized. If the DC Bus 1 is deenergized, the inverter becomes inoperative.

To reduce pilot workload, the AC Power Button should remain pressed, even after engine shutdown. If the AC Power Button is released, a striped bar illuminates to indicate that the button is out of normal operating condition.

During normal airplane operation, if 115 V AC BUS is deenergized, a caution message is displayed on the EICAS. An inverter reset may be attempted through the AC Power Button, by releasing and then pressing it again.

Under electrical emergency conditions the inverter stops the operation.

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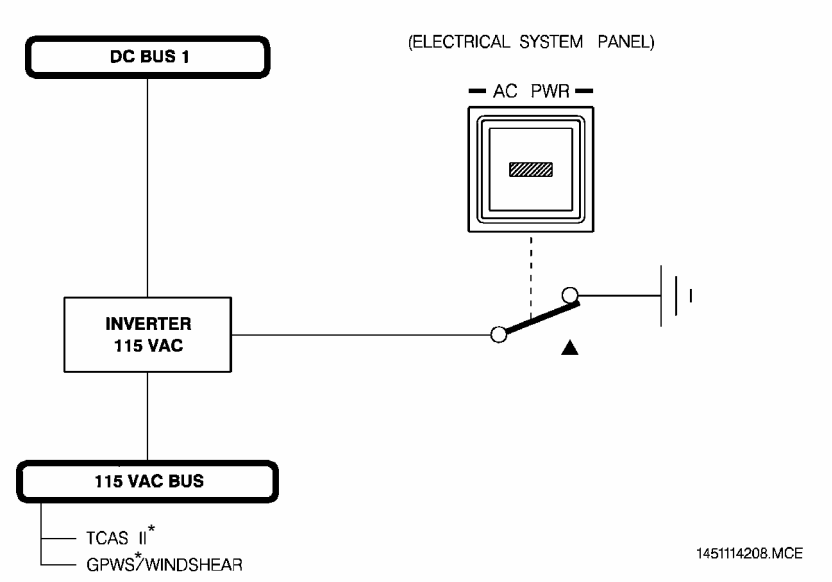

*If installed

AC GENERATION AND DISTRIBUTION SCHEMATICS

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ELECTRICAL DISTRIBUTION LOGIC (EDL) CONFIGURATIONS AND DIAGRAMS

ABNORMAL OPERATION CONFIGURATIONS

For the Electrical Distribution Logic configurations presented here, the initial control positions on the Electrical System Panel are the following:

– Generator Buttons pressed;
– GPU Button released;
– Battery Selector Knobs set to AUTO position;
– Essential Power Button released;
– Bus Tie Selector Knob set to AUTO position;
– Shed Buses Selector Knob set to AUTO position;
– Backup Battery Button pressed;
– Avionics Master Buttons pressed.

NOTE: - All abnormal conditions considered below are in-flight conditions.
- In the schematic configurations, the continuous boxes indicate energized buses while dashed boxes indicate deenergized buses.

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CONFIGURATION 1

Loss of one left side generator (network 1):

- **Without APU generator available:**
  - GLC 1 or 3 is open.
  - ALC is open.
  - BTC 1 is closed.
- **With APU generator available:**
  - GLC 1 or 3 is open.
  - ALC is closed.
  - BTC 1 is closed and BTC 2 is open.

Loss of one right side generator (network 2):

- **Without APU generator available:**
  - GLC 2 or 4 is open.
  - ALC is open.
  - BTC 2 is closed.
- **With APU generator available:**
  - GLC 2 or 4 is open.
  - ALC is closed.
  - BTC 2 is closed and BTC 1 is open.

Loss of two generators with APU generator available:

- GLCs from affected generators are open.
- ALC is closed.
- BTC 1 and BTC 2 are closed.

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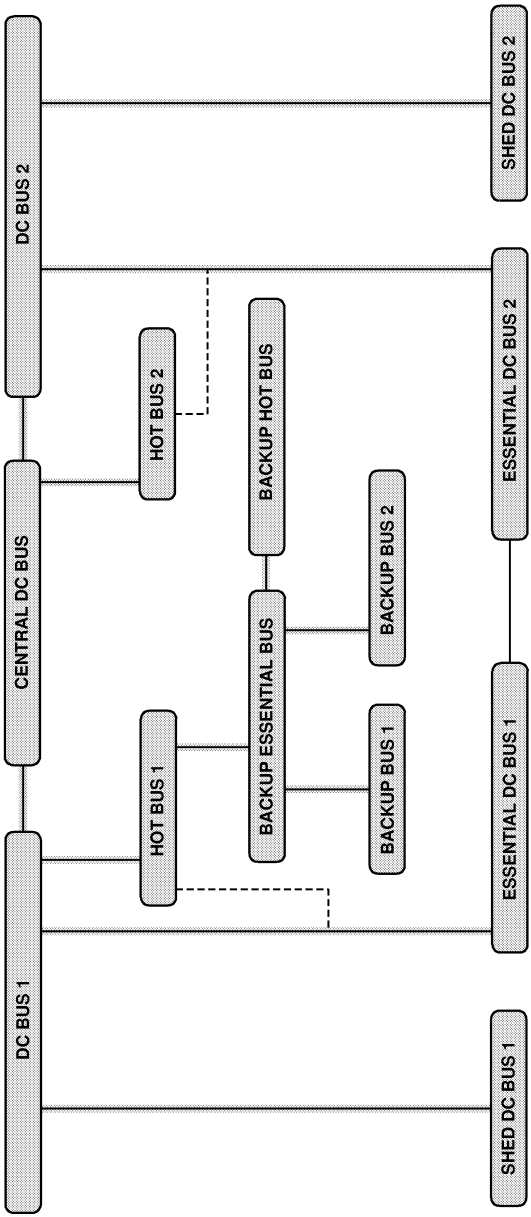

CONFIGURATION 1

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CONFIGURATION 2

Loss of two generators without APU generator available:

- GLCs from affected generators are open.
- ALC is open.
- BTC 1 and BTC 2 are closed.
- SBC 1 and SBC 2 are open.

Loss of three generators without APU generator available:

- GLCs from affected generators are open.
- ALC is open.
- BTC 1 and BTC 2 are closed.
- SBC 1 and SBC 2 are open.

NOTE: Depending on the amount of load on the remaining buses, an overload condition may occur. In this case, the pilot are required to perform an additional load shedding.

Loss of three generators with APU generator available:

- GLCs from affected generators are open
- ALC is closed.
- BTC 1 and BTC 2 are closed.
- SBC 1 and SBC 2 are open.

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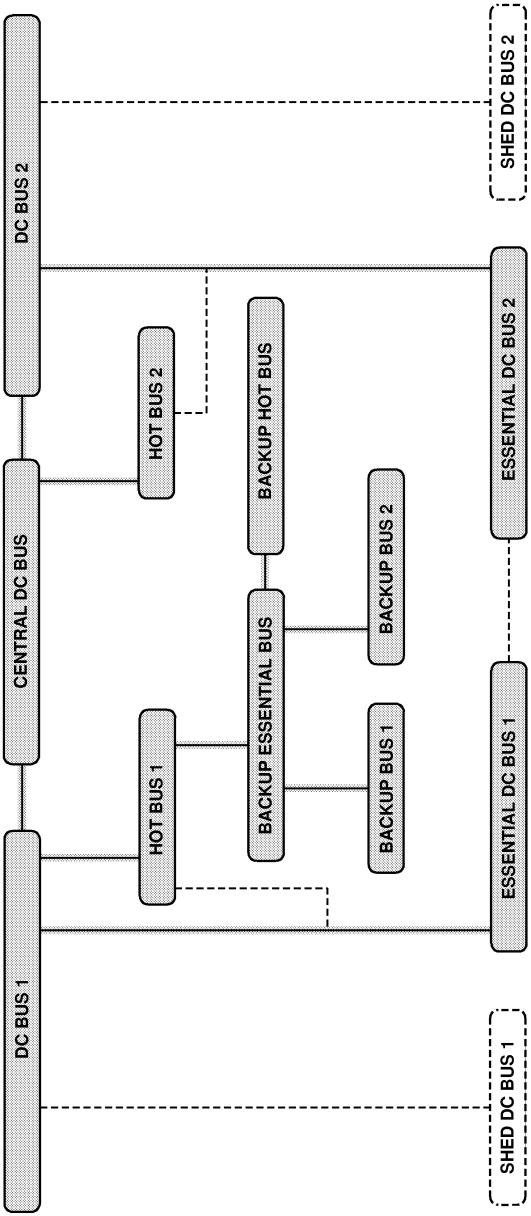

CONFIGURATION 2

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CONFIGURATION 3

Loss of all generators:

- When the last generator fails, the operational logic configures the system to dedicate the batteries to supply the Essential Buses only (electrical emergency condition). In this configuration, the Central DC Bus is also powered to allow the APU to be started.
- BTC 1, BTC 2, BC 1, SBC 1, SBC 2, BBR 1 and BBR 2 are open.
- EIC, EBC 1, EBC 2 and BC 2 are closed.

NOTE:- This operational mode is activated for in-flight condition only.
- A 1-second time delay is provided to avoid inadvertent switching to emergency configuration due to electrical transients.
- If the automatic transfer fails, perform this function manually by pressing the Essential Power Button.
- While In-flight, the electrical system is automatically reset if at least one generator is reset and supplying its associated bus.
- On the ground, the system can be reset by switching both Battery Selector Knobs from AUTO to OFF and then back to AUTO.

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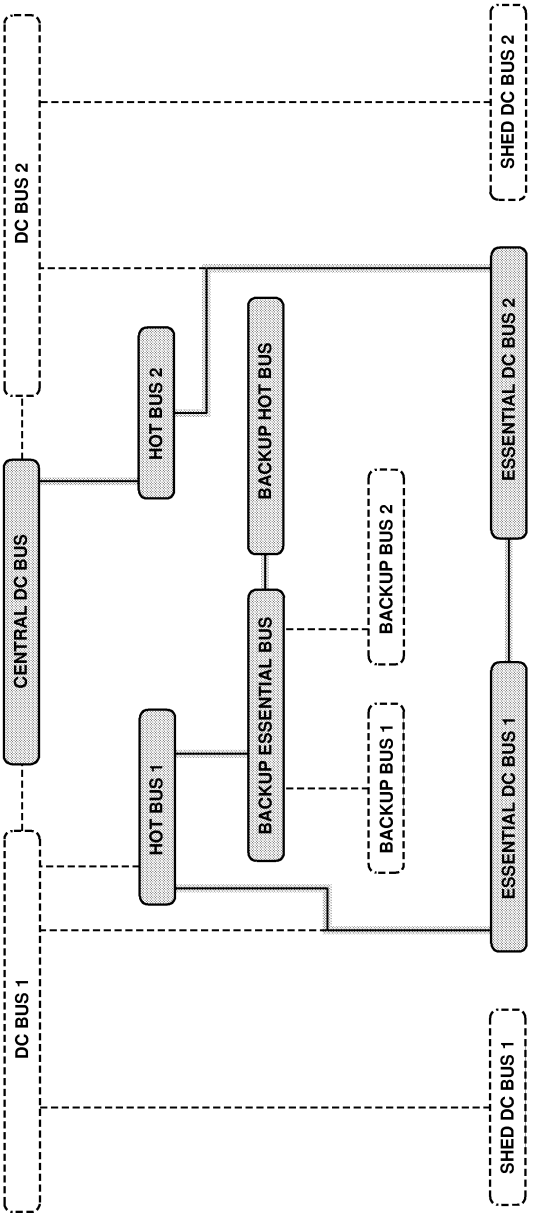

CONFIGURATION 3
(Electrical Emergency Condition)

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ABNORMAL OPERATION - CONFIGURATION 3A

Improper transfer to electrical emergency condition:

If during normal operation an improper transfer to electrical emergency condition occurs, the following modification will take place:

- ELEC EMERG ABNORM caution message on the EICAS.
- EBC 1, EBC 2, EIC and BC 2 are closed.
- BTC 1, BTC 2 and BC 1 are open.
- GLCs from operating generators are closed.
- SBC 1 and SBC 2 are closed if at least three generators are on.

NOTE: - BC 2 remains closed to keep the CENTRAL DC BUS energized and making it possible to perform an APU start.
- In case APU generator is not available, the batteries will feed the essential buses for at least 40 minutes.
- DC BUS 1 and DC BUS 2 remain energized by the respective engine generators, but isolated from the CENTRAL DC BUS.

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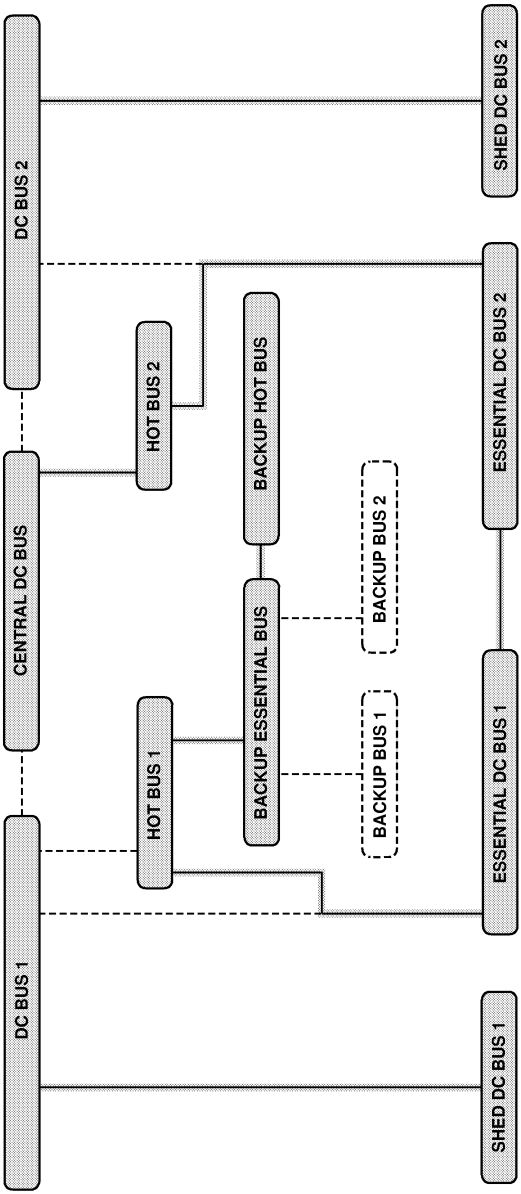

CONFIGURATION 3A

ABNORMAL OPERATION - CONFIGURATION 3B

Electrical essential transfer failure:

An electrical essential transfer failure will occur when all GLCs and ALC are open (loss of all generators) and DC BUS 1 and/or DC BUS 2 remain energized.

The DC BUS 1 may remain energized because:

- BTC 1 fails to open.
- BC 1 fails to open or;
- EBC 1 fails to close.

The DC BUS 2 may remain energized because:

- BTC 2 fails to open or;
- EBC 2 fails to close.

Case 1 - Loss of all generators and BTC 1 is closed (DC BUS 1 is energized):

- ELEC ESS XFR FAIL warning message on the EICAS.
- All GLCs and ALC are open.
- BTC 2, BC 1, SBC 1 and SBC 2 are open.
- EBC 1, EBC 2, BTC 1, BC 2, BBC and EIC are closed.

NOTE: BC 2 remains closed to keep the CENTRAL DC BUS energized and making it possible to perform an APU start.

Case 2 - Loss of all generators and BTC 2 is closed (DC BUS 2 is energized):

- ELEC ESS XFR FAIL warning message on the EICAS.
- All GLCs and ALC are open.
- BTC 1, BC 1, SBC 1 and SBC 2 are open.
- EBC 1, EBC 2, BTC 2, EIC and BC 2 are closed.

NOTE: BC 2 remains closed to keep the CENTRAL DC BUS energized and making it possible to perform an APU start.

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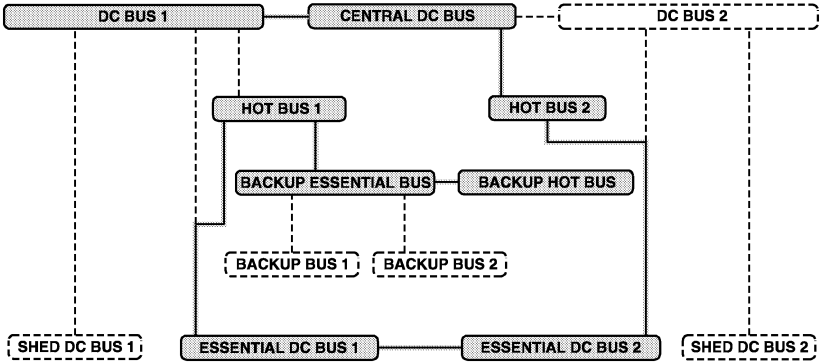
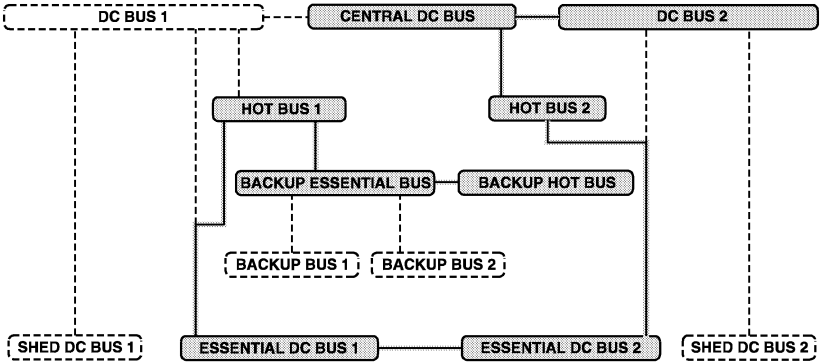


CASE 1



CASE 2

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CONFIGURATION 3B

CONFIGURATION 4

Short circuit at one DC Bus with all generators on:

- Associated battery is removed from affected DC bus through a fuse.
- BTC 1 and BTC 2 are open.
- Both GLCs of the affected DC Bus are open, isolating the bus.
- Cross-side BTC and EIC are closed and affected side EBC is energized to maintain both Essential DC Buses energized and batteries charged.

Short circuit at one DC Bus with loss of one associated generator and with APU generator:

- Associated battery is removed from the affected DC bus through a fuse.
- BTC 1 and BTC 2 are open.
- Remaining GLC of the affected DC Bus opens, isolating the bus.
- Cross-side BTC and EIC are closed, and affected side EBC is energized to maintain both Essential DC Buses energized and batteries charged.

Short circuit at one DC Bus with loss of associated generators and with APU generator:

- Both batteries are removed from the affected DC bus through the fuses.
- BTC 1 and BTC 2 are open.
- EIC closes and EBC of affected side is energized to maintain the associated Essential DC Bus energized and associated battery charged.

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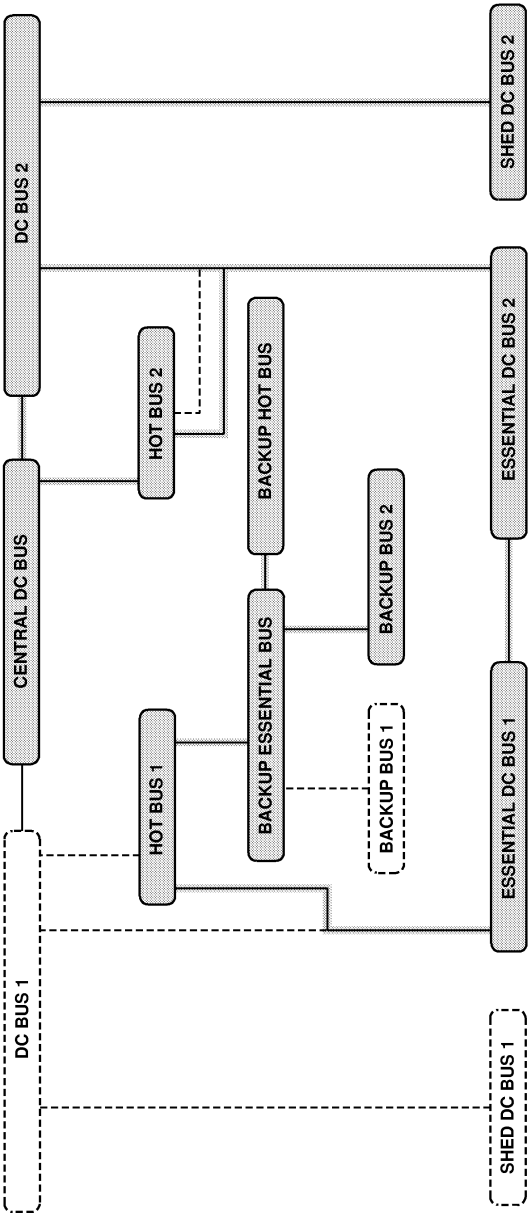

CONFIGURATION 4
(Only EDL 1 Failure Shown)

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CONFIGURATION 5

Short circuit at one DC Bus with loss of one associated generator and without APU generator:

- Both batteries are removed from the affected DC bus through the fuses.
- BTC 1 and BTC 2 are open.
- Remaining GLC of the affected DC Bus opens, isolating the bus.
- Cross-side BTC and EIC close, and EBC of the affected side is energized to maintain both Essential DC Buses energized and associated battery charged.
- Both SBCs are open.

Short circuit at one DC Bus with loss of associated generators and without APU generator:

- Both batteries are removed from the affected DC bus through the fuses.
- BTC 1 and BTC 2 are open.
- EIC closes and EBC of the affected side is energized to maintain the associated Essential DC Bus energized and associated battery charged.
- Both SBCs are open.

Short circuit at one DC Bus with loss of associated generators plus one generator of the other side, with or without APU generator:

- The EDL operational sequence is the same as in the previous condition.

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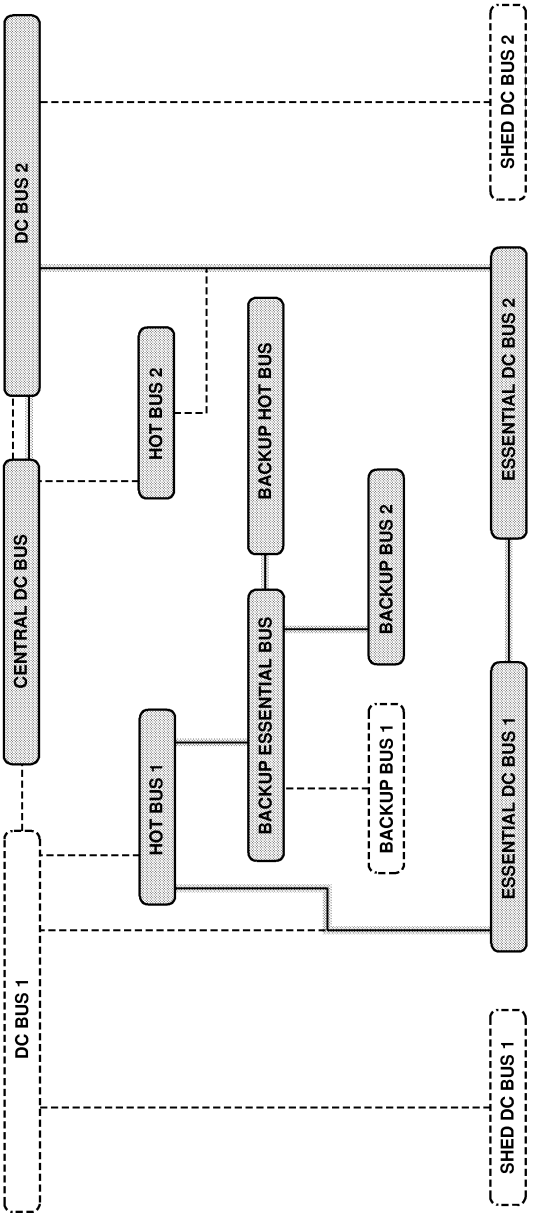

CONFIGURATION 5
(Only EDL 1 Failure Shown)

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NORMAL, ABNORMAL AND EMERGENCY OPERATION DIAGRAMS

The following diagrams present the Electrical System layout when operating in normal, abnormal and emergency condition.

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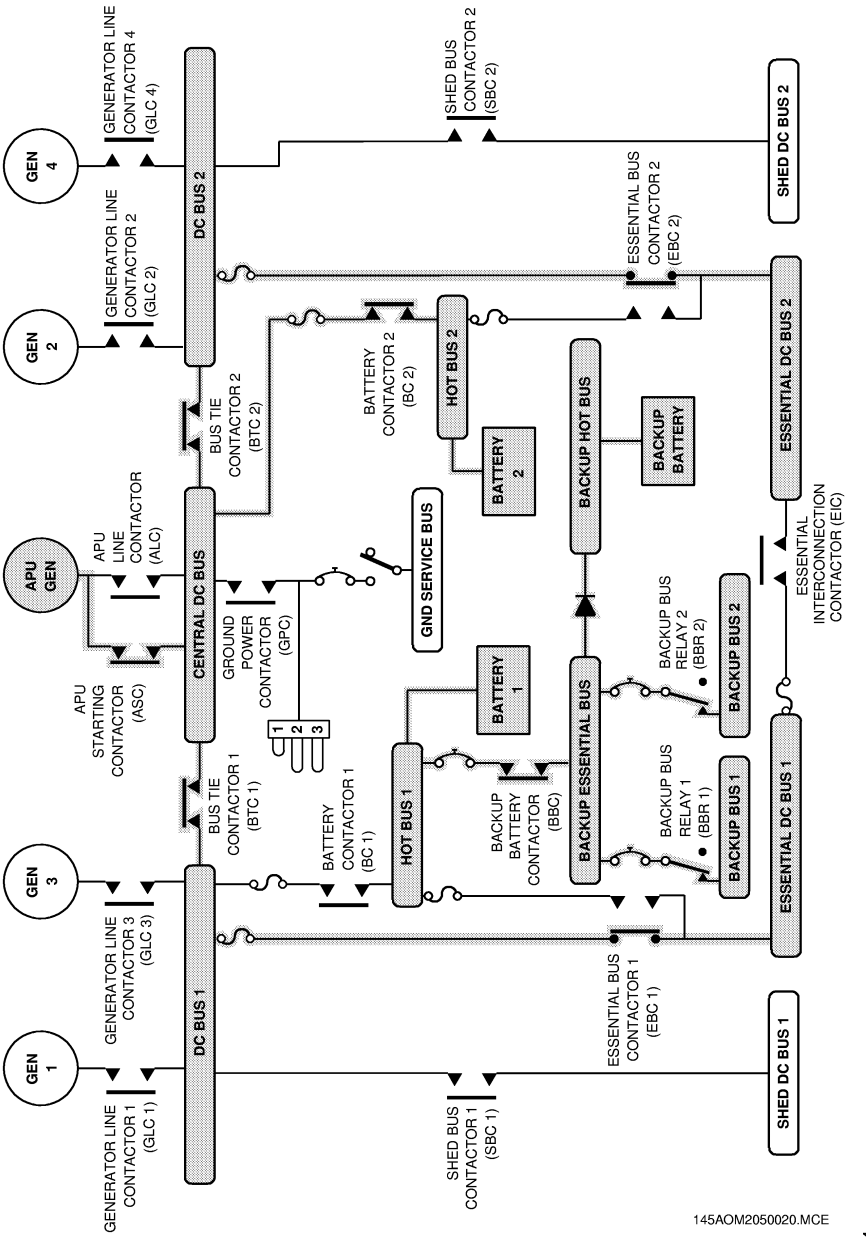

EDL STATUS DURING APU STARTING WITH BATTERIES

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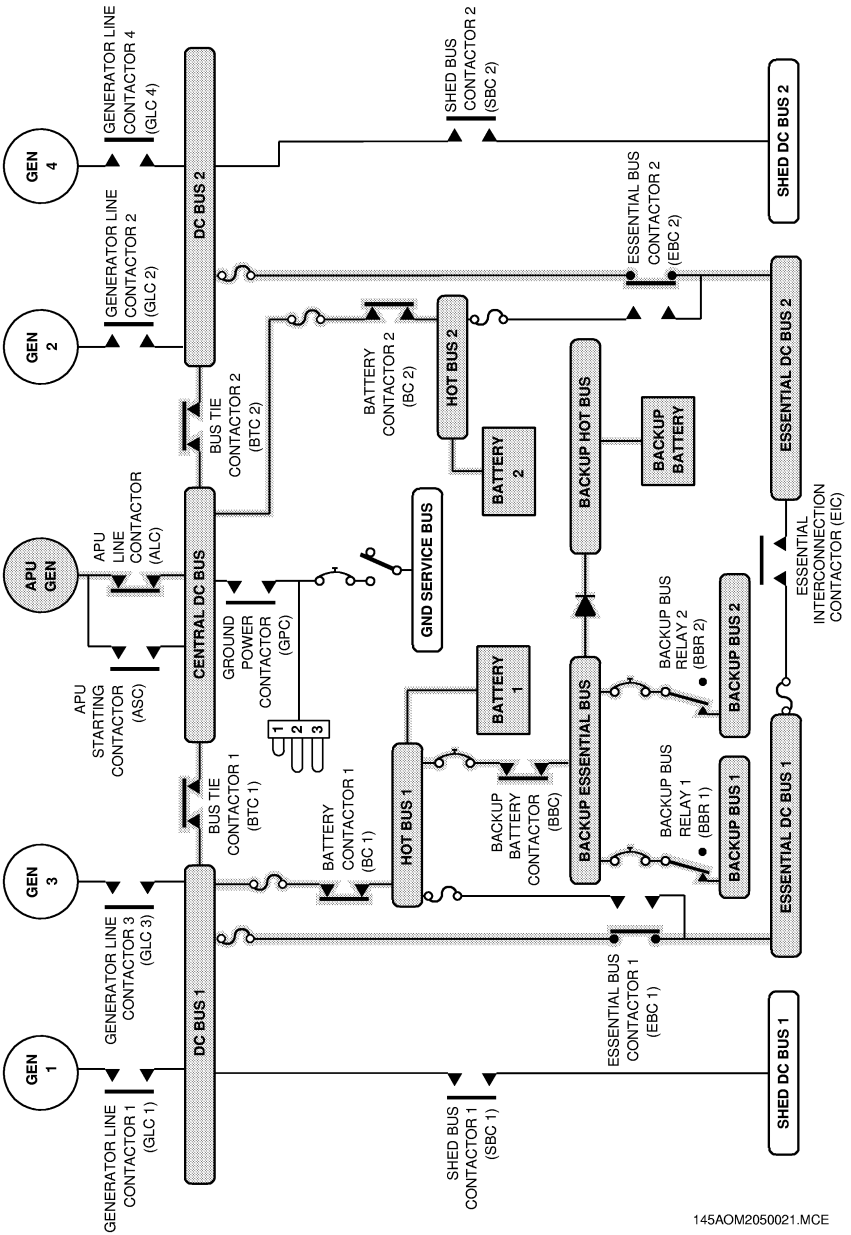

EDL STATUS AFTER APU STARTING WITH BATTERIES

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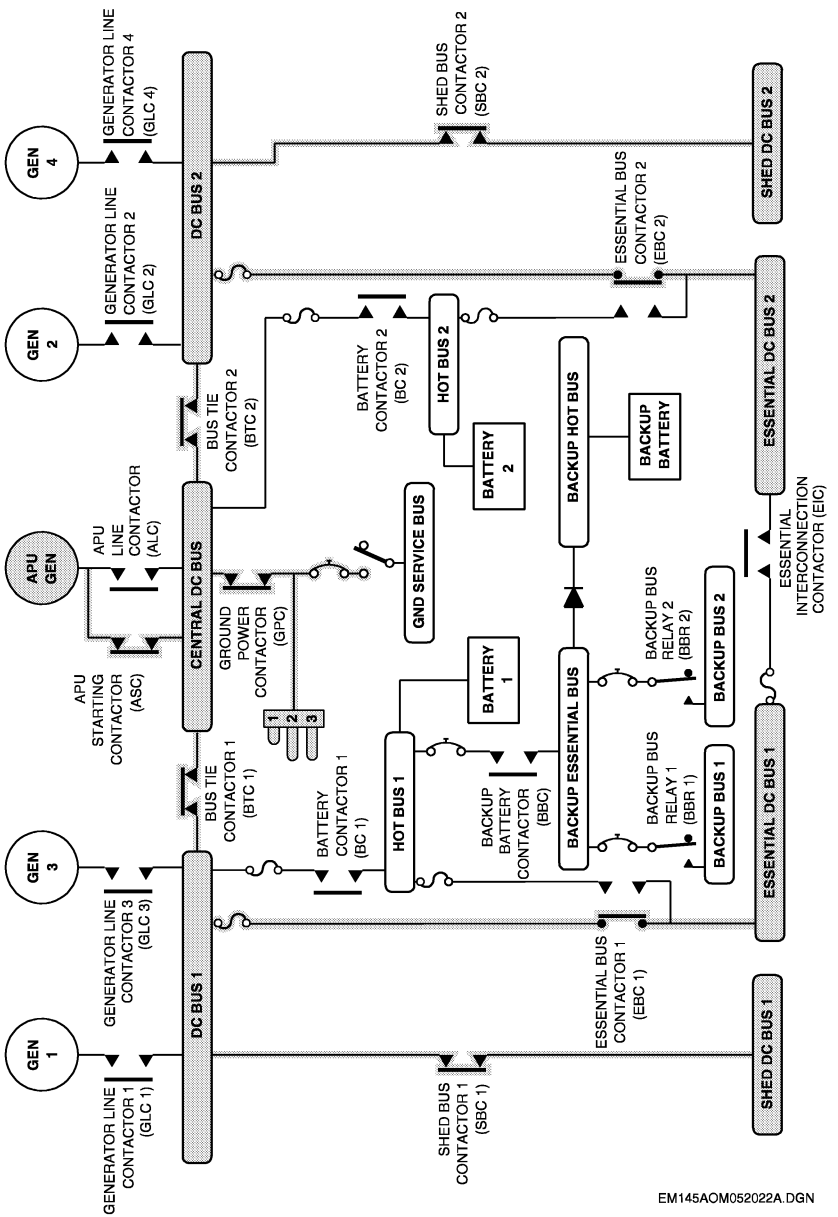

EDL STATUS DURING APU STARTING WITH GPU

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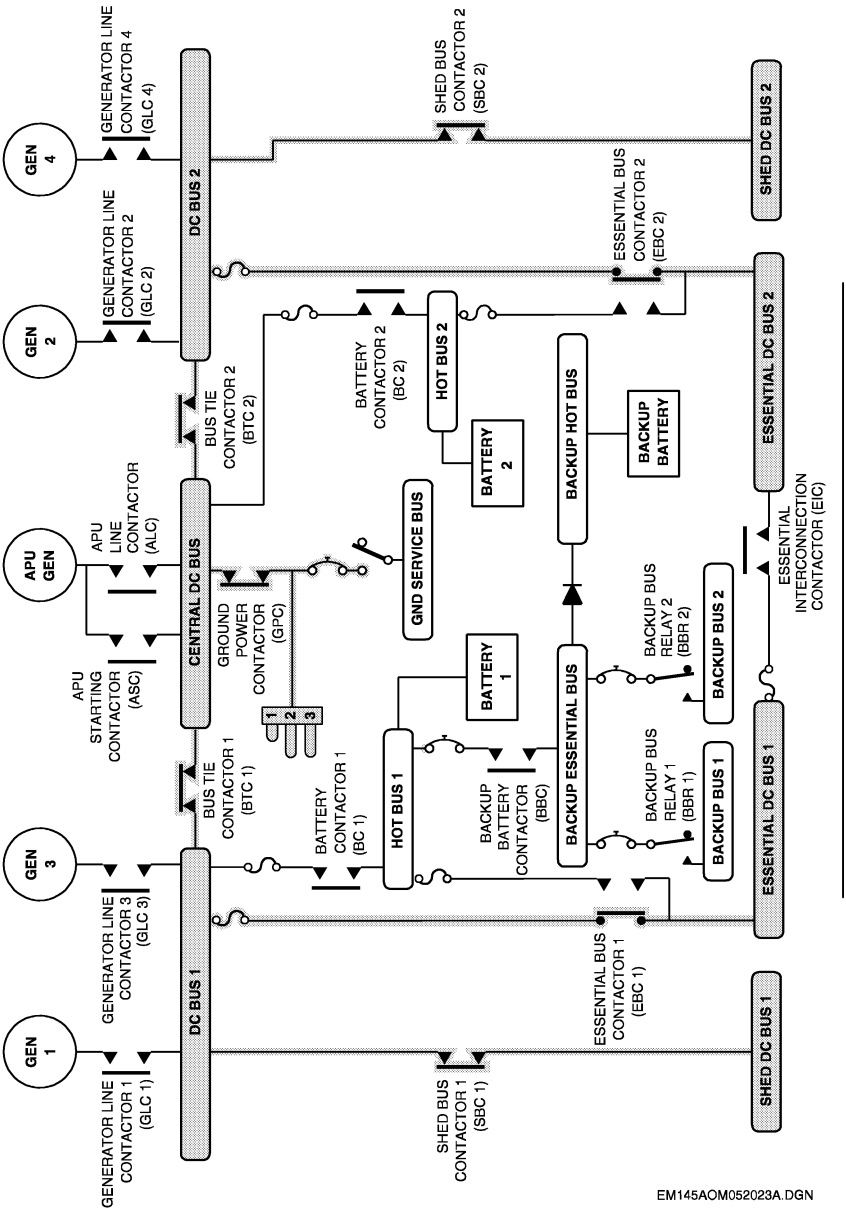

EDL STATUS AFTER APU STARTING WITH GPU

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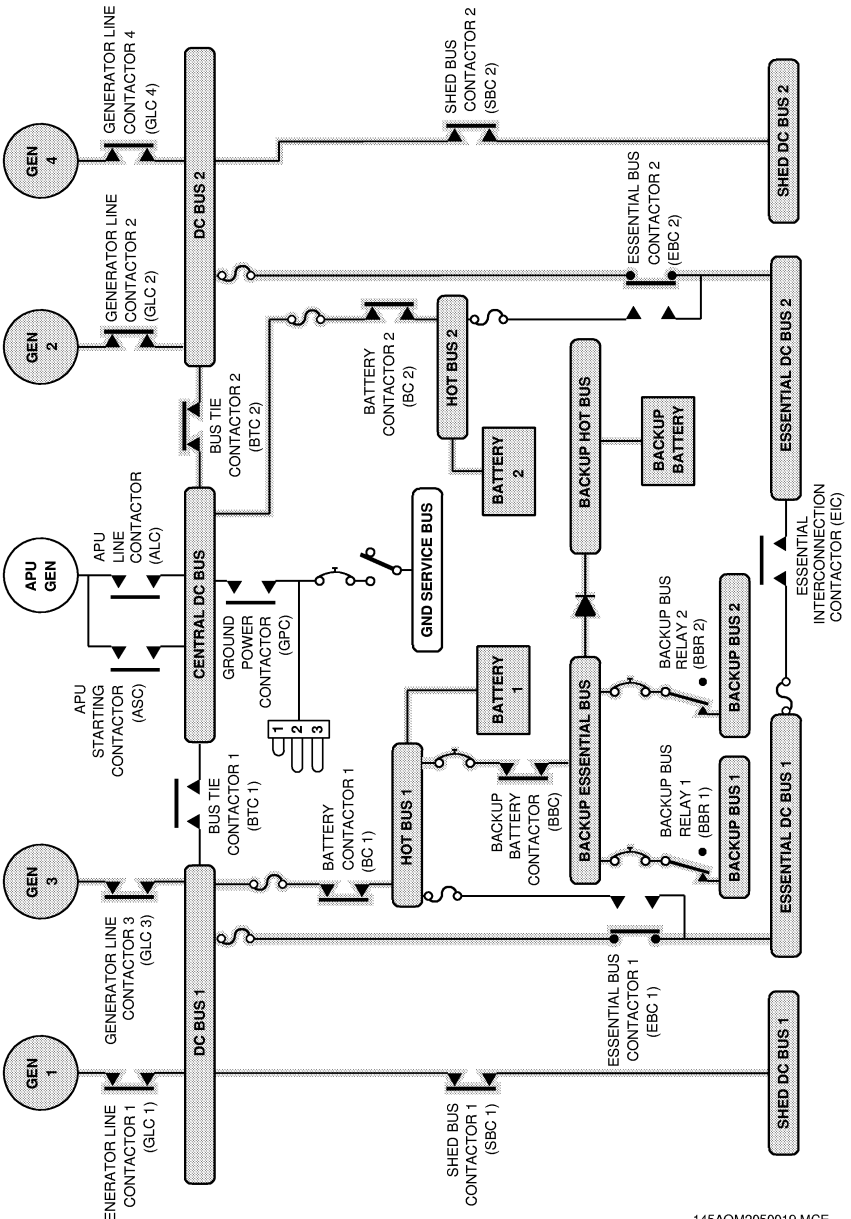

EDL STATUS DURING NORMAL OPERATION

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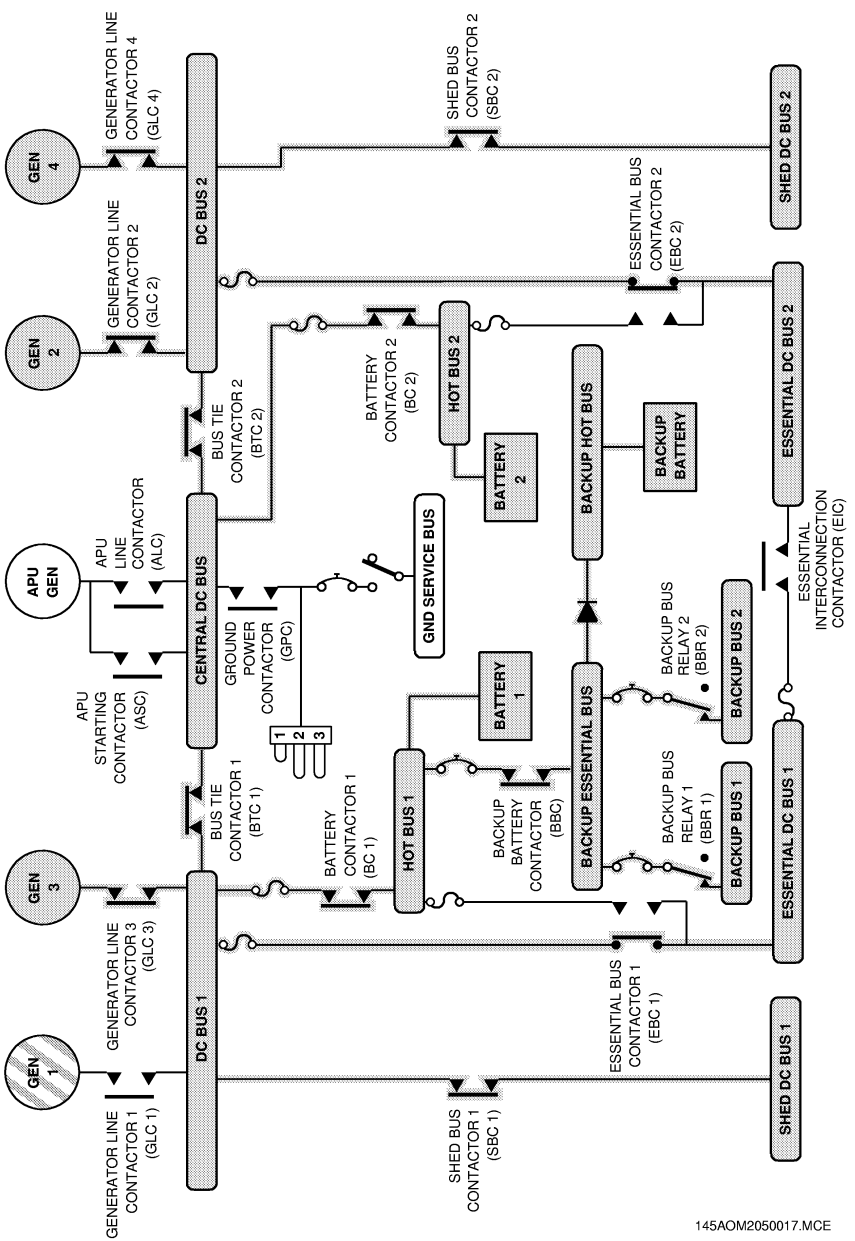

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EDL STATUS AFTER LOSS OF GENERATOR 1 WITHOUT APU GENERATOR

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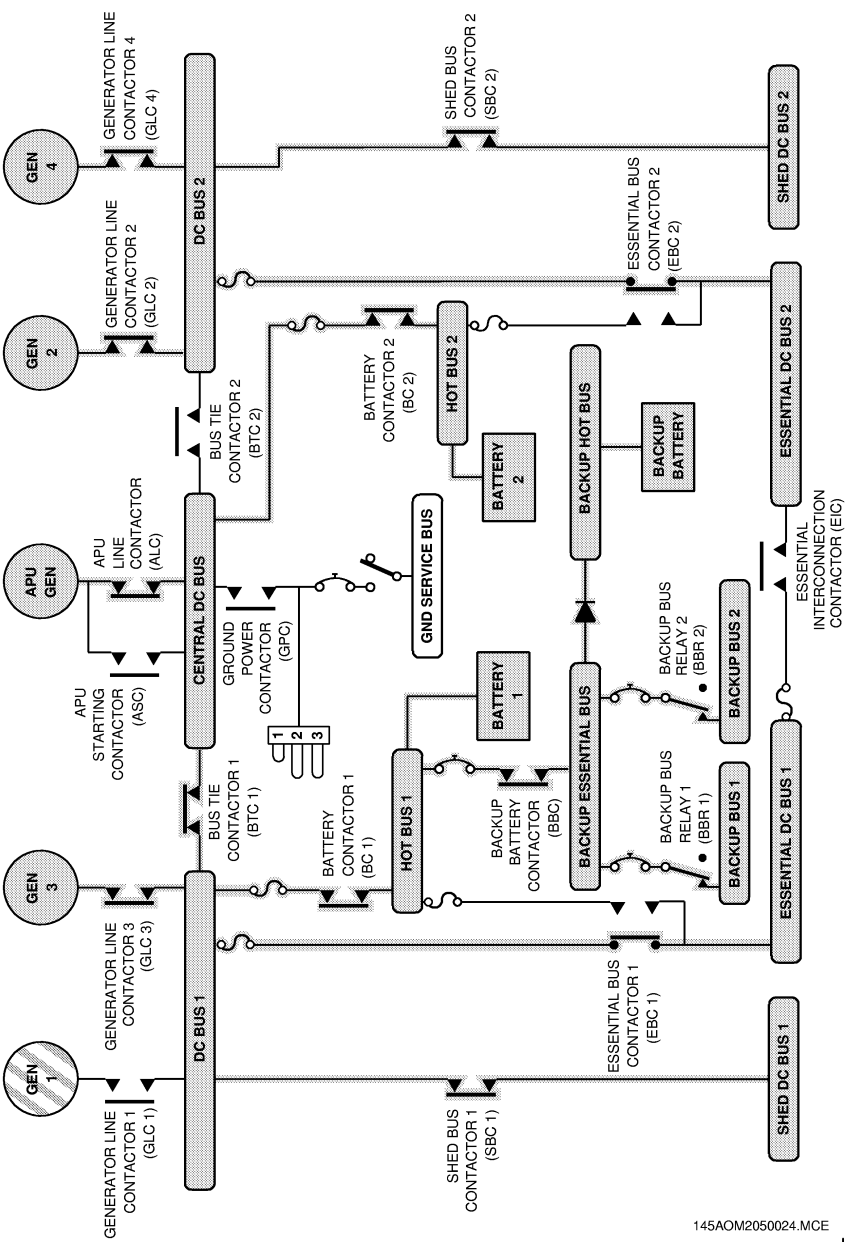

EDL STATUS AFTER LOSS OF GENERATOR 1 WITH APU GENERATOR

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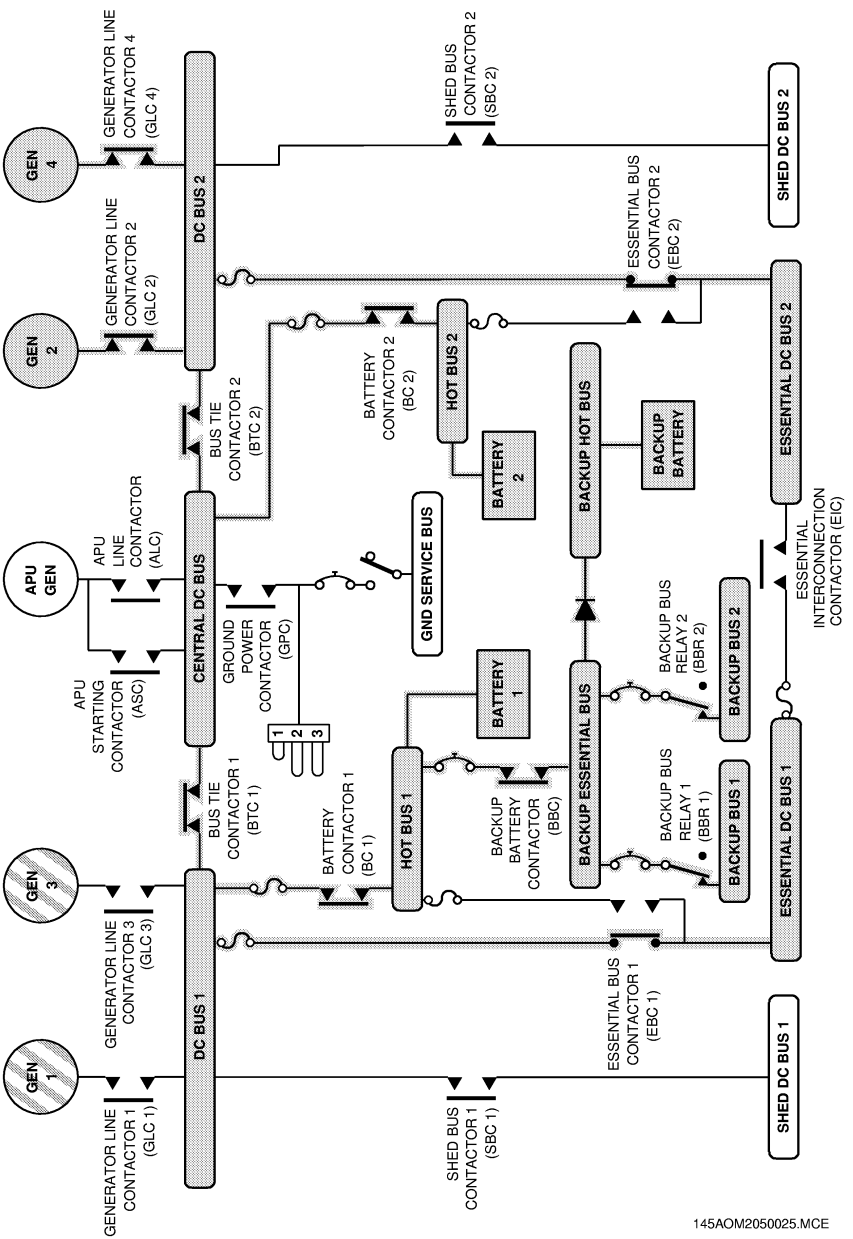

EDL STATUS AFTER LOSS OF GENERATORS 1 AND 3 WITHOUT APU GENERATOR

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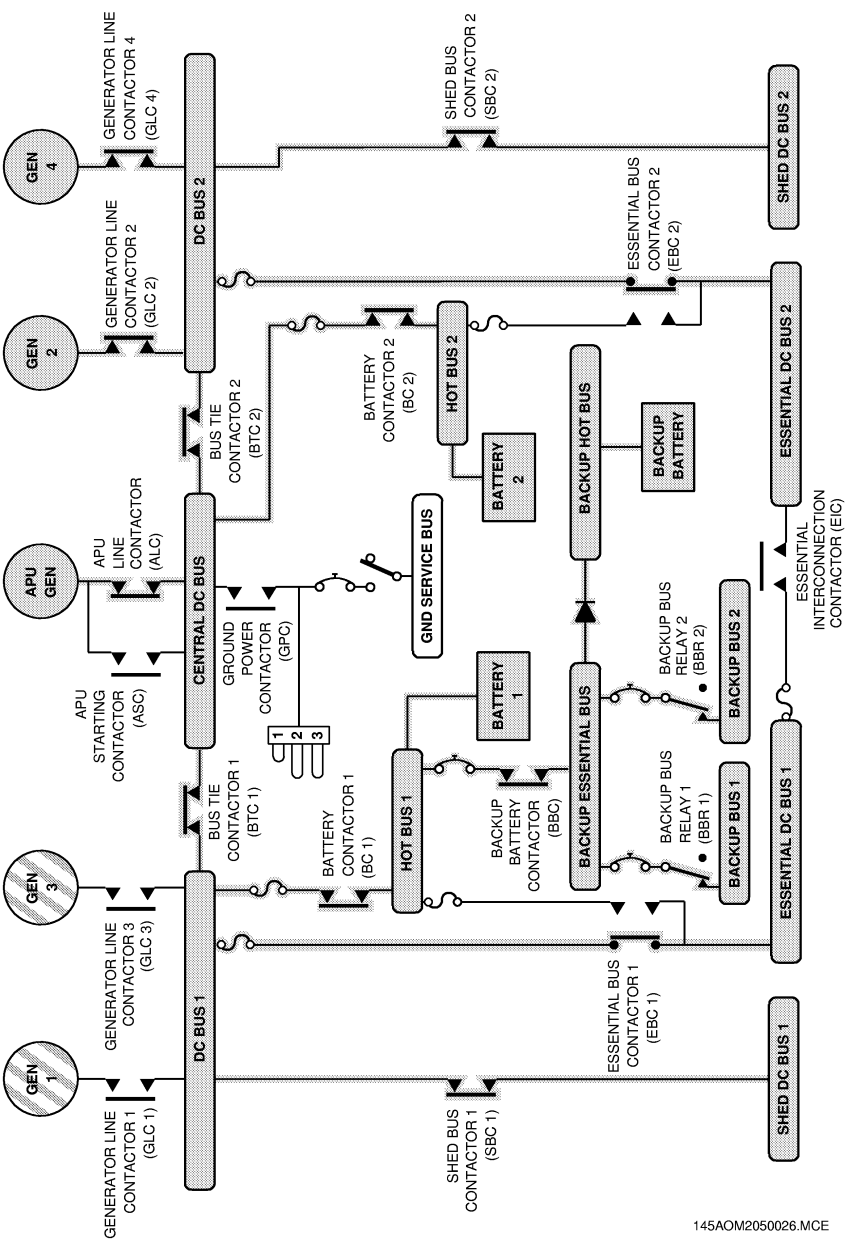

EDL STATUS AFTER LOSS OF GENERATORS 1 AND 3 WITH APU GENERATOR

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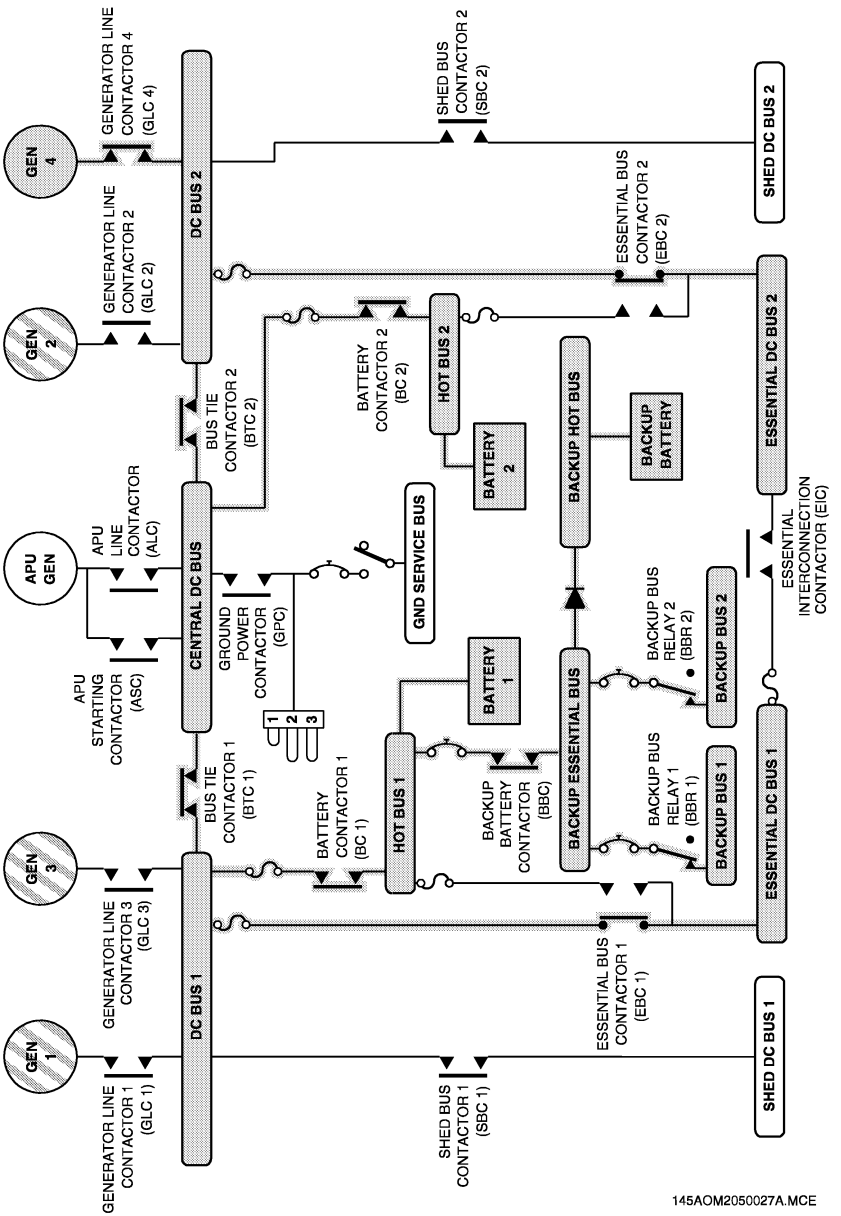
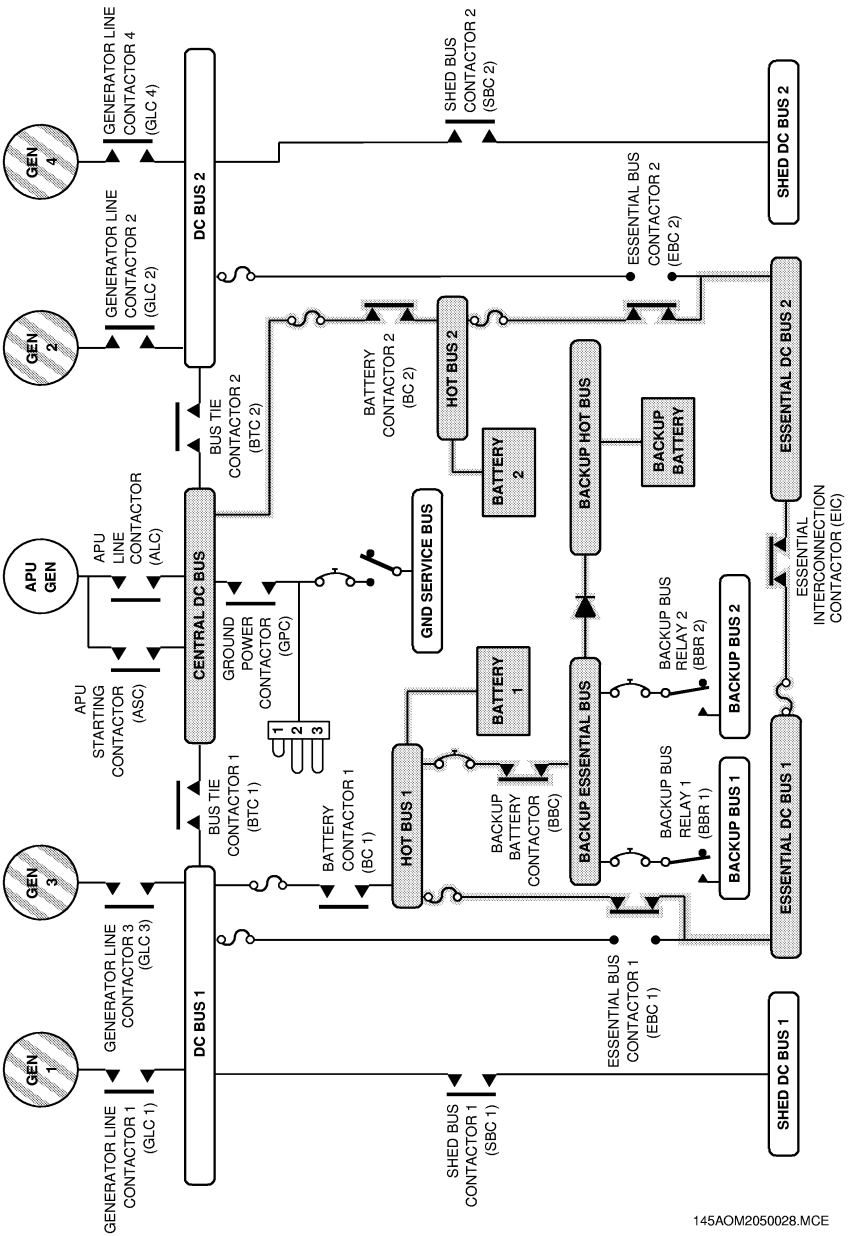


EDL STATUS DURING LOSS OF THREE ENGINE GENERATORS WITHOUT APU GENERATOR



EDL STATUS AFTER LOSS OF ALL THE GENERATORS (ELECTRICAL EMERGENCY CONDITION)

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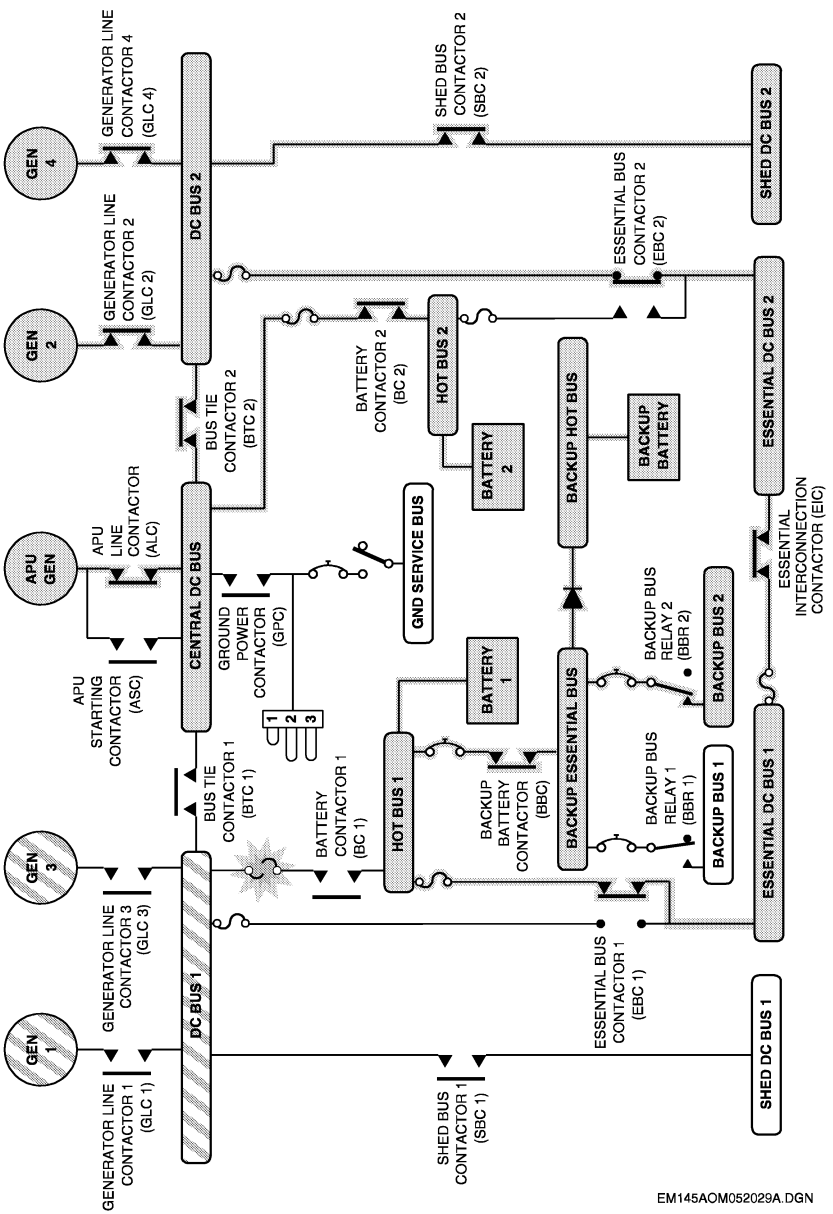

EDL STATUS AFTER A SHORT CIRCUIT AT DC BUS 1 WITH ALL GENERATORS ON

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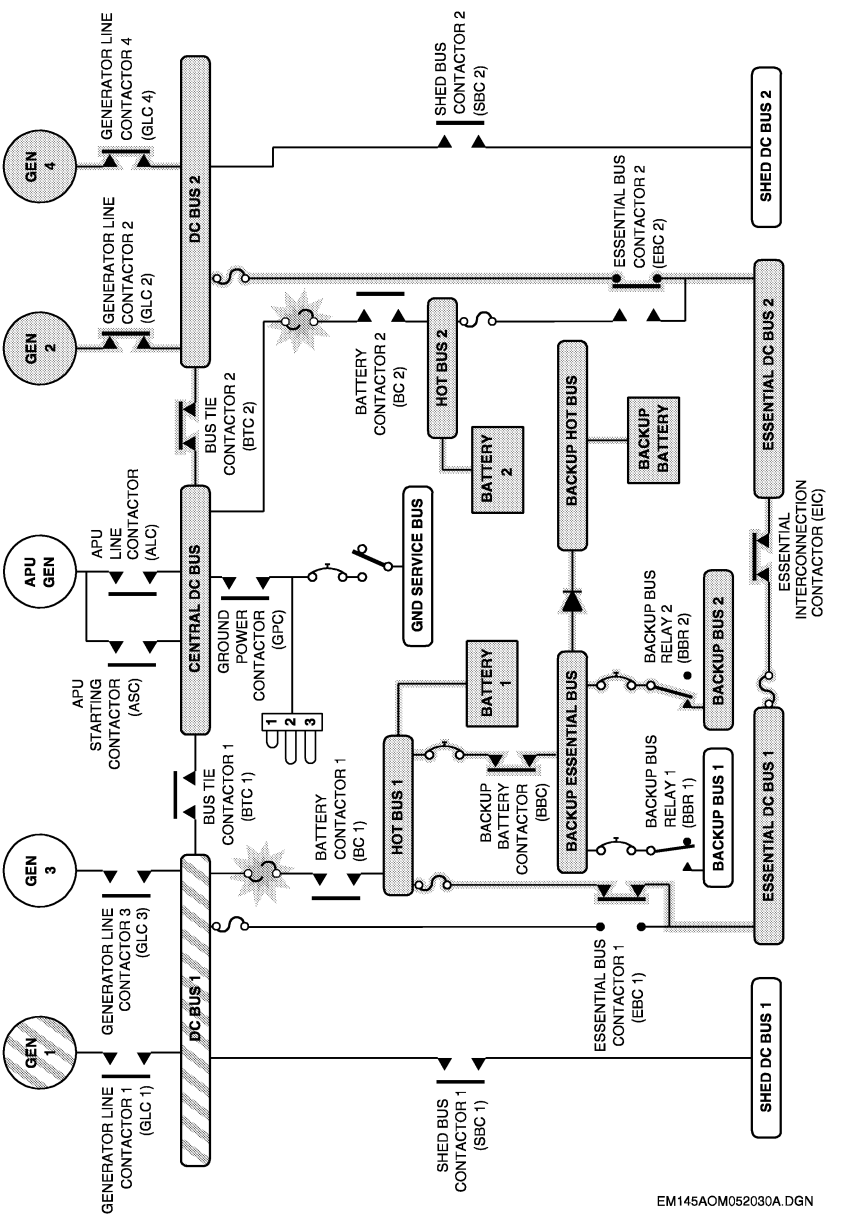

EDL STATUS AFTER A SHORT CIRCUIT AT DC BUS 1 WITH LOSS OF GENERATOR 1 AND WITHOUT APU GENERATOR

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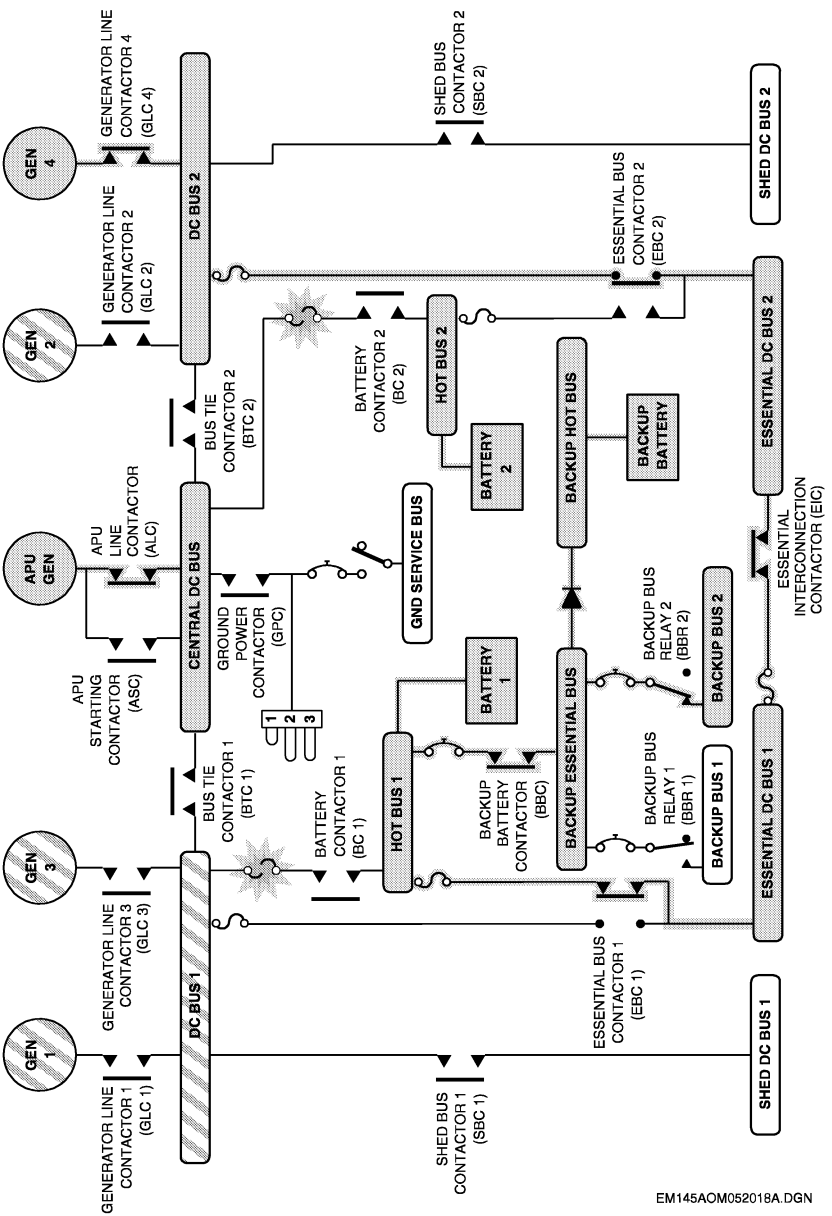

EDL STATUS AFTER A SHORT CIRCUIT AT DC BUS 1 WITH LOSS OF GENERATORS 1, 2 AND 3 WITH APU GENERATOR ON

EICAS MESSAGES

TYPE	MESSAGE	MEANING
WARNING	BATT 1 (2) OVTEMP	Associated battery temperature is above 70°C.
	ELEC ESS XFR FAIL	Automatic transfer to electrical emergency condition has failed.
CAUTION	GEN 1 (2, 3, 4) OVLD	Associated generator current is above 400 A.
	GEN 1 (2, 3, 4) OFF BUS	Associated generator is disconnected from the electrical network after engine stabilization due to generator channel failure or button released.
	APU GEN OVLD	APU generator current is above 400 A.
	APU GEN OFF BUS	APU generator is disconnected from electrical network, due to open ALC, with APU RPM above 95% plus seven seconds. This is caused by generator channel failure or button released.
	APU CNTOR CLSD	APU Starting Contactor (ASC) or Line Contactor (ALC) is inadvertently closed.
	DC BUS 1 (2) OFF	Associated DC Bus is de-energized. If DC Bus 1 is deenergized the inverter becomes inoperative.
	ESS BUS 1 (2) OFF	Associated Essential Bus is deenergized.
	SHED BUS 1 (2) OFF	Associated Shed Bus is deenergized.
	BATT 1 (2) OFF BUS	Associated battery is disconnected from the electrical network.
	BKUP BATT OFF BUS	Backup battery is disconnected from the electrical network.

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EICAS MESSAGES (continued)

TYPE	MESSAGE	MEANING
CAUTION	ELEC EMERG ABNORM	Improper transfer to electrical emergency condition has occurred.
	115 VAC BUS OFF	115 VAC bus is deenergized.
ADVISORY	GEN 1 (2, 3, 4) BRG FAIL	Associated generator bearing has failed.

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CONTROLS AND INDICATORS

ELECTRICAL SYSTEM PANEL

1 - GENERATOR BUTTON

- Connects (pressed) or disconnects (released) the associated generator to/from the respective DC Bus.
- Pressing and depressing the Generator Button causes all GCU latches protection circuits to be reset if the associated generator is running.
- A striped bar illuminates inside the button when it is released.

2 - GROUND POWER UNIT BUTTON

- Connects (pressed) or disconnects (released) the GPU to/from the electrical system.
- A GPU AVAIL inscription illuminates, in the upper half of the button, when the GPU is properly connected to the airplane receptacle and ready to supply power. The GPU AVAIL inscription extinguishes when the button is pressed and the external power is connected to the electrical network.
- A striped bar illuminates inside the button when it is pressed.

3 - APU STARTER GENERATOR BUTTON

- Connects (pressed) or disconnects (released) the APU starter generator, when APU RPM is above 95%, plus 7 seconds.
- A striped bar illuminates inside the button when it is released.

4 - BATTERY SELECTOR KNOB

OFF - Respective battery contactor is kept open, disconnecting the associated battery from the electrical system.

AUTO - The actuation of the respective battery contactor is controlled according to the Electrical Distribution Logic.

5 - ESSENTIAL POWER BUTTON (guarded)

- When pressed the system overrides the automatic transfer to the electrical emergency circuitry, connecting the batteries directly to essential buses, regardless of any other command from the Electrical Distribution Logic.
- When released, the power contactors operate automatically according to the Electrical Distribution Logic.
- A striped bar illuminates inside the button when it is pressed.

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6 - SHED BUSES SELECTOR KNOB

OVRD - Closes the Shed Buses Contactors, provided the airplane is on ground and at least one generator is operative.

AUTO - Controls the operation of Shed Buses Contactors according to the Electrical Distribution Logic.

OFF - Deenergizes the Shed Buses manually regardless of any other command from the Electrical Distribution Logic.

7 - AVIONICS MASTER BUTTONS

- Connect (pressed) or disconnect (released) the navigation and communication equipment supplied by the avionics switched buses.
- A striped bar illuminates inside the button when it is released.

8 - BACKUP BATTERY BUTTON

- Connects (pressed) or disconnects (released) the backup battery to/from the electrical system.
- A striped bar illuminates inside the button when it is released.

9 - AC POWER BUTTON

- Connects (pressed) or disconnects (released) the inverter to/from the system.
- A striped bar illuminates inside the button when it is released.

10- BUS TIES SELECTOR KNOB

OVRD - Bus Tie Contactors (BTCs) are kept closed regardless of Electrical Distribution Logic, provided that no overcurrent is detected by one of the five GCUs.

AUTO - Controls the operation of the BTCs according to the Electrical Distribution Logic.

OFF - Opens the BTCs and EIC regardless of any other command from the Electrical Distribution Logic.

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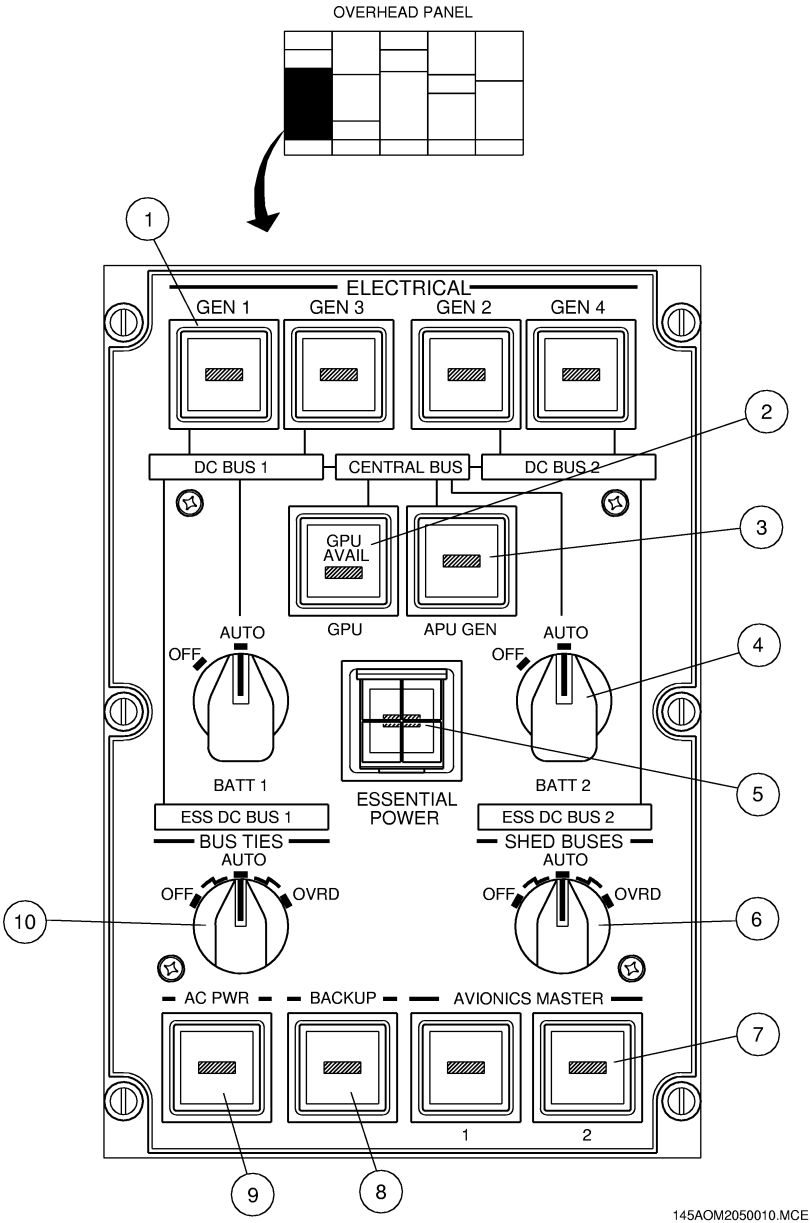

ELECTRICAL SYSTEM PANEL

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MFD ELECTRICAL PAGE

1 - LABELS AND UNITS

– Labels and units are always white.

2 - GENERATOR VOLTAGE AND CURRENT INDICATION

VOLTAGE:

– Digits are green and boxes are white during normal operation.
– Digits and boxes are amber when the generator is inadvertently off bus.
– Ranges from 0 to 40.0 V, with a resolution of 0.1 V.

CURRENT:

– Digits are green and boxes are white during normal operation.
– Digits and boxes are amber when the generator is inadvertently off bus or when the current is higher than 400 A.
– Ranges from 0 to 600 A, with a resolution of 5 A.

NOTE: The APU indication is removed when the APU is not available and/or the APU Master Selector is set to the OFF position with APU RPM below 10%.

3 - DC BUS INDICATION

– Green when bus is energized.
– Amber when bus is off.

4 - GPU VOLTAGE INDICATION

– Digits are always green.
– Box is always white.
– Ranges from 0 to 40.0 V, with resolution of 0.1 V.

NOTE: GPU voltage indication is removed in flight.

5 - BUS LINES INDICATION

– Bus lines are always white.

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6 - BATTERY VOLTAGE AND TEMPERATURE INDICATION

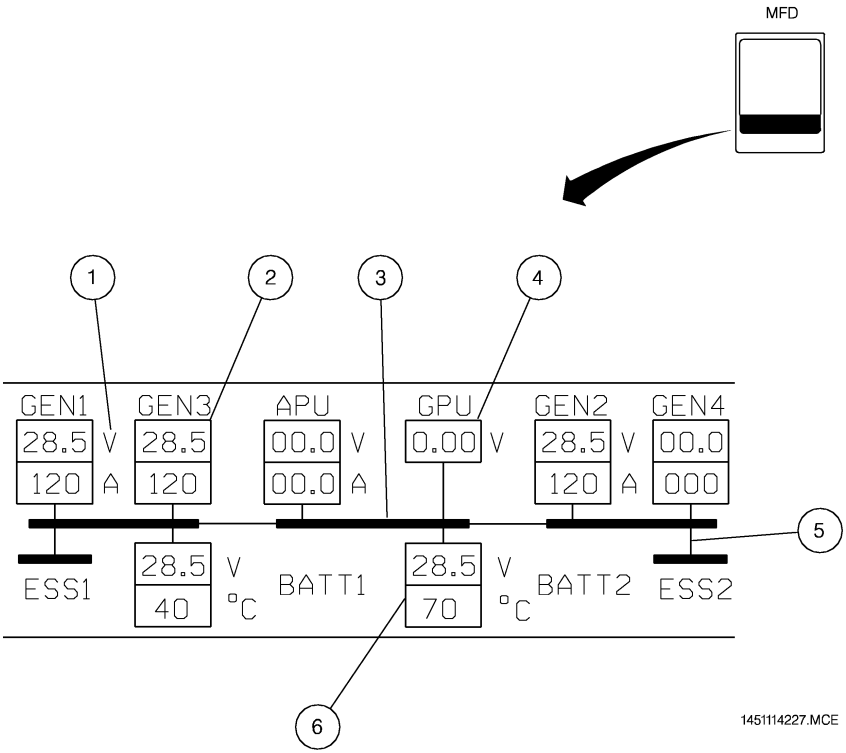
VOLTAGE:

- Digits are green and boxes are white during normal battery operation.
- Digits and boxes are amber when the battery is inadvertently off bus.
- Ranges from 0 to 40.0 V, with a resolution of 0.1 V.

TEMPERATURE:

- Boxes are white during battery normal operation.
- Boxes are amber when the battery is off bus.
- Digits are green when the temperature is below 70°C.
- Ranges from –40°C to 150°C, with a resolution of 1°C.
- Digits and boxes are red when the temperature is greater than 70°C.

NOTE: The red alerts supersede any other condition.



ELECTRICAL PAGE ON MFD

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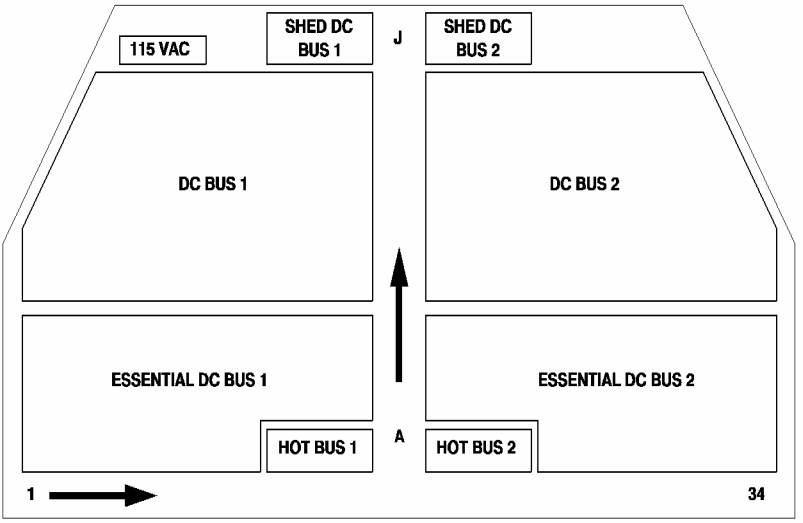
CIRCUIT BREAKER PANEL AND LOAD DISTRIBUTION

CIRCUIT BREAKER PANEL

The Circuit Breaker Panel is divided in areas associated to electrical system buses.

Columns and lines on the circuit breaker panel are identified through an alphabetic (for the lines) and numeric (for the columns) code.



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CIRCUIT BREAKER PANEL MAP

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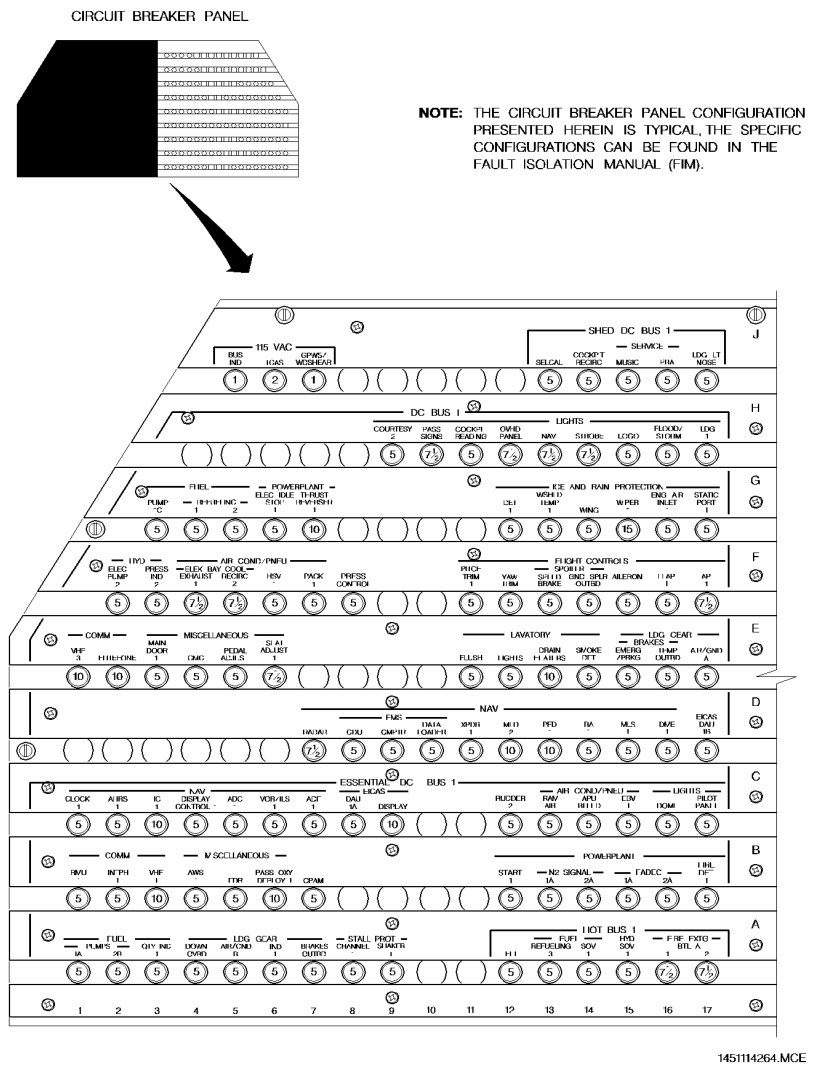

CIRCUIT BREAKER PANEL (TYPICAL)

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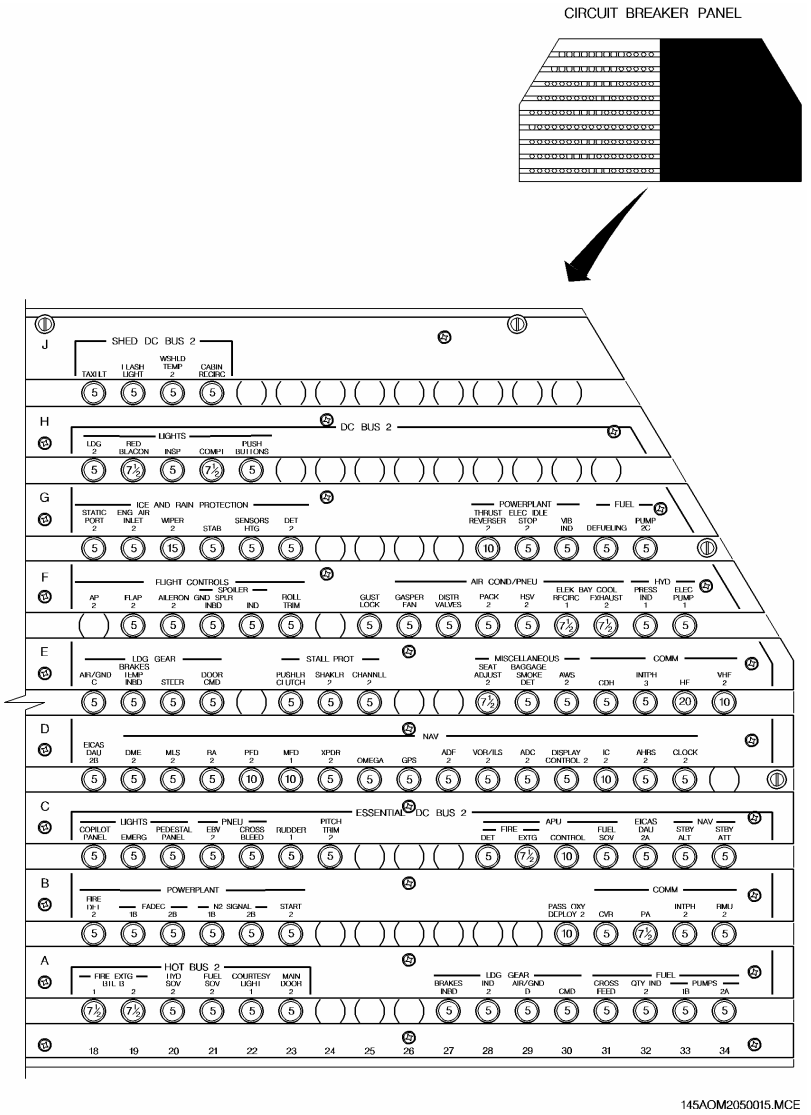

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CIRCUIT BREAKER PANEL (TYPICAL)

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DC BUS LOAD DISTRIBUTION (TYPICAL)

The following list identifies the DC buses and the equipment powered by them. Optional equipment are preceded by an asterisk (*).

DC BUS 1

AILERON CONTROL SYSTEM 1
AIR/GND POSITION SYSTEM A
AOA 1 SENSOR HEATING
BRAKES TEMPERATURE INDICATION OUTBD
CABIN LIGHTING 1
CENTRAL MAINTENANCE COMPUTER
CLEAR ICE DETECTION SYSTEM - CHANNEL 1
COCKPIT READING LIGHT
COURTESY/STAIR LIGHTS 2
CREW PEDAL ADJUSTMENT
CREW SEAT ADJUSTMENT 1
EICAS POWER (DAU 1B)
* ELECTRICAL FLIGHT IDLE STOP 1
ELECTRONIC BAY COOLING (EXHAUST 1)
ELECTRONIC BAY COOLING (RECIRC 2)
EMER/PARKING BRAKE
ENG 1 FUEL PUMPS 1C
* ENG 1 THRUST REVERSER COMMAND
ENGINE 1 LIP ANTI-ICE
FLAP POWER/COMMAND 1
FLOOD/STORM LIGHTS
FUEL PRESSURE REFUELING 1/2
GROUND SPOILER OUTBD
* HEAD-UP GUIDANCE SYSTEM
HYDRAULIC ELECTRIC PUMP 2
HYDRAULIC GEN SYS 2 INDICATION
ICE DETECTOR 1
INVERTER
LANDING LIGHTS 1
LAVATORY FLUSH
LAVATORY LIGHTS
LAVATORY SMOKE DETECTOR
LAVATORY WATER DRAIN HEATER
LOGOTYPE LIGHTS
MAIN DOOR CONTROL 1
NAVIGATION LIGHTS
OVERHEAD PANEL LIGHTING
PACK VALVE 1
PASSENGER SIGNS
PITCH TRIM 1
PITOT 1 HEATING
PNEUMATIC HSV 1
PRESSURIZATION CONTROL
SPEED BRAKE
STATIC PORT HEATING 1
STROBE LIGHTS
TAT 1 SENSOR HEATING
* TCAS 2000
VENTRAL FUEL TRANSFER PUMP A (EMB-145 XR)
WINDSHIELD HEATING 1
WINDSHIELD WIPER SYSTEM 1 (IF INSTALLED)
WING ANTI-ICE SYSTEM
YAW TRIM SYSTEM

DC BUS 2

ADC 2 POWER/CONTROL
AHRS 2 POWER
AILERON CONTROL SYSTEM 2
AIR/GND POSITION SYSTEM C
AOA 2 SENSOR HEATING
AURAL WARNING SYSTEM 2
BAGGAGE SMOKE DETECTOR
BRAKES TEMP INDICATION INBD
CABIN RECIRCULATION
CLEAR ICE DETECTION SYSTEM - CHANNEL 2
COMPARTMENT LIGHTS
COPILOT'S CLOCK
CREW SEAT ADJUSTMENT 2
DEFUELING
DISPLAY PRCS/CONTROL POWER 2 (IC2)
EICAS POWER (DAU 2B)
ELECTRICAL FLIGHT IDLE STOP 2
ELECTRONIC BAY COOLING (RECIRC 1)
ELECTRONIC BAY COOLING (EXHAUST 2)
ENG 2 FUEL PUMPS 2C
* ENG 2 THRUST REVERSER COMMAND
ENGINE 2 LIP ANTI-ICE
ENGINE VIBRATION SENSORS
FLAP POWER/COMMAND 2
GASPER FAN
GROUND SPOILER INBD
* GUST LOCK (ELECTROMECHANICAL)
HYDR ELECTRIC PUMP 1
HYDR GEN SYS 1 INDICATION
ICE DETECTOR 2
INSPECTION LIGHTS
* IRS POWER 2
LANDING GEAR DOOR COMMAND
LANDING LIGHTS
OBSERVER AUDIO (INTPH 3)
OVERHEAD PANEL LIGHTING
PACK VALVE 2
PASSENGER CABIN LIGHTS 1/2/3
PITOT 2 HEATING
PNEUMATIC HSV 2
RED BEACON LIGHTS
ROLL TRIM SYSTEM
SENSORS HEATING CONTROL
SPOILER INDICATION
SPS (SHAKER 2/CHANNEL 2)
SPS PUSHER
STABILIZER ANTI-ICE SYSTEM
STATIC PORT HEATING 2
STEERING SYSTEM
TAT 2 SENSOR HEATING
VENTRAL FUEL TRANSFER PUMP B (EMB-145 XR)
WINDSHIELD WIPER SYSTEM 2 (IF INSTALLED)

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AVIONIC SWITCHED DC BUS 1A

AUTOPILOT 1
DME 1
MFD 2 POWER
* MLS 1 POWER/CONTROL
PFD 1 POWER
RADIO ALTIMETER 1

AVIONIC SWITCHED DC BUS 2A

AUTOPILOT 2
DME 2
* FMS SYSTEM 2 DATA LOADER (#)
* FMS SYSTEM 2 COMPUTER (#)
* FMS SYSTEM 2 CDU (#)
MFD 1 POWER
* MLS 2 POWER/CONTROL
PFD 2 POWER
* RADIO ALTIMETER 2
TUNING BACKUP CONTROL HEAD
VHF SYSTEM 2

AVIONIC SWITCHED DC BUS 1B

* CMU MARK III
* FLITEFONE
* FMS SYSTEM 1 DATA LOADER
* FMS SYSTEM 1 COMPUTER
* FMS SYSTEM 1 CDU
RADAR SYSTEM
* TDR 1 POWER/CONTROL
* VHF SYSTEM 3

AVIONIC SWITCHED DC BUS 2B

* ADF 2
* GPS
* HF POWER/CONTROL
* OMEGA
TDR 2 POWER/CONTROL
VOR/ILS/MB 2

SHED DC BUS 1

COCKPIT RECIRCULATION
* GALLEY OVEN POWER
NOSE LANDING LIGHTS
* MUSIC
* PRE RECORD ANNOUNCEMENTS (PRA)
READING LIGHTS/ATTENDANT CALL 1
* SELCAL SYSTEM

SHED DC BUS 2

CABIN RECIRCULATION
FLASHLIGHT
* GALLEY
* GALLEY COFFEE MAKER POWER
READING LIGHTS/ATTENDANT CALL 2/3
TAXI LIGHTS
WINDSHIELD HEATING 2

HOT BUS 1

EMERGENCY LOCATOR TRANSMITER (ELT)
ENG 1 FIRE EXTINGUISHING (BTL A1)
ENG 2 FIRE EXTINGUISHING (BTL A2)
FUEL PRESSURE REFUELING 3
FUEL SHUTOFF VALVES 1
HYDRAULIC SHUTOFF VALVE 1

HOT BUS 2

COURTESY/STAIR LIGHTS 1
ENG 1 FIRE EXTINGUISHING (BTL B 1)
ENG 2 FIRE EXTINGUISHING (BTL B 2)
FUEL SHUTOFF VALVES 2
HYDRAULIC SHUTOFF VALVE 2
MAIN DOOR CONTROL 2

BACKUP ESSENTIAL BUS

AHRS POWER 1
DATA ACQUISITION UNIT ½
DISPLAY PRCS/CONTROL POWER 1
EICAS POWER
* IRS POWER 1

BACKUP HOT BUS

APU GENERATION
DC DISTRIBUTION
DC GENERATION 1
DC GENERATION 2
DC GENERATION 3
DC GENERATION 4
ISIS (EMB-145 XR)

BACKUP BUS 1

NONE

BACKUP BUS 2

AHRS POWER 2
* IRS POWER 2

(#) Applicable only if DUAL FMS is installed

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ESSENTIAL DC BUS 1

ADC 1 POWER/CONTROL
AHRS 1 POWER
AIR/GND POSITION SYSTEM B
APU BLEED
AURAL WARNING SYSTEM 1
BRAKE CONTROL UNIT (OUTBOARD SYSTEM)
COCKPIT DOME LIGHTS
DISPLAY PRCS/CONTROL POWER 1 (IC 1)
EICAS DISPLAY POWER
EICAS POWER (DAU 1A)
ENG 1 FIRE DETECTION 1
ENG 1 FUEL PUMPS 1A
ENG 2 FUEL PUMPS 2B
ENGINE 1 FADEC A POWER
ENGINE 2 FADEC A POWER
ENGINE 1 STARTING
ENGINES N2 SIGNALS 1A
ENGINES N2 SIGNALS 2A
FDR MANAGEMENT
FUEL QUANTITY INDICATION 1
LANDING GEAR CONTROL (DOWN OVRD)
LANDING GEAR NOSE INDICATION 1
* IRS POWER 1
PASSENGER OXYGEN SYSTEM 1
PILOT/COPILOT AUDIO SYSTEM (INTPH 1)
PILOT'S CLOCK
PILOT'S PANEL LIGHTING
PNEUMATIC 1 (EBV 1)
RAM AIR DISTRIBUTION
RMU 1 POWER/CONTROL
RUDDER CONTROL SYSTEM 2
SPS (SHAKER 1/CHANNEL 1)
VHF SYSTEM 1

ESSENTIAL DC BUS 2

AIR/GND POSITION SYSTEM D
APU CONTROL
APU FIRE DETECTION
APU FIRE EXTINGUISHING
APU FUEL FEED
BRAKE CONTROL UNIT (INBOARD SYSTEM)
COPILOT'S PANEL LIGHTING
CROSS BLEED
EICAS POWER (DAU 2A)
EMERGENCY LIGHTING CONTROL
ENG 2 FIRE DETECTION 2
ENG 1 FUEL PUMPS 1B
ENG 2 FUEL PUMPS 2A
ENGINE 1 FADEC B POWER
ENGINE 2 FADEC B POWER
ENGINE 2 STARTING
ENGINES N2 SIGNALS 1B
ENGINES N2 SIGNALS 2B
FUEL CROSS FEED
FUEL QUANTITY INDICATION 2
ISIS (ALL MODELS EXCEPT EMB-145 XR)
LANDING GEAR CONTROL
LANDING GEAR NOSE INDICATION 2
PASSENGER OXYGEN SYSTEM 2
PEDESTAL PANEL LIGHTING
PILOT/COPILOT AUDIO SYSTEM (INTPH 2)
PITCH TRIM 2
PITOT HEATING 3
PNEUMATIC 2 (EBV 2)
PUBLIC ADRESS
RMU 2 POWER/CONTROL
RUDDER CONTROL SYSTEM 1
STANDBY ALTIMETER
STANDBY ATTITUDE INDICATOR
VOICE RECORDER

AVIONIC SWITCHED ESSENTIAL DC BUS 1

ADF 1
VOR/ILS/MB 1

AVIONIC SWITCHED ESSENTIAL DC BUS 2

NONE

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SECTION 2-06

LIGHTING

TABLE OF CONTENTS

Block Page

General ..... 2-06-05 ..01
Cockpit Lighting..... 2-06-05 ..01
Controls and Indicators..... 2-06-05 ..04
Passenger Cabin Lighting ..... 2-06-10 ..01
Sterile Light (Optional)..... 2-06-10 ..02
Courtesy and Stairs Lighting ..... 2-06-10 ..02
Controls and Indicators..... 2-06-10 ..03
External Lighting ..... 2-06-15 ..01
Service Compartments Lighting ..... 2-06-15 ..05
Baggage Compartment Lighting..... 2-06-15 ..05
Controls and Indicators..... 2-06-15 ..06
Emergency Lighting ..... 2-06-20 ..01
EICAS Messages ..... 2-06-20 ..04
Controls and Indicators..... 2-06-20 ..04

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GENERAL

This airplane is equipped with a lighting system in order to illuminate all essential parts located inside and outside of the fuselage and to assure a proper and safe operation of the airplane.

The cockpit is illuminated by dome, chart, fluorescent/flood and reading lights. External lighting consists of navigation, anticollision (strobe and red beacon), landing, taxi, inspection and logotype lights.

The system also provides lighting for baggage and service compartments.

COCKPIT LIGHTING

The lighting system inside the cockpit is composed of five different types of lights, which are as follows:

- Dome lights.
- Reading lights.
- Chart lights.
- Fluorescent flood/storm light.
- Instruments and panels lights.

DOME LIGHTS

Cockpit illumination is provided by two dome lights of fixed intensity, commanded by a switch on the overhead panel. One light is located above the pilot's seat and the other is located above the copilot's seat.

READING LIGHTS

In order to provide adequate light distribution for the reading of maps, check lists and manuals there are three reading lights inside the cockpit, one for the pilot, a second for the copilot and a third for the observer.

By rotating the inner bezel of each of these three light installations, lighting intensity can be adjusted from off to full bright according to crew preference. The aperture or size of the light pattern is independently adjustable from a small to a large square pattern by rotating the outer bezel.

CHART LIGHTS

Chart lights are provided to illuminate the chart holders located at the pilot's and copilot's control wheel.

The chart light is turned on when the chart holder assembly is lifted. Light intensity is controlled by potentiometer knobs located on each side of the glareshield panel and may be selected from dim to full bright.

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FLUORESCENT FLOOD/STORM LIGHT (OPTIONAL)

Three flood/storm lights provide a proper lighting level in the cockpit and assures instrument readability when the ambient lighting is too intense with lightning flashes.

The lights are located under the glareshield panel, two for the pilot's and central side and the other for the copilot's side. Light intensity is controlled by potentiometer knobs located on each side of the glareshield panel and may be selected from off to full bright.

INSTRUMENTS AND PANELS LIGHTS

The instrument and control panel lights system provides lighting for instruments, control panels, and pushbuttons. Light intensity is controlled by potentiometer knobs located on each side of the glareshield panel and on the overhead panel.

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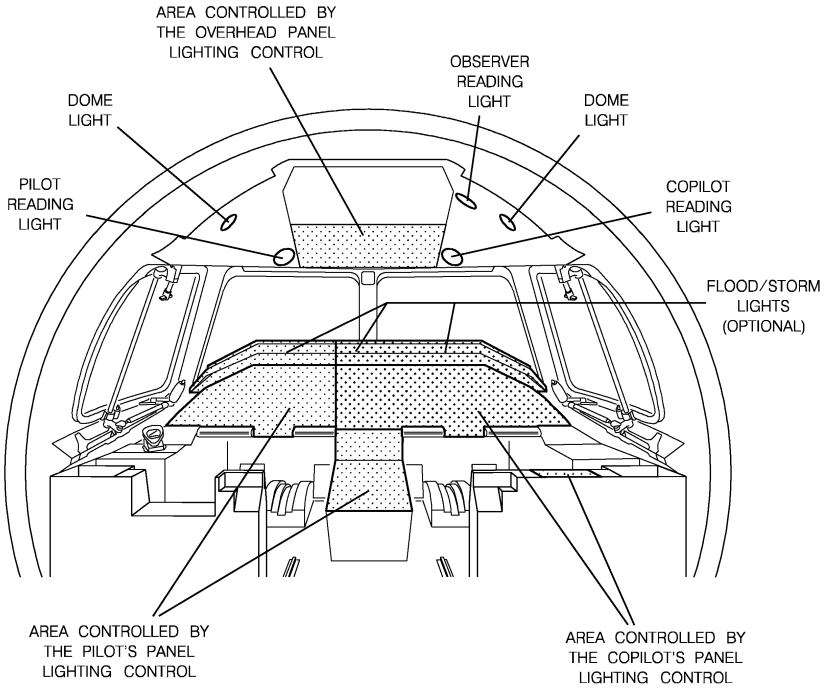

COCKPIT LIGHTING

CONTROLS AND INDICATORS

GLARESHIELD PANEL

1 - FLOODLIGHT CONTROL KNOBS

- Turn on/off and regulate the brightness of flood lighting.
- Pilot's knob controls pilot's panel, center panel and control pedestal.
- Copilot's Knob controls copilot's panel.

2 - CHART HOLDER LIGHTING CONTROL KNOBS

- Regulate the brightness of associated chart holder lighting.

NOTE: Chart light is turned on when the chart holder assembly is lifted.

3 - DISPLAYS LIGHTING CONTROL KNOBS

- Regulate the brightness of Electronic Display.
- Pilot's knobs control pilot's PFD and MFD.
- Copilot's knobs control EICAS and copilot's PFD and MFD.

4 - PANEL LIGHTING CONTROL KNOBS

- Turn on/off and regulate the brightness of panels lighting.
- Pilot's knobs control pilot's panel, center panel and control pedestal.
- Copilot's knob controls copilot's panel and observer panel.

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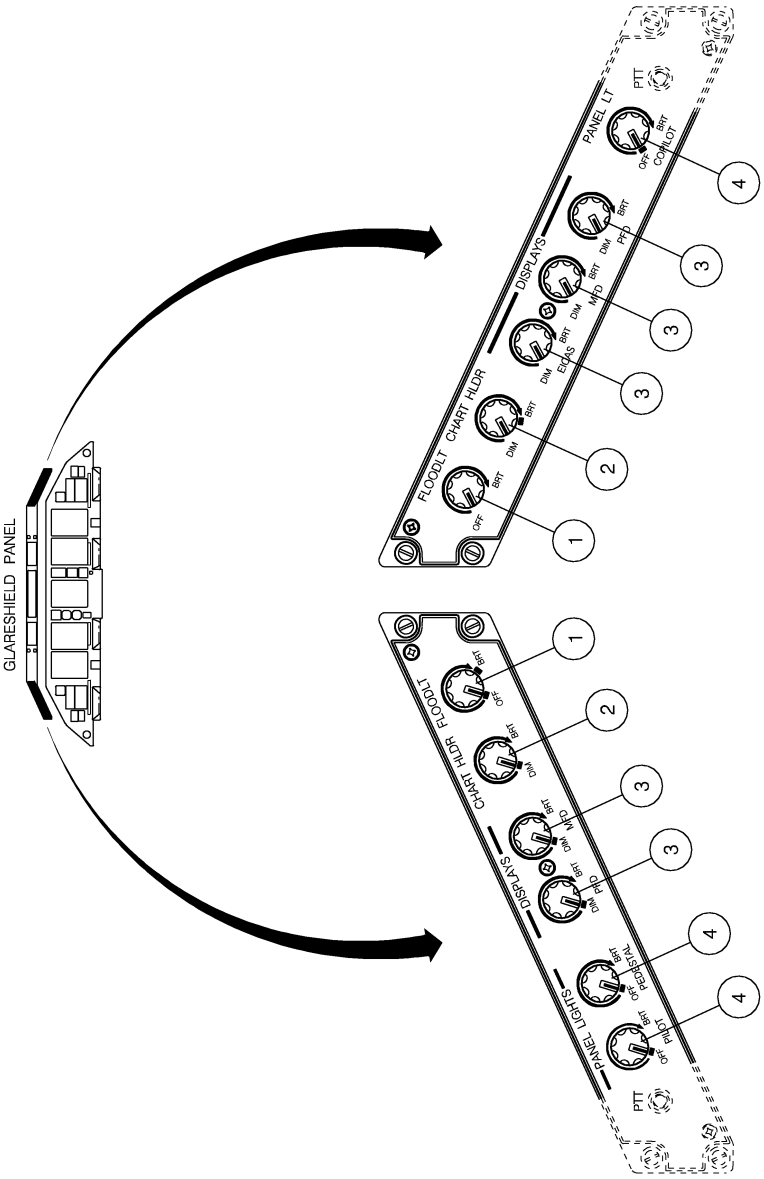

GLARESHIELD PANEL

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OVERHEAD PANEL

1 - PUSHBUTTON LIGHTS TEST SWITCH (if installed)

- When actuated to the TEST position (momentary position) allows checking of the striped bars and caption indications.
- The striped bars and caption indications in all pushbuttons located on the main panel, overhead panel, control pedestal and right lateral console will illuminate, allowing verification of lamp integrity.
- The fire handles, APU fire extinguish button, BAGG EXTG button, electromechanical GUST LOCK indication lights, GPU AVAIL annunciator, digital pressurization control button and ATDT CALL button will not illuminate and will not be tested.

2- OVERHEAD PANEL LIGHTING CONTROL KNOB

- Turns on/off and regulates the brightness of the overhead panel lighting.

3 - COCKPIT DOME LIGHTS SWITCH

- Turns on/off the two cockpit dome lights.

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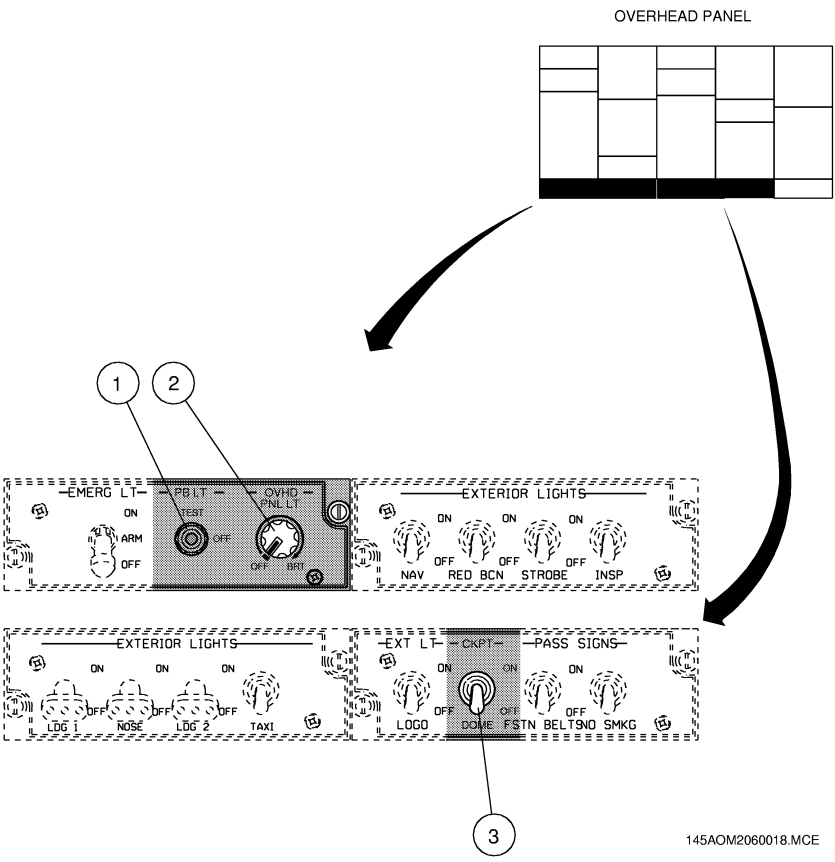

OVERHEAD PANEL

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FLIGHT CREW READING LIGHTS

1 - INNER RING

- Provides turn on/off and dimming control.

2 - OUTER RING

- Provides reading area adjustment, allowing light beam orientation up to 35 degrees from the vertical axis in any direction.

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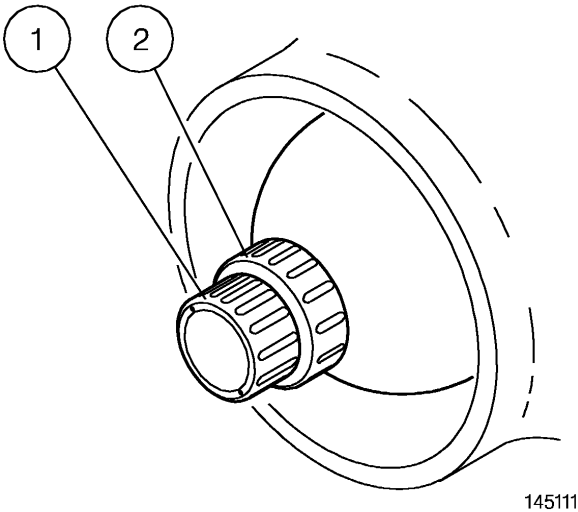

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FLIGHT CREW READING LIGHTS

PASSENGER CABIN LIGHTING

Passenger cabin lighting includes general illumination, reading lights, lavatory, galley lights and cabin signs.

GENERAL PASSENGER CABIN ILLUMINATION

General passenger cabin illumination is provided by fluorescent tubes fitted in the fuselage ceiling and sidewall. These lights are controlled by control buttons located on the Attendant Panel.

READING LIGHTS

A separate reading light and control is provided above each passenger seat, on the Passenger Service Unit (PSU). For PSU details, refer to Section 2-2–Equipment and Furnishings.

LAVATORY

The lavatory lights are automatically controlled through a microswitch installed in the latch assembly of the door. When the airplane is powered up and the toilet door is open or closed, the lavatory lights turn on in dim mode. If the toilet door is closed and locked, the lavatory lights turn on in the bright mode.

Two illuminated LAVATORY OCCUPIED signs indicate when the lavatory is in use. A RETURN TO SEAT sign in the lavatory illuminates in conjunction with the FASTEN SEAT BELTS sign.

PASSENGER CABIN SIGNS

The passenger warning signs are illuminated signs that will be clearly visible under normal daylight lighting conditions. They provide passengers and flight attendants with NO SMOKING, FASTEN SEAT BELTS, RETURN TO SEAT, and LAVATORY OCCUPIED instructions.

The NO SMOKING and FASTEN SEAT BELTS signs are controlled through respective switches located on the overhead panel. The signs are repeated on every Passenger Service Unit. An aural signal sounds whenever any passenger sign is turned on or off by the pilot. The NO SMOKING and FASTEN SEAT BELTS signs are also activated when the oxygen dispensing units are open. For PSU details refer to Section 2-2–Equipment and Furnishings.

GALLEY LIGHT

The galley light illuminates the galley area between forward and aft galleys. The light is controlled through two buttons, located on the Galley Control Panel. For Galley Control Panel details refer to Section 2-2–Equipment and Furnishings.

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STERILE LIGHT (OPTIONAL)

A blue sterile light, located on the cockpit/pax partition, indicates, when lit, that entry into the cockpit is not allowed. It is commanded through a switch located at the overhead panel.

COURTESY AND STAIRS LIGHTING

The courtesy and stair lights provide lighting for safe boarding of crewmembers and passengers. The courtesy and stair lights consist of the main door light (entry area), service door light (galley area), stairway lights and cockpit step light as follows:

- Main door light: A light is installed on the main door ceiling panel, above the entry area of the airplane, to illuminate the stair, entry area, aisle toward cockpit and passenger cabin.
- Service door light: A light is installed on the service door ceiling panel in order to light the galley area.
- Stairway lights: Airplanes equipped with airstair main doors have stair lights installed in each step of the main door stair to provide adequate step illumination.
- Cockpit step light: A red light is installed in the step between the passenger cabin and the cockpit to provides light for safe entry into the cockpit. This light is illuminated simultaneously with the main door light.

These lights are controlled by a main door microswitch and a control knob, located on the Entrance Panel, above the standard flight attendant seat on the cockpit partition.

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CONTROLS AND INDICATORS

ATTENDANT'S PANEL

1 - CABIN LIGHTING CONTROL BUTTONS

ON - All associated cabin lights are turned on.

OFF - All associated cabin lights are turned off.

BRT - All associated cabin lights are set to full brightness.

DIM - All associated cabin lights are set to reduced brightness.

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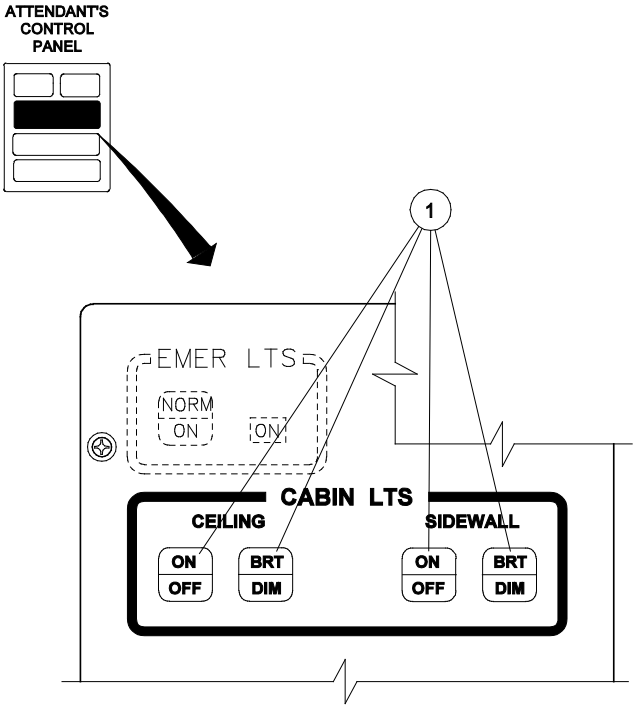

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ATTENDANT'S PANEL

NOTE: For airplanes Post-Mod. SB 145-33-0040, the Dim Mode of the passenger cabin lighting system is disabled.

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COURTESY LIGHTING PANEL

1 - COURTESY AND STAIRS LIGHTING CONTROL KNOB

OFF - All courtesy and stair lights are turned off.

AUTO - All courtesy and stair lights are extinguished when the main door is closed and lit when the main door is open.

NOTE: The cockpit dome lights may be commanded through the Courtesy and Stairs Lighting Control Knob provided the airplane is deenergized and the Cockpit Dome Lights Switch is set to the ON position.

ON - All courtesy and stair lights are turned on, when the main door is open. When the main door is closed, only the overdoor light remains on, to illuminate the main door area in flight.

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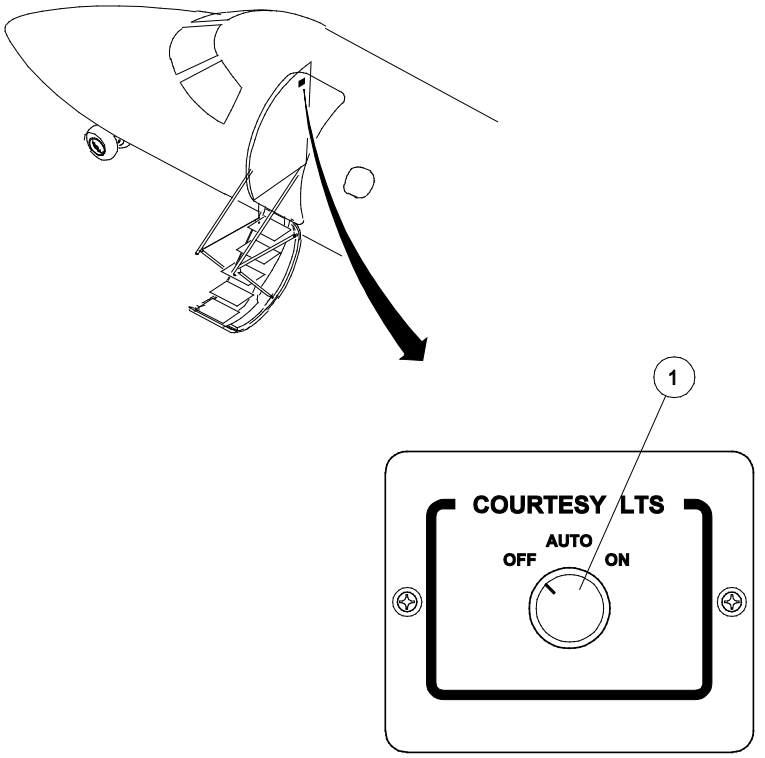

COURTESY LIGHTING PANEL

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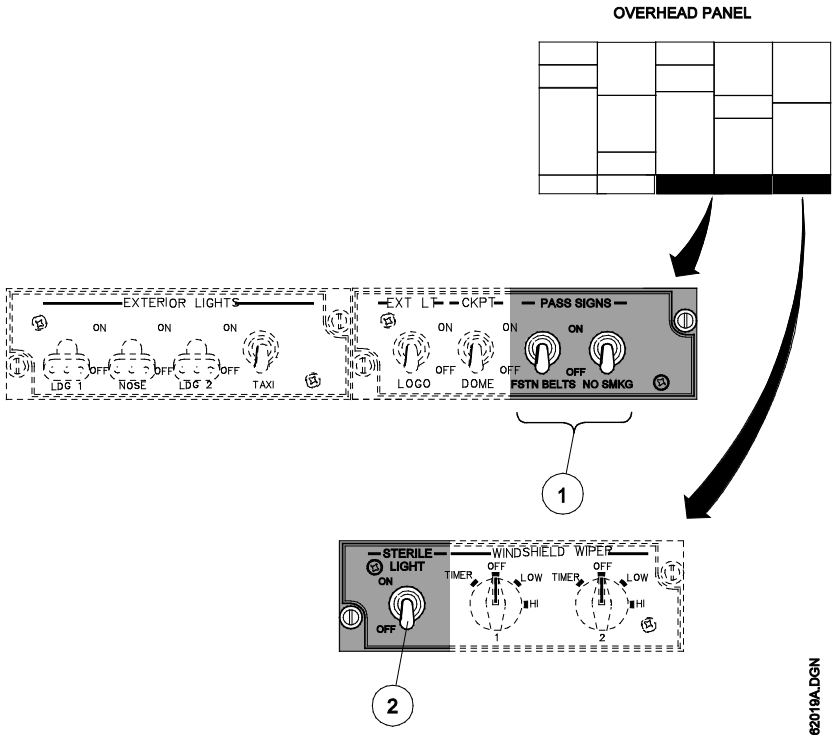
OVERHEAD PANEL

1 - FASTEN SEAT BELTS AND NO SMOKING SIGNS SWITCHES

– Turns on/off the associated passenger signs.

2 - STERILE LIGHT SWITCH

– Turns on/off the sterile light.



OVERHEAD PANEL

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EXTERNAL LIGHTING

The external lights necessary to a proper and safe operation of the aircraft are:

- Landing lights.
- Taxi lights.
- Navigation lights.
- Anti-collision lights.
- Wing inspection lights.
- Logotype lights.

LANDING LIGHTS

The landing lights provide adequate lighting during final approach, flare-out and take-off. Two landing lights are fitted in the wing leading edge close to the fuselage. A third landing light is mounted on the nose landing gear strut. The switches located on the overhead panel are responsible for the control of the landing lights.

TAXI LIGHTS

The taxi light provides sufficient intensity and beam spread to aid pilots during all taxi operation phases, covering the runway and adjacent areas.
Two taxi lights are fitted on the nose landing gear strut and are commanded by a single switch located on the overhead panel.

NAVIGATION LIGHTS

The navigation lights include two red navigation lights at the left wingtip, two green navigation lights at the right wingtip, and two white navigation lights at the tail boom. Some airplanes are equipped with four white navigation lights.

Unlike the other models, the EMB-145XR is equipped with two white navigation lights installed at the trailing edge of either wing.

The navigation lights are controlled by means of the NAV LT switch, located on the overhead panel. This switch turns on one lamp at each wingtip and two lamps at the tail boom.

In case a green or red light becomes inoperative, the standby wingtip lamps are activated through a switch located on the cockpit maintenance panel.

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On airplanes equipped with four white navigation lights, in case one or both of the tail navigation lights in use become(s) inoperative, the relevant standby tail lamps are activated through a switch located on the aft ramp hail panel.

ANTI-COLLISION LIGHTS

The anti-collision lights provide illumination for visual recognition and collision avoidance during all flight/taxi operations. White strobe (anti-collision) lights are fitted to each wing tip and cone top of the horizontal stabilizer. The EMB-145XR, in its turn, is provided with only two white strobe lights, which are located at the winglets.

Red beacon lights are mounted on the upper and lower fuselage. Two different switches, one for strobe lights and another for the red beacon lights are located on the overhead panel.

WING INSPECTION LIGHTS

Two inspection lights, one on each side of the fuselage, provide lighting of the wing leading edge to allow the crew to verify ice formation. The inspection lights are controlled by a switch located on the overhead panel.

LOGOTYPE LIGHTS

The logo lights are installed on the underside of the horizontal stabilizer and are aimed at the vertical fin. They provide adequate illumination of the airplane's logo during operation on the ground and in flight. A switch located on the overhead panel controls the logotype lights.

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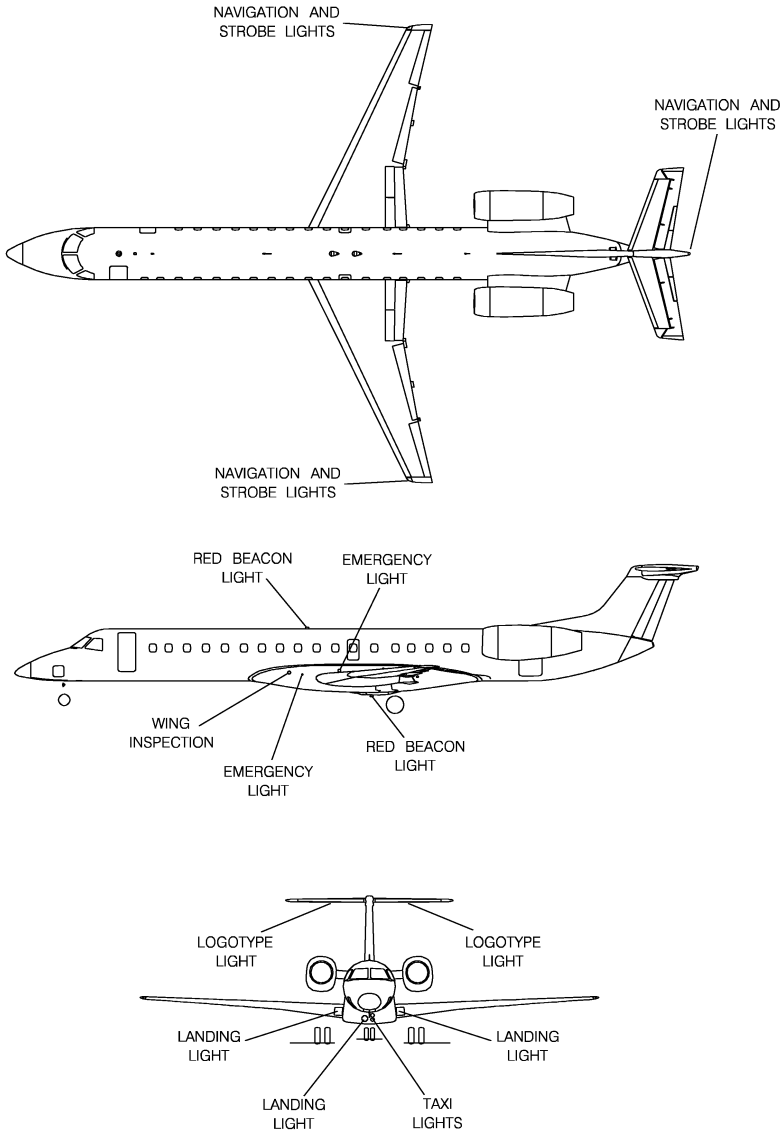

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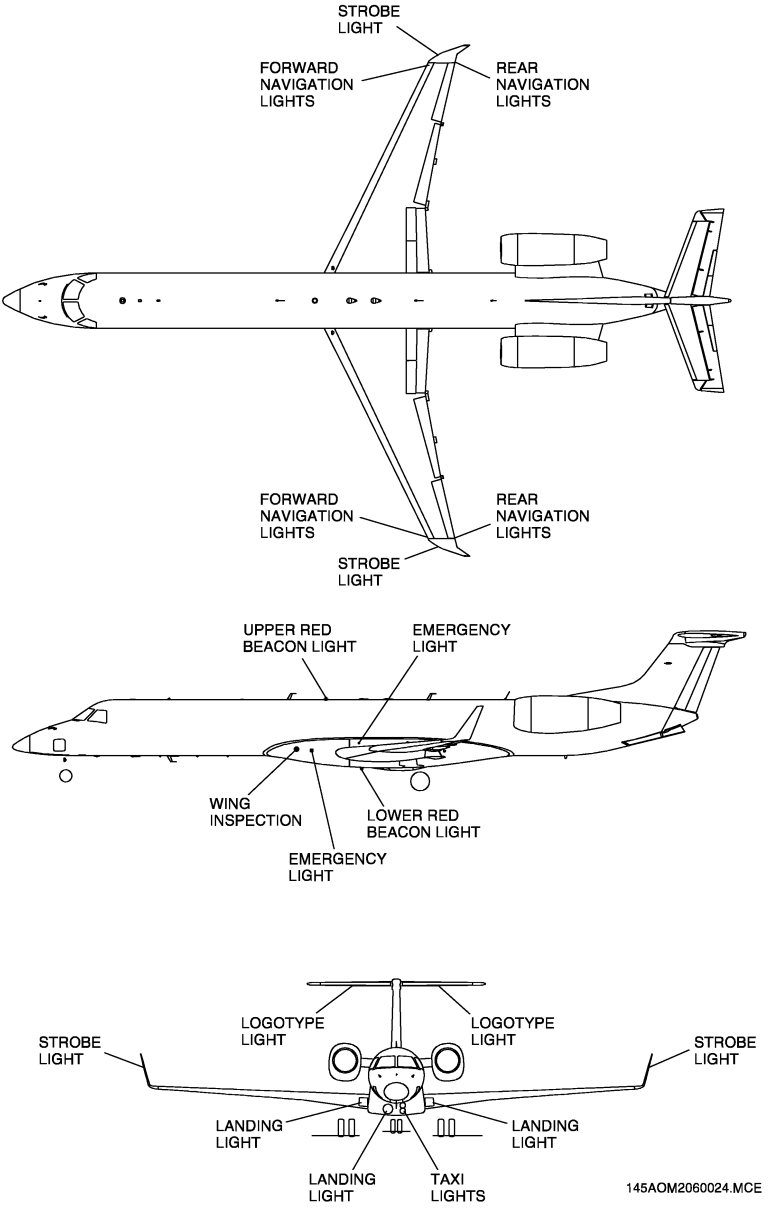

EXTERNAL LIGHTS - EMB-145XR

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SERVICE COMPARTMENTS LIGHTING

The system provides lighting in the service compartments for quick inspection and accomplishment of several tasks. Service lights are installed in the nose landing gear, rear and forward electronic bays, tail cone and forward flight control compartments. The lights are controlled by a door micro-switch, that turns on the associated light when the access doors is open, or by dedicated switches, installed in the compartment.

BAGGAGE COMPARTMENT LIGHTING

The baggage compartment is equipped with three lights installed on the ceiling panel. The baggage lights operate according to the following conditions:

– They come on automatically whenever the cargo door is open, and they go off when the door is closed. For airplanes equipped with a push-button installed on the lavatory, it is possible to turn on the baggage lights in flight to allow visual inspection of the baggage compartment through a inspection sight glass located in the baggage compartment/lavatory partition.

OR

– They come on automatically when the aircraft is energized and they remain on until the aircraft is deenergized.

Some airplanes are optionally equipped with a cargo door light installed in the left pylon that provides external lighting of the baggage compartment. The light is automatically turned on when the baggage compartment door is open.

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CONTROLS AND INDICATORS

OVERHEAD PANEL

1 - NAVIGATION, RED BEACON, STROBE AND WING INSPECTION LIGHTS SWITCHES

– Turns on/off the associated light.

2 - LOGOTYPE LIGHTS SWITCH

– Turns on/off the logotype lights.

3 - TAXI LIGHTS SWITCH

– Turns on/off the taxi lights.

NOTE: Taxi lights are not turned on if nose landing gear is not down and locked, regardless of the Taxi Lights Switch position.

4 - LANDING LIGHTS SWITCHES

– Turn on/off the associated landing light.

NOTE: Nose landing light is not turned on if nose landing gear is not down and locked, regardless the of Nose Landing Light Switch position.

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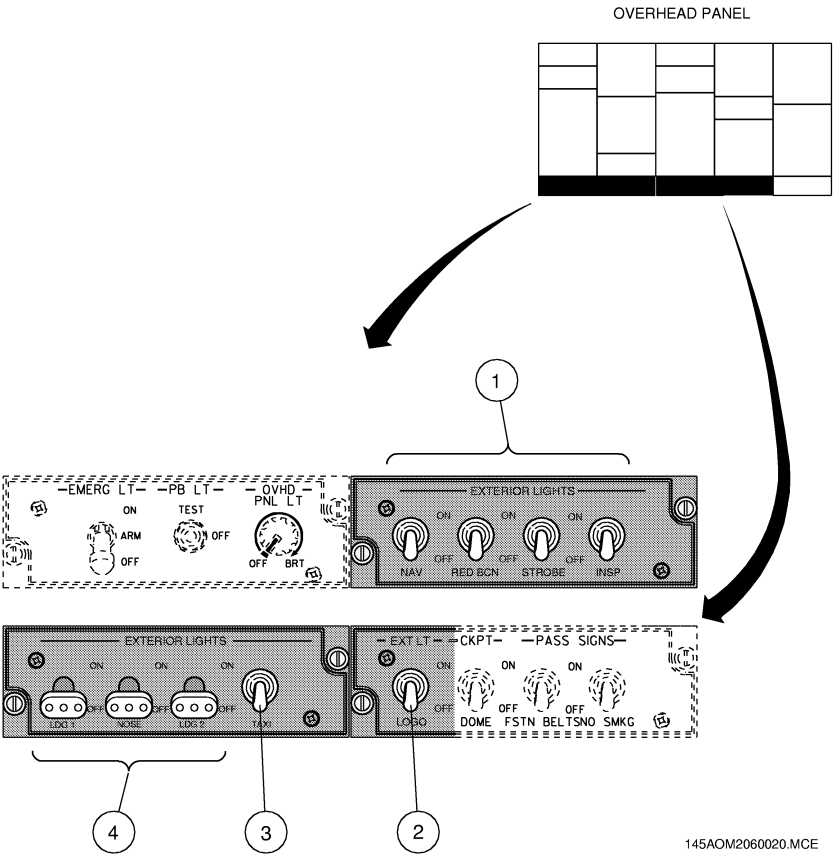

OVERHEAD PANEL

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EMERGENCY LIGHTING

The emergency lighting consists of internal and external lights that provide proper illumination for emergency cabin evacuation. These lights are powered by four dedicated batteries charged through the Essential Bus. Batteries power is sufficient to supply all internal and external emergency lights for approximately 15 minutes.

The exterior emergency lights installed are as follows:

- Two lights installed on each side of the wing-to-fuselage fairing in order to illuminate the wing escape route and the ground area.
- One emergency light installed in the main door and in the service door provides illumination of the external main door and service door areas, when the door is open.

Internal emergency lights consist of the cockpit light, aisle lights, main door lights, galley service door lights, overwing emergency exit lights, floor proximity lights and EXIT signs as follows:

- Cockpit light: This light is located on the cockpit ceiling to provide general cockpit emergency illumination.
- Aisle lights: Four dome lights are located along the aisle for general emergency cabin illumination.
- Main door, galley service door and overwing emergency exits lights: Four lights are installed for the purpose of illuminating the passageway leading from the main aisle to each of the exit openings.
- Floor proximity emergency lights: Either electroluminescent or photoluminescent strips are installed along the passenger cabin floor to provide a means of identifying the emergency escape path even in conditions of dense smoke.

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NOTE: Photoluminescent escape path system strips must be charged prior to the first flight of the day. Charging is provided by the interior cabin lighting being the charging time defined by the table below. It should be pointed that during such time, cabin activity is limited to minor aisle traffic of crew and personnel and that operational duration is not limited if daylight ambient conditions exist throughout flight or if cabin lighting is operated on the ON or BRIGHT settings.

Charge	Bin door position	Charge duration (minutes)	Operational duration (when lights are extinguised)
Initial	Closed	15	4.75 hours
		30	6.5 hours
Subsequent	Closed	15	6.75 hours
		30	9 hours
	Open	30	5 hours

– Illuminated EXIT signs: They are installed near each door and emergency exits.

Emergency lighting is controlled through the Emergency Lighting Switch, located on the overhead panel, and through the Attendant Emergency Lighting Button, located on the Attendant's Panel.

A caution message is presented on the EICAS if the system is not armed.

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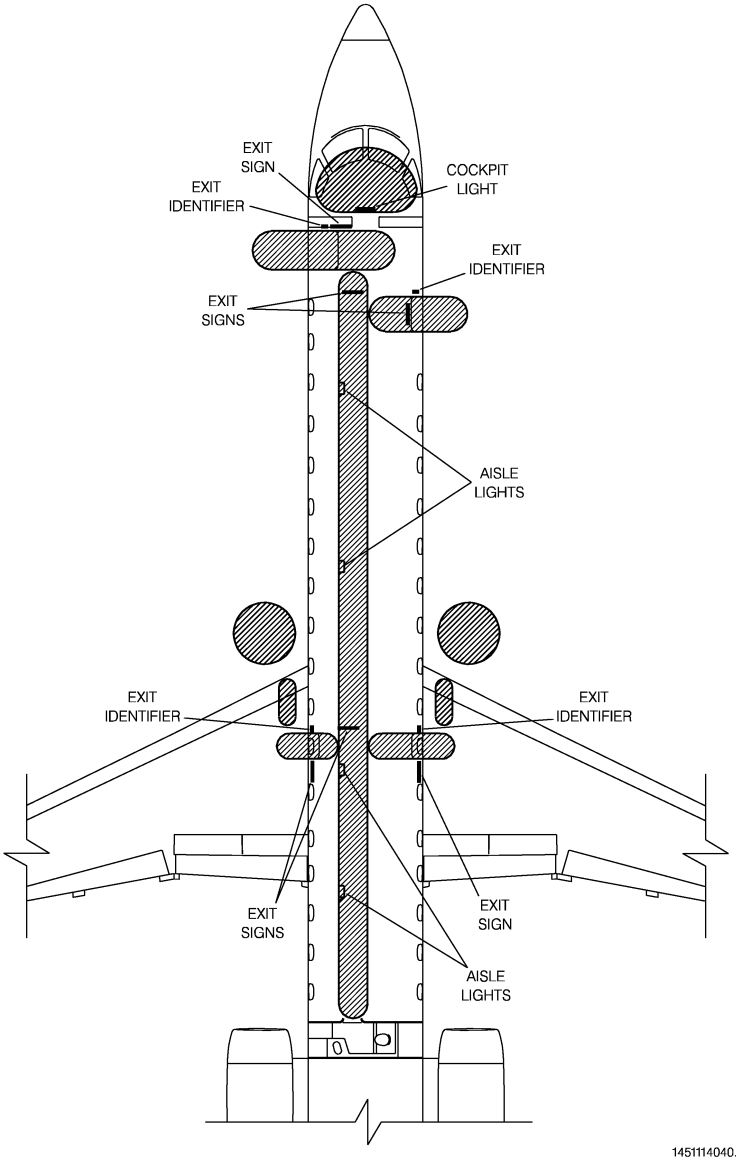

AREA ILLUMINATED BY EMERGENCY LIGHTING

EICAS MESSAGE

TYPE	MESSAGE	MEANING
CAUTION	EMERG LT NOT ARMD	Emergency lighting system is not armed.

CONTROLS AND INDICATORS

OVERHEAD PANEL

1 - EMERGENCY LIGHTING SWITCH

ON - Emergency lights illuminate with power supplied by the dedicated batteries.

ARM- Emergency lights are in standby mode (lights turned off and the batteries being charged) and illuminate automatically in case of an electrical emergency, with power supplied by the dedicated batteries.

OFF - Emergency lights are turned off. Emergency lighting dedicated batteries are not charged.

NOTE: The emergency lights are controlled by the Emergency Lighting Switch when the Attendant Emergency Lighting Button, on the Attendant's Panel, is in the NORM mode.

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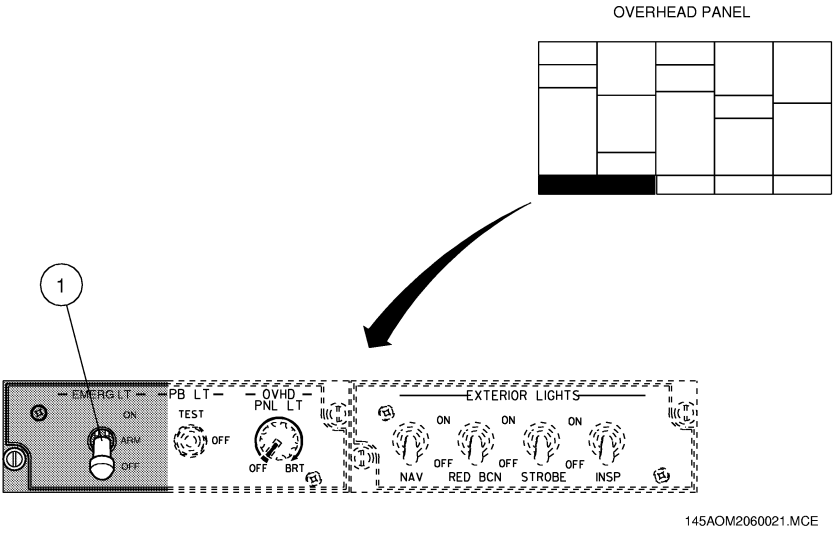

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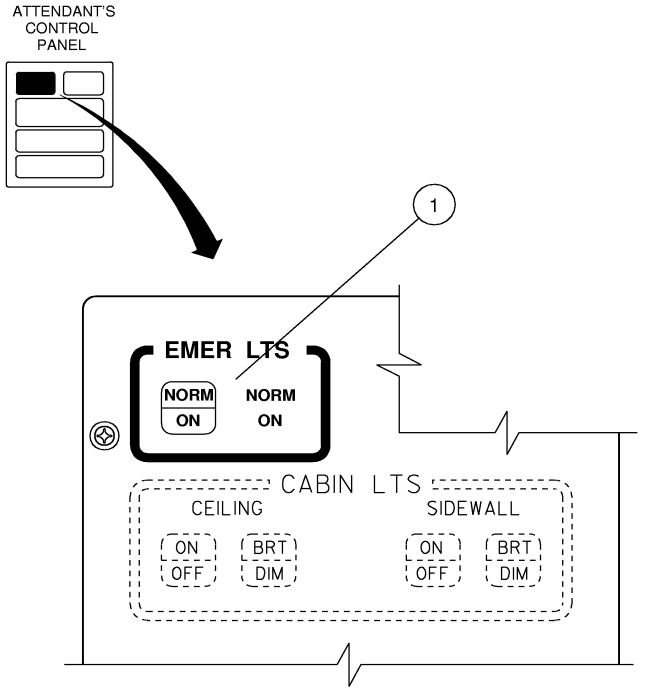
OVERHEAD PANEL

ATTENDANT'S PANEL

1 - ATTENDANT EMERGENCY LIGHTING CONTROL BUTTON

NORM - Emergency lights remain in the mode selected by Emergency Lighting Switch position in the cockpit.

ON - Emergency lights are turned on with power supplied by dedicated batteries, regardless of Emergency Lighting Switch position on the cockpit.



ATTENDANT'S PANEL

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SECTION 2-07

FIRE PROTECTION

TABLE OF CONTENTS

Block Page

General ..... 2-07-05 ..01
Engine and APU Fire Protection System ..... 2-07-10 ..01
Fire/Overheat Detection ..... 2-07-10 ..01
Fire Extinguishing ..... 2-07-10 ..04
Controls and Indicators..... 2-07-10 ..07
EICAS Messages ..... 2-07-10 ..10
Lavatory Fire Protection System ..... 2-07-15 ..01
Lavatory Smoke Detection ..... 2-07-15 ..01
Lavatory Fire Extinguishing ..... 2-07-15 ..01
EICAS Message ..... 2-07-15 ..01
Controls and Indicators..... 2-07-15 ..04
Baggage Compartment Fire Protection System ..... 2-07-20 ..01
Baggage Compartment Smoke Detection System..... 2-07-20 ..01
Baggage Compartment Fire Extinguishing System..... 2-07-20 ..01
EICAS Messages ..... 2-07-20 ..02
Controls and Indicators..... 2-07-20 ..04

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GENERAL

The fire protection system consists of fire/overheat detection and extinguishing for the engines and APU.

The detection system provides visual and aural means of detecting a localized fire or general overheating. Monitoring circuitry is provided to continuously check the fire detection/extinguishing system and to signal the EICAS in case of failure.

The baggage compartment is provided with a smoke detection system. The class “C” baggage compartment is provided with a fire extinguishing system.

In addition, the lavatory compartment is equipped with a dedicated smoke detection system and the lavatory waste container is equipped with a fire extinguishing system.

Extinguisher bottles are installed to extinguish the fire in the airplane’s engines, APU, baggage compartment and lavatory waste container. Portable halon fire extinguishers installed at the front and rear of the airplane can be used to extinguish small fires in the cockpit or main cabin area. A single water extinguisher is an additional option.

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ENGINE AND APU FIRE PROTECTION SYSTEM

FIRE/OVERHEAT DETECTION

The engines and the APU are protected against the occurrence of fire by means of fire detection and fire extinguishing systems.

Essential DC bus 1 powers the engine 1 fire detection system and essential DC bus 2 powers the engine 2 and the APU fire detection system. Hot battery bus 1 and 2 power the engine fire extinguishing system, whereas the APU fire extinguishing system is powered by essential DC bus 2.

The fire/overheat detection system is provided with independent sensor tubes installed in the engines and APU. The sensor tube contains a fixed volume of inert gas (Helium) and a gas-impregnated (Hydrogen) core material. The inert gas provides sensing of overheating. The core element provides sensing of localized fire or high-intensity heating. Overheating causes the sensor tube's internal gas pressure to increase. This closes a switch on the fire/overheating detection system's electrical circuit and activates the warning system. Localized fire or high-intensity heating increases the central core's gas volume, raising the sensor tube's internal pressure, thus activating the alarm switch in the same manner as described above.

Manual resetting of the fire detection system is not available. Upon removal of the fire or overheat condition, a reversible process takes place, and the system automatically returns to the normal standby operation mode.

An integrity switch continuously monitors the sensor tube's integrity. The integrity switch is held closed by the sensor's internal pressure. Should this pressure be lost the integrity switch opens, generating a signal to indicate that the system is inoperative.

Upon detection of a fire/overheat signal in the engine or APU, the associated handle (for the engines) illuminates, an aural warning is generated and a warning message is presented on the EICAS. The visual warning remains activated as long as the fire signal exists. The aural warning may be canceled by pressing the master warning light.

In the case of failure of any fire detector, a caution message is presented on the EICAS.

The APU fire detection system provides a signal to shut down the APU automatically in case of fire warning during ground operation.

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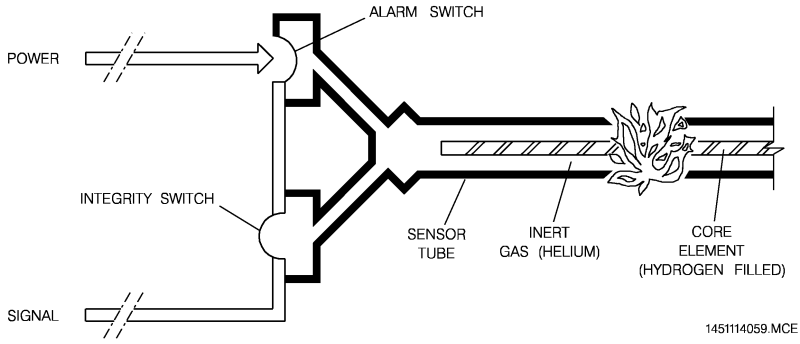

FIRE OVERHEAT DETECTION SCHEMATIC

FIRE EXTINGUISHING

Two fire extinguishing bottles for the engines and one for the APU are installed in the airplane's tail cone.

The extinguishing agent discharge is accomplished by braking the extinguisher bottle's seal through an electrically actuated cartridge in the discharge valve.

Each engine fire extinguisher bottle contains two discharge valves, a pressure gauge with a pressure switch and a fill/safety relief valve. The engine bottles are cross-connected by two double check tees to provide dual shot capability, thus one or both bottles can be discharged into one or the other engine. The double-check tee prevents the extinguishing agent of the remaining bottle from filling the emptied bottle in case of a second shot of the system. The engine extinguisher bottles are discharged by pulling and rotating the Fire Extinguishing Handle, which is located on the overhead panel.

CAUTION: DO NOT DISCHARGE THE SAME EXTINGUISHER BOTTLE TWICE. ACTUATING THE FIRE HANDLE INTO AN EMPTY BOTTLE MAY CAUSE STRUCTURAL DAMAGE TO THE BOTTLE.

The APU bottle contains only one discharge valve, a pressure gauge with a pressure switch, and a fill/safety relief valve. It provides single shot capability for the APU. The APU extinguisher bottle is discharged by pressing the APU Fire Extinguishing Button, located on the overhead panel.

A caution message is presented on the EICAS should any bottle be discharged or be inoperative for any reason (failed cartridge, loss of pressure, or loss of power).

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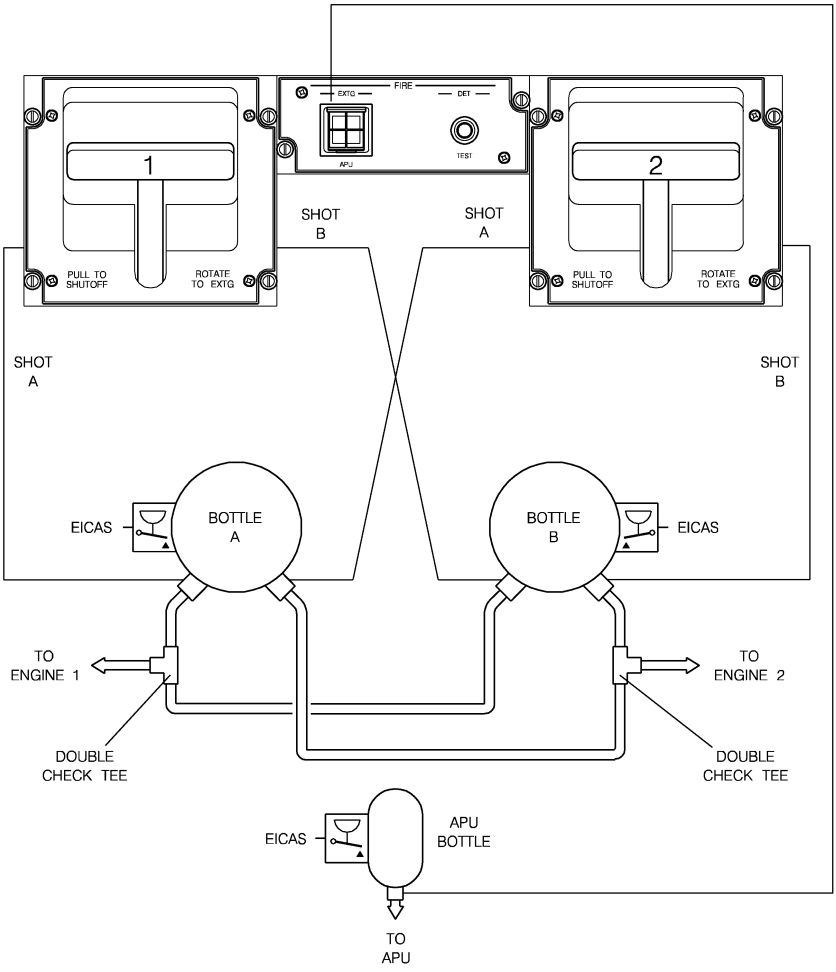

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ENGINE AND APU FIRE EXTINGUISHING SYSTEM SCHEMATIC

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CONTROLS AND INDICATORS

ENGINE AND APU FIRE DETECTION/EXTINGUISHING SYSTEM PANEL

1 - ENGINE FIRE EXTINGUISHING HANDLE

- During normal flight conditions, the handle remains flush with the panel.
- A red light illuminates inside the handle upon detection of fire or overheating.
- When pulled, it closes the fuel, hydraulic, bleed air, and lip anti-icing shutoff valves of the associated engine.
- When rotated counterclockwise or clockwise, it respectively discharges extinguisher bottles A or B into the associated engine.

2 - APU FIRE EXTINGUISHING BUTTON (guarded)

- When pressed, it closes the APU fuel shutoff valve and discharges the APU fire extinguisher bottle. On APU Model T-62T-40C11, a signal is sent to the ESU to simulate an overspeed condition in order to execute the APU shutdown procedure. On APU Model T-62T-40C14, a stop request signal is sent to the FADEC in order to execute the APU shutdown procedure.

3 - FIRE DETECTION SYSTEM TEST BUTTON

- When pressed and held for at least two seconds, it permits the fire detection system to be checked.

  On airplanes equipped with class “C” baggage compartment, the fire test is successfully completed if the conditions below occur simultaneously:
  - The following EICAS fire detection messages are displayed:
    - Warning: APU FIRE, ENG 1 (2) FIRE, BAGG SMOKE
    - Caution: APU FIREDET FAIL, E1 (2) FIREDET FAIL
  - Fire handles illuminate.
  - Baggage fire extinguishing button illuminates.
  - Baggage compartment fan deactivates.
  - WARNING/CAUTION lights flash.
  - Aural warning sounds.

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NOTE: - On the ground, when pressed approximately for more than 10 seconds, the APU is shut down, if it is running.
- If it is necessary to repeat the test, wait at least 6 seconds to press the test button again.
- If Fire Detection Test button is held for less than 2 seconds the BAGG EXTG button may remain illuminated. In this case, repeat the test.

On airplanes equipped with class “D” baggage compartment, the fire test is successfully completed if the conditions below occur simultaneously:

– The following EICAS fire detection messages are displayed:
  – Warning: APU FIRE, ENG 1 (2) FIRE
  – Caution: APU FIREDET FAIL, E1 (2) FIREDET FAIL
– Fire handles illuminate.
– WARNING/CAUTION lights flash.
– Aural warning sounds.

NOTE: - On the ground, when pressed approximately for more than 10 seconds, the APU is shut down, if it is running.
- If it is necessary to repeat the test, wait at least 6 seconds to press the test button again.

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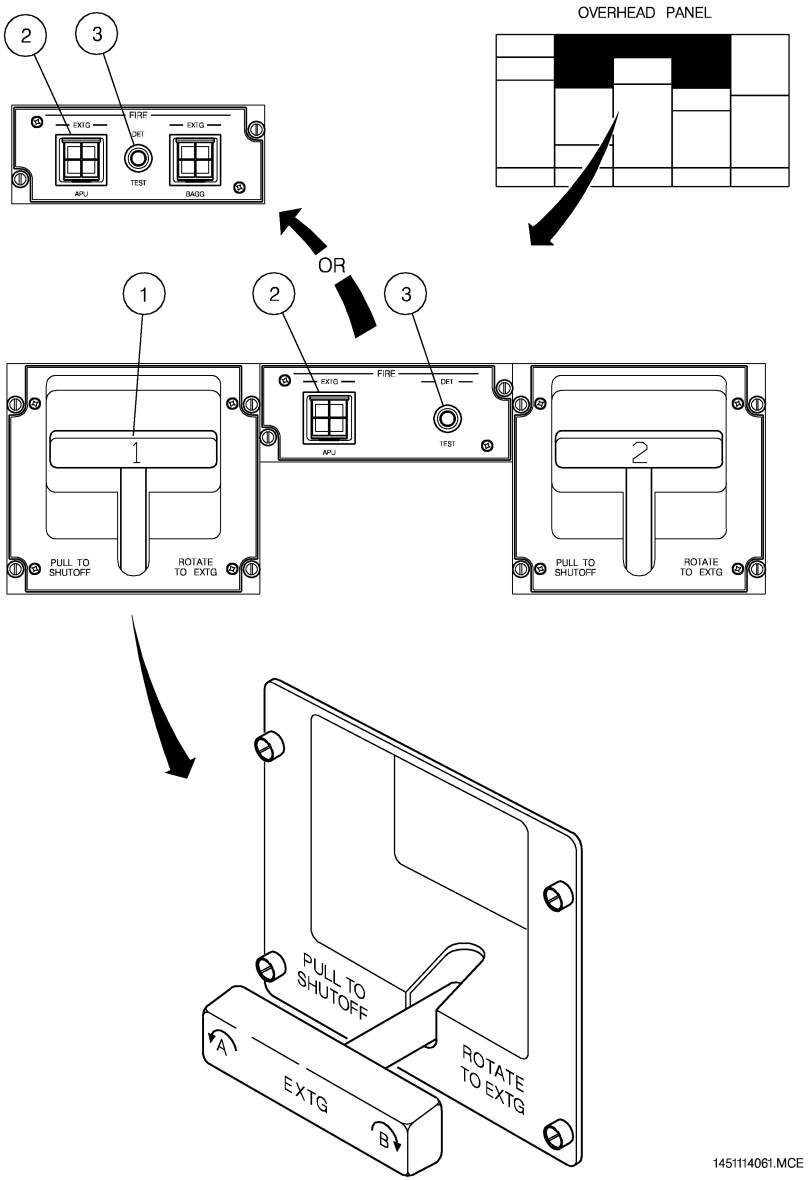

ENGINE AND APU FIRE DETECTION/EXTINGUISHING PANEL

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
WARNING	APU FIRE	Fire in the APU.
	ENG1 (2) FIRE	Fire in associated engine.
CAUTION	E1 (2) FIREDET FAIL	Associated engine fire detection system failed.
	APU FIREDET FAIL	APU fire detection system failed.
	E1 (2) EXTBTLA INOP	Associated bottle has been discharged or is inoperative.
	E1 (2) EXTBTLB INOP	
	APU EXTBTL INOP	

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LAVATORY FIRE PROTECTION SYSTEM

LAVATORY SMOKE DETECTION

The lavatory smoke detection system consists of a smoke sensor installed in the lavatory ceiling and a Smoke Detector Panel located near the forward galley.

Upon detection of smoke inside the lavatory, the smoke detector signals the panel to activate a red alarm light and a horn. In addition, a warning message is presented on the EICAS. The smoke sensor is less sensitive to smoke from cigarettes.

The EMB-135 has an additional horn, installed in the aft cabin section on the ceiling panel, right in front of the lavatory door.

LAVATORY FIRE EXTINGUISHING

A single fire extinguisher bottle is installed for fire protection of the lavatory waste container.

The bottle discharging tube outlets are fitted to the waste container, and are provided with temperature sensitive heads. Discharge of the extinguishing agent is accomplished by sensitive heads melting under high temperatures, which opens an outlet passage.

No warning is provided in the cockpit when the waste container extinguisher bottle is discharged.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
WARNING	LAV SMOKE	Smoke has been detected inside the lavatory.

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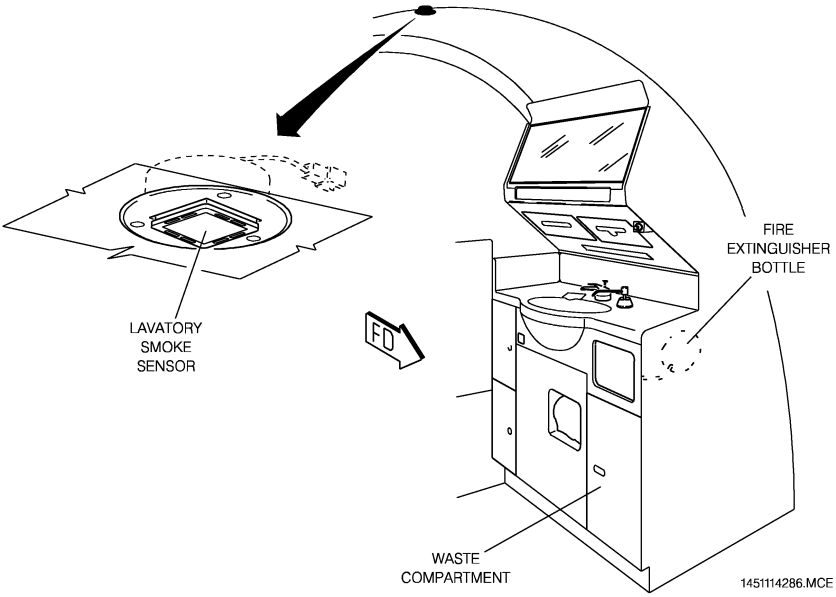


LAVATORY FIRE PROTECTION SYSTEM

CONTROLS AND INDICATORS

LAVATORY SMOKE DETECTOR PANEL

1 - LAVATORY SMOKE DETECTOR OPERATION LIGHT (green)

- Illuminates during normal system operation.

2 - LAVATORY SMOKE DETECTOR ALARM LIGHT (red)

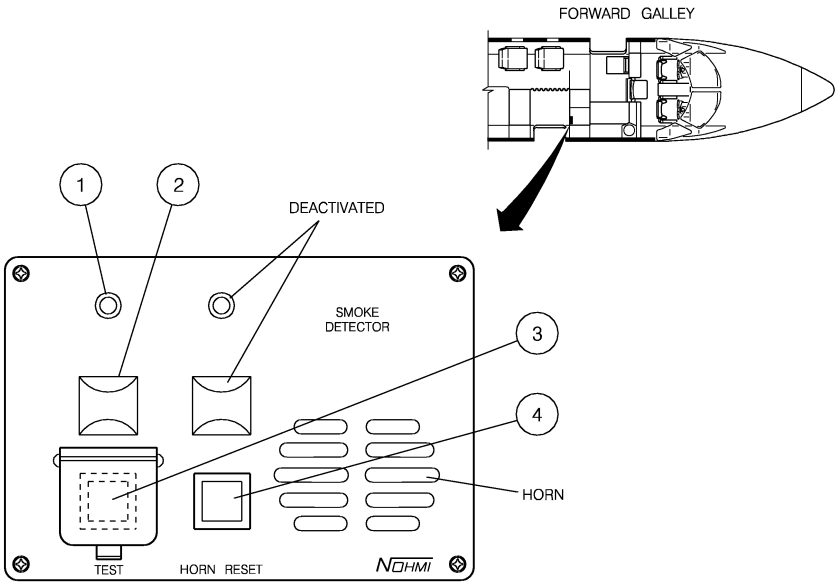
- Flashes in case of smoke detection inside the lavatory. In this case, a horn is also activated.

3 - LAVATORY SMOKE DETECTOR TEST BUTTON (guarded)

- When pressed (momentarily), simulates a smoke detection condition and activates all associated alarms (horn, red alarm light and EICAS message).
- During test, the green operation light extinguishes.

4 - LAVATORY SMOKE DETECTOR RESET BUTTON

- Cancels the horn and resets the system for operation.



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LAVATORY SMOKE DETECTOR PANEL

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LAVATORY FIRE PROTECTION SYSTEM

The information presented herein is valid for airplanes Post-Mod. SB 145-26-0014 or equipped with an equivalent modification factory incorporated.

LAVATORY SMOKE DETECTION

The lavatory smoke detection system consists of a smoke sensor installed in the lavatory ceiling and a Smoke Detector Panel located near the forward galley.

Upon detection of smoke inside the lavatory, the smoke detector signals the panel to activate a red alarm flashing light and a horn. In addition, a warning message is presented on the EICAS. The smoke sensor is less sensitive to smoke from cigarettes.

LAVATORY FIRE EXTINGUISHING

A single fire extinguisher bottle is installed for fire protection of the lavatory waste container.

The bottle discharging tube outlets are fitted to the waste container, and are provided with temperature sensitive heads. Discharge of the extinguishing agent is accomplished by sensitive heads melting under high temperatures, which opens an outlet passage.

No warning is provided in the cockpit when the waste container extinguisher bottle is discharged.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
WARNING	LAV SMOKE	Smoke has been detected inside the lavatory.

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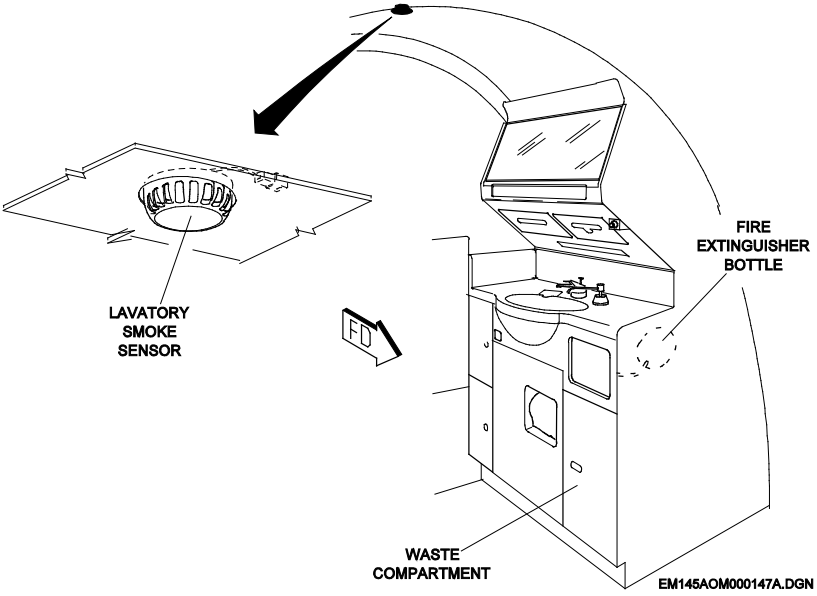

LAVATORY FIRE PROTECTION SYSTEM

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CONTROLS AND INDICATORS

LAVATORY SMOKE DETECTOR PANEL

1 - LAVATORY SMOKE DETECTOR ALARM LIGHT (RED)

- Flashes in case of smoke detection inside the lavatory. In this case, a horn is also activated.

2 - LAVATORY SMOKE DETECTOR HORN OFF BUTTON

- Turns off the horn alarm when pressed.

3 - LAVATORY SMOKE DETECTOR RESET BUTTON

- Cancels the horn and resets the system for operation.

4 - LAVATORY SMOKE DETECTOR TEST BUTTON (GUARDED)

- When pressed (momentarily), simulates a smoke detection condition and activates all associated alarms (horn, red alarm light and EICAS message).

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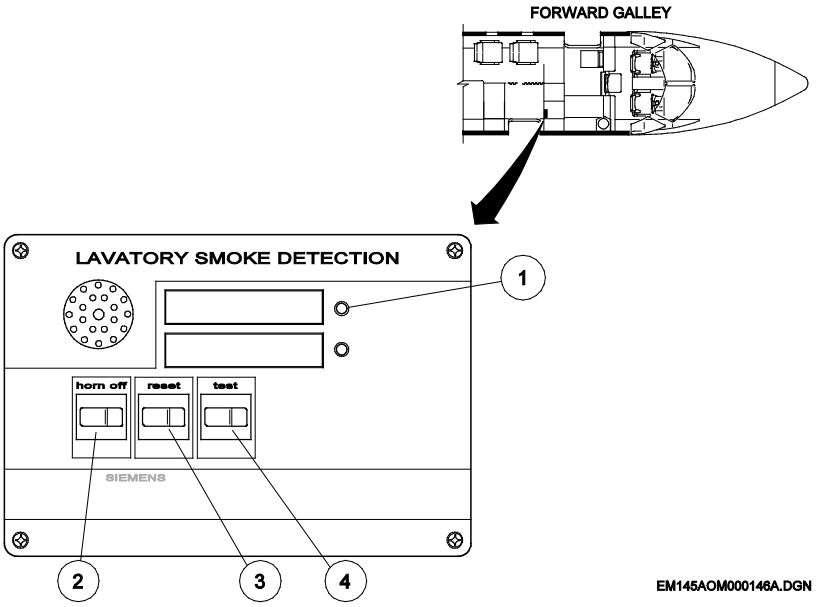

LAVATORY SMOKE DETECTOR PANEL

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BAGGAGE COMPARTMENT FIRE PROTECTION SYSTEM

BAGGAGE COMPARTMENT SMOKE DETECTION SYSTEM

A smoke detection system is provided in the baggage compartment. The system consists of two smoke detection modules installed on the compartment ceiling.

A warning message is presented on the EICAS to indicate smoke detection inside the baggage compartment and this message disappears when the smoke is no longer present.

The smoke sensor resumes normal operation when the fire is extinguished, the smoke has been cleared or the smoke sensor is reset. On airplanes equipped with JAMCO (PN PU 90-431R1) detector, the smoke sensor may also be reset through the power-reset button, located on each smoke detection module.

Flight crew inspection of the baggage compartment is possible for airplanes equipped with an optional sight glass in the rear lavatory partition. For some airplanes a switch is available to turn on the lights in the baggage compartment (Refer to 2-06-15 – Lighting).

BAGGAGE COMPARTMENT FIRE EXTINGUISHING SYSTEM (OPTIONAL)

Two fire extinguishing bottles are installed in the rear electronic compartment for baggage compartment fire protection.

The High-Rate Discharge Bottle is designed to instantaneously fill the baggage compartment while the Metering Discharge Bottle provides the required level of fire extinguishing agent concentration for at least 60 minutes.

Two smoke detectors are installed in the baggage compartment. Upon smoke detection inside the baggage compartment, either one or both smoke detectors send a signal to deactivate the baggage compartment fan and illuminate the baggage fire extinguisher button on the Fire Detection/Extinguishing Panel. When smoke is no longer present, the baggage compartment fan is reactivated and the baggage fire extinguisher button light turns off.

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
WARNING	BAGG SMOKE	Smoke has been detected inside the baggage compartment.
CAUTION	BAGG EXTBTL INOP	Any of the bottles have been discharged or are inoperative, in class C baggage compartment.

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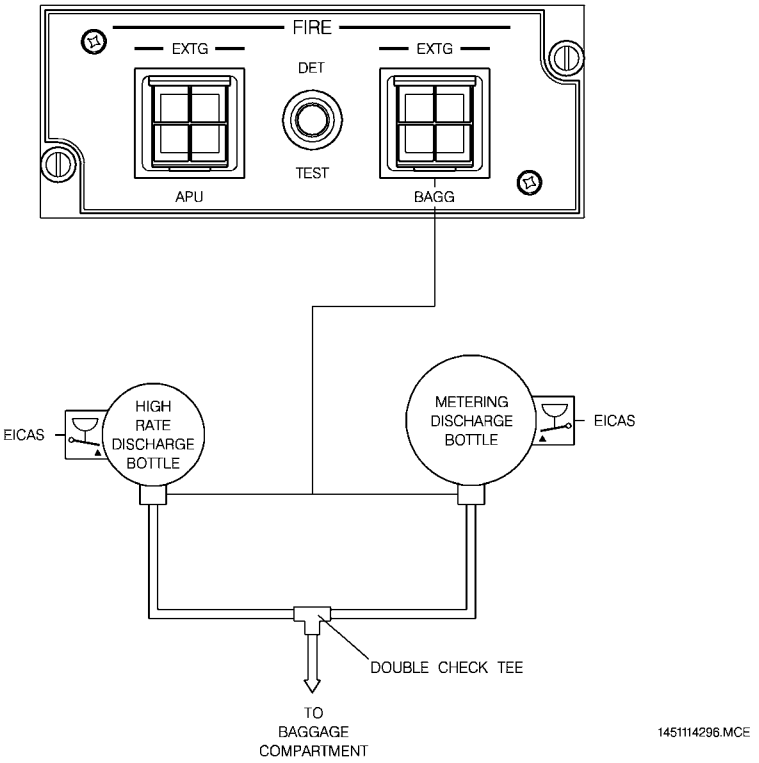

BAGGAGE FIRE EXTINGUISHING SCHEMATIC

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CONTROLS AND INDICATORS

BAGGAGE DETECTION/EXTINGUISHING PANEL (OPTIONAL)

1 - BAGGAGE FIRE EXTINGUISHING BUTTON (guarded)

- When lit, button indicates that smoke was detected inside the baggage compartment or that the fan has been deactivated.
- Button remains lit as long as there is smoke inside baggage compartment.
- When pressed:
  - Discharges the baggage fire extinguishing bottles.
  - Deactivates the baggage compartment fan.

NOTE: Fire extinguishing agent may activate the smoke detector.

2 - FIRE DETECTION SYSTEM TEST BUTTON

- Refer to ENGINE AND APU FIRE DETECTION/EXTINGUISHING PANEL.

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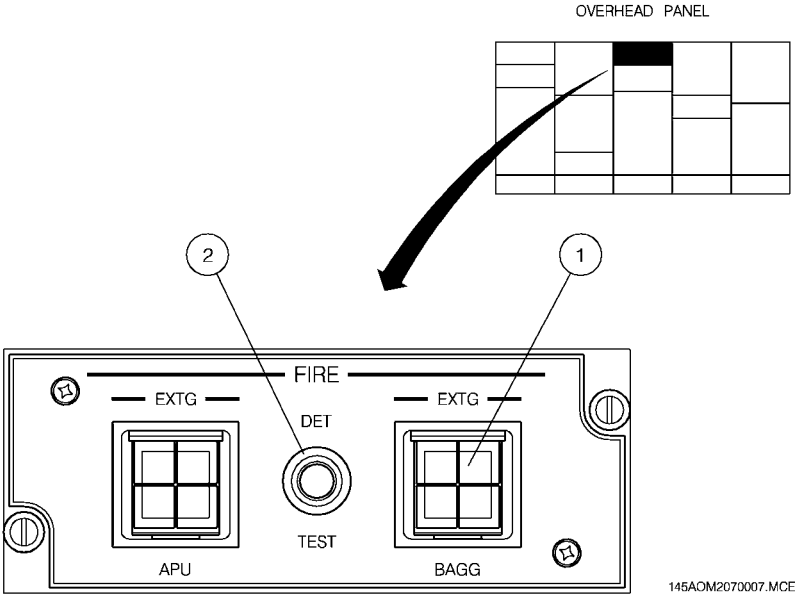

BAGGAGE DETECTION/EXTINGUISHING PANEL

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BAGGAGE COMPARTMENT SMOKE DETECTOR

AIRPLANES PRE-MOD S.B. 145-26-0004

1 - BAGGAGE SMOKE DETECTOR OPERATION LIGHT (green)

- Illuminates during normal system operation.

2 - BAGGAGE SMOKE DETECTOR RESET SWITCH

- Cancels the EICAS message and resets the system for operation.

3 - BAGGAGE SMOKE DETECTOR TEST SWITCH

- When pressed (momentarily), simulates a smoke detection condition and activates all associated alarms (red alarm light and EICAS message).
- During test, the green operation light extinguishes.

4 - BAGGAGE SMOKE DETECTOR ALARM LIGHT (red)

- Illuminates in case of smoke detection inside the baggage compartment.

BAGGAGE COMPARTMENT SMOKE DETECTOR

AIRPLANES POST-MOD SB 145-26-0004 OR S/N 145.119, 145.134 AND ON

- Detectors are tested during Fire Detection System test.

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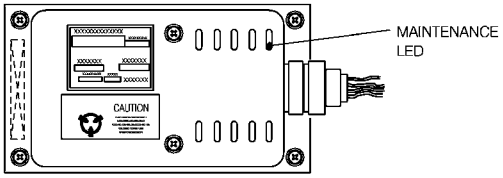
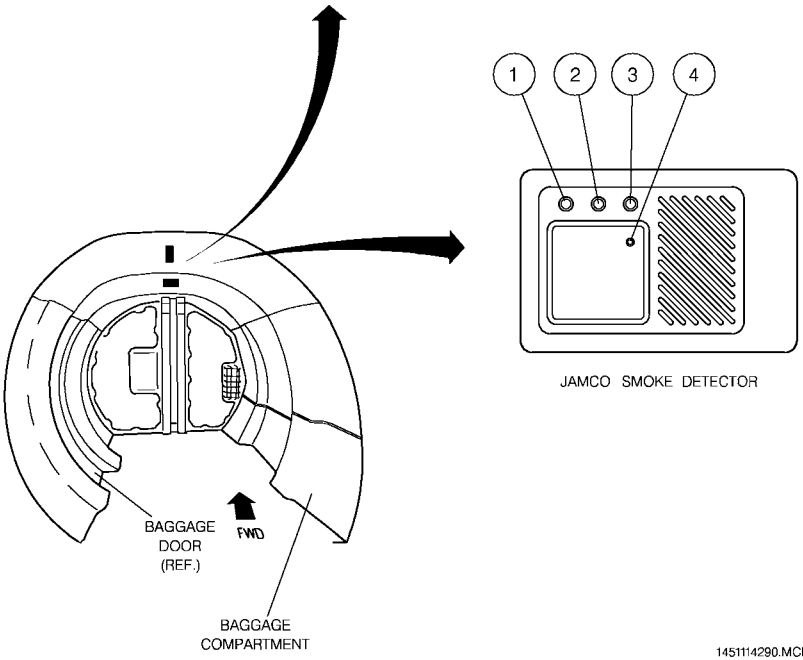


WALTER KIDDE AEROSPACE SMOKE DETECTOR



JAMCO SMOKE DETECTOR

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BAGGAGE COMPARTMENT SMOKE DETECTOR

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SECTION 2-08

FUEL

TABLE OF CONTENTS

Block Page

General ..... 2-08-05 ..01
Fuel Tanks ..... 2-08-05 ..02
Fuel Tank Vent System ..... 2-08-05 ..02
Engine and APU Fuel Distribution and Control ..... 2-08-05 ..03
EICAS Messages ..... 2-08-05 ..07
Controls and Indicators ..... 2-08-05 ..08
Fuel System Panel ..... 2-08-05 ..08
MFD Bezel ..... 2-08-05 ..10
Fuel Page on MFD ..... 2-08-05 ..12
EICAS Indications ..... 2-08-05 ..14
Refueling and Defueling ..... 2-08-10 ..01
Pressurized Refueling ..... 2-08-10 ..01
Defueling ..... 2-08-10 ..02
Refueling Panel ..... 2-08-10 ..04
Fuel Measuring Stick ..... 2-08-15 ..01

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GENERAL

The EMB-145/135 fuel feed system consists of two independent systems, one for each engine, interconnected by a crossfeed line. The fuel system ensure proper fuel supply to the engines and APU under all the operating conditions.

The system allows refueling and defueling operation to be performed either by pressure or by gravity.

NOTE: The fuel weight values present in this manual are based on a fuel density of 0.811 kg/liter (6.767 lb/US Gal).

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FUEL TANKS

The airplane has two fuel tanks, one in each wing. The fuel flows from the wing tip to the wing root by gravity. A collector box in the wing root keeps the electrical pumps inlets submerged. To prevent pumps cavitation, a ejector pump and flaps valves ensure enough fuel in the collector box at all conditions.

The fuel tank capacity changes according to airplane model. The EMB-145LR/LU and EMB-135LR models are equipped with a wing stub tank that increases the tank capacity. These airplanes have the collector boxes located in the wing stub.

	TANK CAPACITY			
	Airplanes Without Stub Tank		Airplanes With Stub Tank	
	One Tank	Both Tanks	One Tank	Both tanks
Liters	2573	5146	3198	6396
US gallons	679.8	1359.6	844.9	1689.8
Kilograms	2087	4173	2594	5187
Pounds	4600.2	9200.4	5717.4	11434.9

When performing pressure refueling, the usable fuel quantity in each tank may be reduced by 7.9 US Gal (STD, ER and MP models) or 13.2 US Gal (LR model) maximum.

NOTE: When operating with the TS-1 fuel, the FQIS may display a fuel quantity 2% (two percent) higher than the actual fuel loaded in the airplane.

Conversion factors:

- 3.785412 liter/US gallon.
- 1.2330456 liter/kg.
- 0.4536 kg/lb.

FUEL TANK VENT SYSTEM

The purpose of the fuel vent system is to prevent damage to the wings due to excessive buildup of positive or negative pressures inside the fuel tanks. The system consists of float vent valves, vent lines, a surge box and a NACA air intake. The surge box is located in the wing and it is connected to the fuel tank through two float valves. These valves allow at least one venting point to be open between the surge box and the fuel tank under any flight condition. The surge boxes are connected to outside air through a NACA air intake installed under the wing.

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ENGINE AND APU FUEL DISTRIBUTION AND CONTROL

There are three electric pumps for each wing tank that provides pressurized fuel to the engines and APU. One pump is capable to supply fuel for both engines and APU under all phases of flight, except takeoff and go-around.

During takeoff and go-around one electric pump is required for each engine and the APU.

Engine-driven fuel pumps will provide suction feed if the electric fuel pumps operation is not available limited up to a ceiling altitude of 25000 ft.

NOTE: Crossfeed Selector Knob must be OFF during takeoff and go-around.

Five knobs located in the overhead fuel panel controls the electric pumps and crossfeed operation. Two PUMP PWR knobs energizes/de-energizes the electric pumps and the other two PUMP SEL knobs selects which pumps will be operating. The remaining pumps will be on standby. If the fuel pressure drops below 6.5 psi, the remaining pumps are automatically switched on and start cycling, until the pilot selects one of them.

The XFEED knob controls the crossfeed operation.

Crossfeed operation should be performed in case of fuel imbalance between tanks. The crossfeed knob acts over the crossfeed valve and over the electric pumps. Selecting the knob to LOW1 or LOW2 will deenergize the pump associated to the side with low level. The crossfeed valve will open connecting the engine 1 and engine 2 fuel feed lines. The fully-opened crossfeed valve position is indicated on the EICAS by an advisory message. In case of valve failure, the EICAS displays a caution message.

NOTE: Crossfeed operation does not allow fuel transfer between tanks.

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Fuel for APU operation is normally supplied from the right side fuel system. Fuel from the left side system may be used by selecting the crossfeed knob to LOW2. The APU fuel shutoff valve will close in the following conditions:

- APU master knob positioned to OFF.
- By pressing the APU fuel shutoff button.
- By pressing the APU fire extinguishing button.
- Automatically, through the APU fire detection system in case of APU fire on ground.

Sensors installed in the tanks and along fuel lines provide signals to indicate system failures and status. Such indications and messages are shown on the MFD Fuel page as well as on the EICAS.

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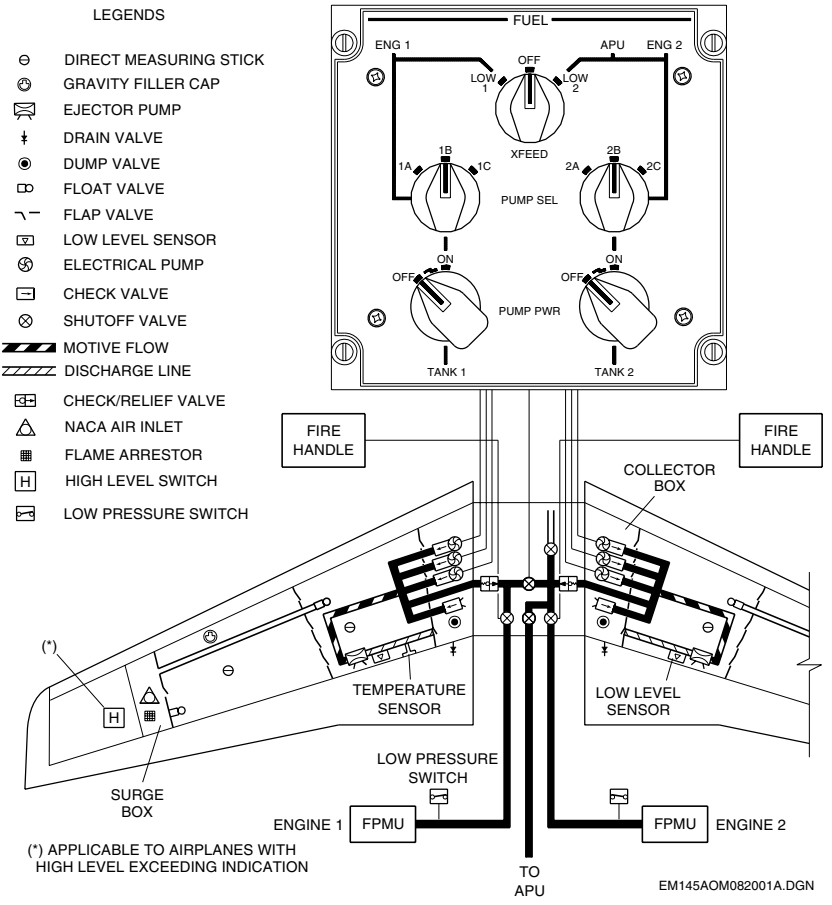

FUEL SYSTEM SCHEMATIC

(AIRPLANES WITHOUT STUB TANK)

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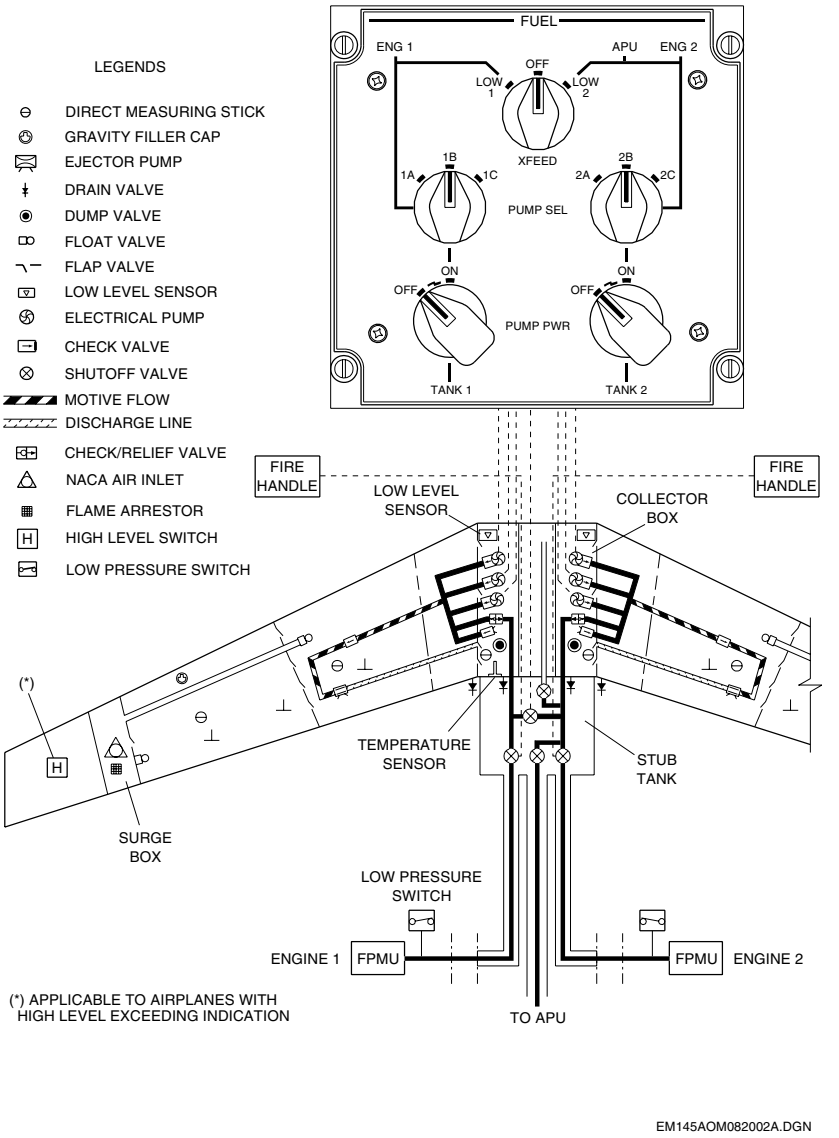

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FUEL SYSTEM SCHEMATIC

(AIRPLANES WITH STUB TANK)

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
WARNING	FUEL 1(2) LO LEVEL	The remaining fuel quantity in the associated tank ranges from 210 kg (463 lb) to 265 kg (584 lb), for leveled flight condition.
CAUTION	E1(2) FUEL LO PRESS	Fuel pressure is below 6.5 psi.
	FUEL TANK LO TEMP	Fuel temperature inside left tank is at or below –40°C.
	FUEL XFEED FAIL	Disagreement between crossfeed valve and knob position.
	FUEL IMBALANCE	Fuel quantity in one tank differs by 363 kg (800 lb) from the other tank. Message is removed when difference between tanks decreases below 45 kg (100 lb).
	APU FUEL LO PRESS	Fuel pressure is below 6.5 psi with APU operating.
	E1 (2) FUEL SOV INOP	Associated shutoff valve is not in the commanded position.
	APU FUEL SOV INOP	APU shutoff valve is not in the commanded position.
	FUELING DOOR OPN	Refueling panel door is open.
	FUEL EQ XFEED OPN	- Crossfeed valve remains open after fuel imbalance correction - difference between wing tanks fuel quantities lower than 45 kg (100 lb); or - Crew activated the wing fuel imbalance correction to the wing tank with low level.

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EICAS MESSAGES (CONT.)

TYPE	MESSAGE	MEANING
ADVISORY	E1 (2) FUEL SOV CLSD	Associated shutoff valve is closed.
	APU FUEL SOV CLSD	APU fuel shutoff valve is closed. Message remains on for 10 seconds after APU Master Knob is set to off. If valve has been commanded to close through APU Fuel Shutoff Button or APU Fire Extinguishing Button the message will remain on continuously.
	FUEL XFEED OPEN	Crossfeed valve is open.

CONTROLS AND INDICATORS

FUEL SYSTEM PANEL

1 - CROSSFEED Selector Knob

LOW1 – Opens the crossfeed valve and turns off the selected pump of the left wing tank.

OFF – Closes the crossfeed valve.

LOW2 – Opens the crossfeed valve and turns off the selected pump of the right wing tank.

2 - WING TANK FUEL PUMP SELECTOR KNOB

– Selects which electric pump will be operative for each wing tank. The non-selected wing pumps remain as standby.

3 - WING TANK FUEL PUMP POWER KNOB

ON - Turns ON the selected wing fuel pump.

OFF - Turns OFF the selected wing fuel pump.

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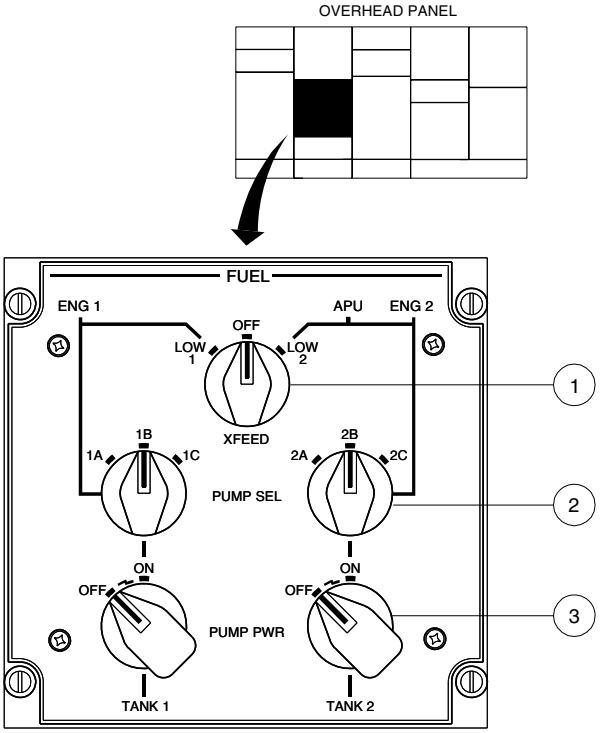

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FUEL SYSTEM PANEL

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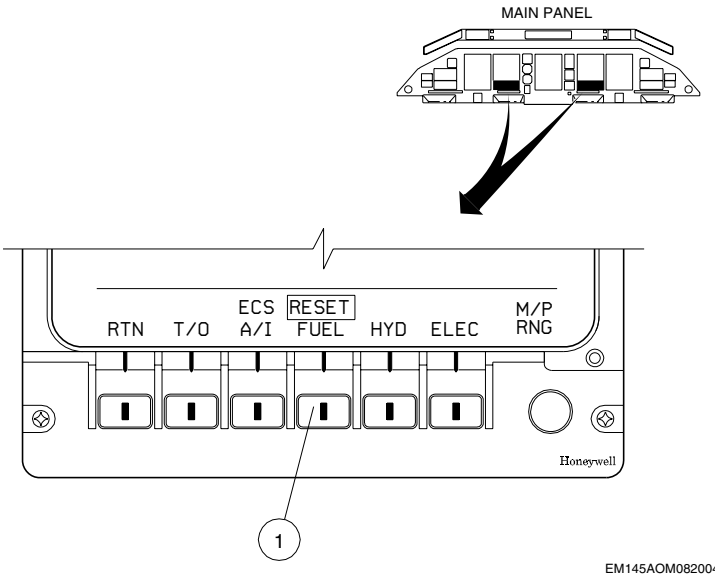
MFD BEZEL

1 - FUEL SYSTEM and RESET BUTTON

- Pressing FUEL button selects the fuel system page on MFD. Pressing the button a second time resets the fuel used to zero. Fuel used must be reset individually on each MFD.



MFD BEZEL

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FUEL PAGE ON MFD

1 - DIGITAL FUEL QUANTITY INDICATION (TANK 1,TANK 2 and TOTAL)

- The digital fuel tank quantity indicator ranges from 0 to 9990 (for airplanes without stub tank) or from 0 to 15000 (for airplanes with stub tank) with a digital resolution of 10 units, regardless of unit being used (lb or kg), for TANK 1, TANK 2, and TOTAL.
- Colors for each tank identification:
  - Green above 400 kg (880 lb).
  - Amber and boxed from 280 kg to 400 kg (620 lb to 880 lb).
  - Red and boxed below 280 kg (620 lb).
- Colors for TOTAL indication: if TANK1, TANK2 or both fuel quantities enter into red or amber region, total fuel quantity will be boxed (on EICAS and MFD) and displayed in the same color, with the red taking precedence over the amber.
- Amber dashes replace the indication, in the event of any fault which affects fuel gauging.

2 - ANALOG FUEL QUANTITY INDICATION

- Quantity is indicated by a vertical bar and a pointer. The colors and ranges are the same used for digital fuel quantity indications.

3 - DIGITAL FUEL USED INDICATION

- The fuel used indicator ranges from 0 to 9990 (for airplanes without stub tank) or from 0 to 15000 (for airplanes with stub tank) with a digital resolution of 10 units, regardless of unit being used (lb or kg).
- Color: Green under normal operation. Replaced by Amber dashes (in flight) or amber zero (on ground) if any problem is verified.

4 - DIGITAL FUEL TEMPERATURE INDICATION

- Ranges from –60°C to +60°C with a resolution of 1°C.
- Colors:
  - Green above –40°C.
  - Amber and boxed below –40°C.

5 - OPERATING PUMP INDICATION

- This indicator displays A, B, C or OFF, depending on which pump is selected and whether it is on or off.
- Color: green.
- Wing tank pumps indication may blink when cycling, until the pilot selects another pump.

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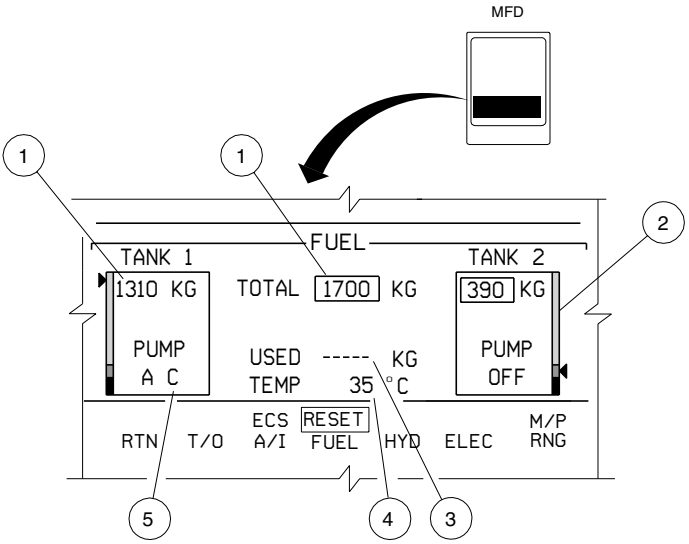

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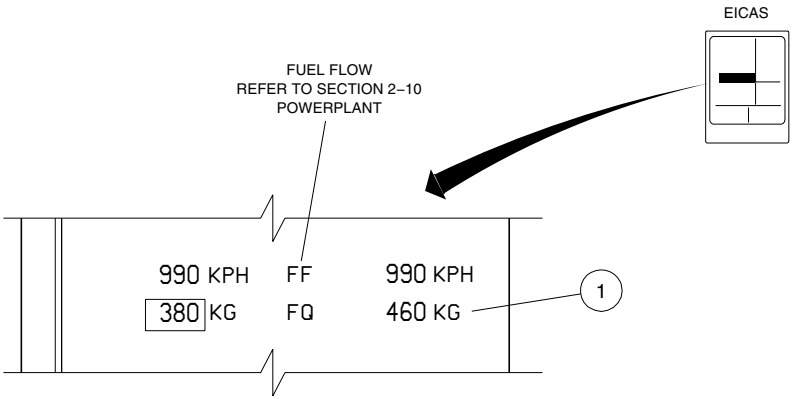
MFD FUEL PAGE

EICAS INDICATIONS

1 - FUEL QUANTITY (TANK 1 and TANK 2) AND FUEL FLOW

- Fuel quantity for each tank and fuel flow for each engine is displayed continuously on EICAS.
- Fuel quantity for each tank:
  - Green above 400 kg (880 lb).
  - Amber and boxed from 280 kg to 400 kg (620 lb to 880 lb).
  - Red and boxed below 280 kg (620 lb).
- Fuel flow for each engine:
  - Ranges from 0 to 2000 kph (or 4000 pph) with a resolution of 5 kph (or 10 pph).
  - Color: Green



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REFUELING AND DEFUELING

Refueling and defueling operations may be performed either by pressure or by gravity. The refueling panel in the right wing-to-fuselage fairing allows pressurized refueling/defueling operation. A gravity filler cap on the upper skin of each wing allows gravity filling. Dump valves and drain valves are used for gravity defueling.

PRESSURIZED REFUELING

Pressurized refueling operations require the refueling system being energized. This can be accomplished by either energizing the airplane through APU, GPU, battery or running engine, selecting the power selection switch to BATTERY.

As fuel pressure is applied on the adapter the two CLOSED lights will illuminate to indicate that refueling shutoff valves are closed. Selecting the refueling switch to OPEN will open the shutoff valves, starting refueling operation. The shutoff valves will close, stopping the refueling operation, when:

- The fuel level in the tanks lifts the associated pilot valve's float. This level defines the maximum fuel volume approved for that tank, through pressure refueling.
- The selected fuel quantity on the refueling panel is achieved.
- The refueling switch is commanded to closed.

For airplanes with High Level Exceeding Indication System incorporated, an automatic refueling shutoff failure will be identified by the HLEIS (High Level Exceeding Indication System), that will sense, via one HLS (High Level Sensor) in each wing tank, that the fuel level in the failed tank reached over the maximum quantity approved for that tank and will advise the operator by illuminating, on the refueling panel, the "STOP RFL" red indicating light of the failed tank. The operator shall interrupt the refueling operation immediately, after viewing the red light on, to prevent fuel spillage through the vent valve and shall call the maintenance personnel to follow the procedure to remove the extra fuel of the associated tank(s).

The fueling cart or fueling truck shall deliver a refueling pressure (deadhead) within 35 to 50 psi.

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DEFUELING

Pressurized defueling uses the same adapter as pressure refueling. Pressurized defueling can be performed using the electric fuel feed pumps installed in the tanks or by suction (4 psi max.) provided by an appropriated external source. Selecting the defueling switch to OPEN will open the defueling shutoff valve allowing defueling operation. To defuel the left tank, the crossfeed knob on the overhead fuel panel, in the cockpit, must be positioned to LOW2.

Complete gravity defueling may be achieved by using the drain valve and opening the associated gravity refueling cap. Partial gravity defueling can be done through the dump valves located on the wing under skin near the wing root. Pressurized defueling can only be performed with the airplane normally energized.

CAUTION: DO NOT RUN ELECTRIC PUMPS WITH FUEL QUANTITY IN EACH TANK BELOW 30 LITERS (8 US GAL) OR 24 KG (54 LB).

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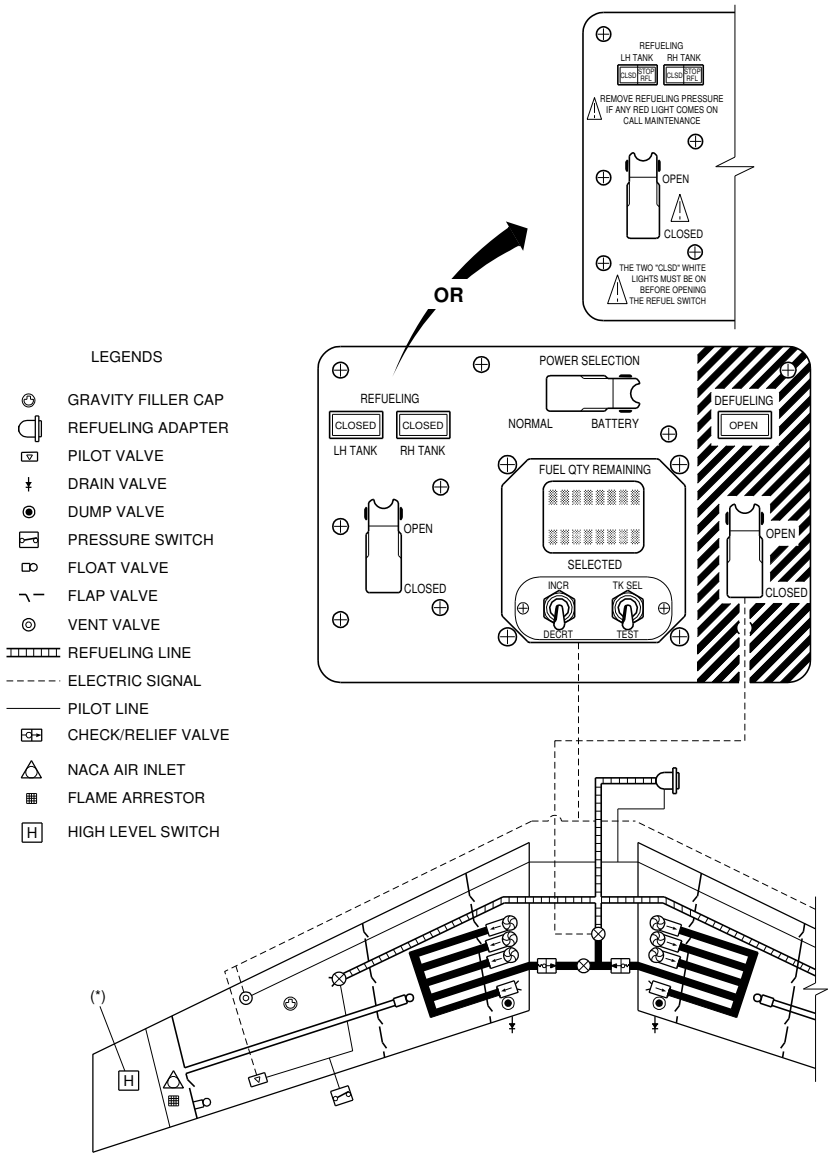

(*) APPLICABLE TO AIRPLANES WITH HIGH LEVEL EXCEEDING INDICATION

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PRESSURE REFUELING/DEFUELING SYSTEM SCHEMATIC

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REFUELING PANEL

1 - REFUELING CLOSED LIGHTS (WHITE)

– Illuminate when the associated refueling line is pressurized and the associated shutoff valve is closed.

- STOP REFUELING LIGHTS (RED)

– Illuminate when fuel level in the failed tank reached over the maximum quantity approved for that tank (For airplanes with High Level Exceeding Indication incorporated).

2 - POWER SELECTION SWITCH (GUARDED)

NORMAL - Refueling system is energized by the DC Bus 1.

BATTERY - Refueling system is connected to the Hot Bus 1.

3 - DEFUELING OPEN LIGHT (WHITE)

– Illuminates when the defueling shutoff valve is open.

4 - DEFUELING SWITCH (GUARDED)

– Actuates the defueling shutoff valve to open or to close.

5 - FUEL QUANTITY REMAINING INDICATOR

– Displays fuel remaining in each tank or the total as selected by the TK SEL/TEST Switch.
– The selection is identified by the letters L, R and T (L for the left tank, R for the right tank and T for the airplane total quantity).
– The unit of measurement (kg or lb) is also displayed.
– In case of failure, FAIL inscription is displayed blinking and the refueling/defueling operation is interrupted.
– The established accuracy of the EMB-145 airplane Fuel Quantity Gauging System (FQGS) is: ± 2% of the provided indication plus ± 35 kg (77 lb), considering the approved fuels and normal flight attitudes.

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6 - TK SEL/TEST SWITCH (spring loaded to center position)

TEST - Initiates indicator built-in and probes conditions test. All light segments illuminate and a failure code is presented, if a failure is detected.

TK SEL - Selects which fuel quantity is going to be displayed in the upper display. When the indicator is energized, the total fuel quantity is shown. Sequentially pushing the switch to TKSEL will select left tank, right tank and total fuel quantity.

7 - QUANTITY SELECTION SWITCH (SPRING LOADED TO CENTER POSITION)

- Increment (INCR) or decrement (DECRT) the fuel quantity selection.
- If moved from the neutral position during refueling, it interrupts the operation. The refueling operation will be restored 4 seconds after switch return to the neutral position.

8 - FUEL QUANTITY SELECTED INDICATOR

- Displays the fuel quantity in the airplane and the fuel quantity to be refueled.
- When the FAIL inscription is displayed blinking on the fuel quantity remaining indicator and the TKSEL/TEST switch is pushed to TKSEL, the active fail description is momentary displayed in both indicators.
- The indicator displays zero as the refueling compartment door is opened.

9 - REFUELING SWITCH (GUARDED)

- When the switch is closed, both wing pilot valves close the refueling shutoff valves.

NOTE: The defueling and the power selection switch are moved to close/normal position when the refueling panel door is closed, besides refueling/defueling procedure requires manual closure.

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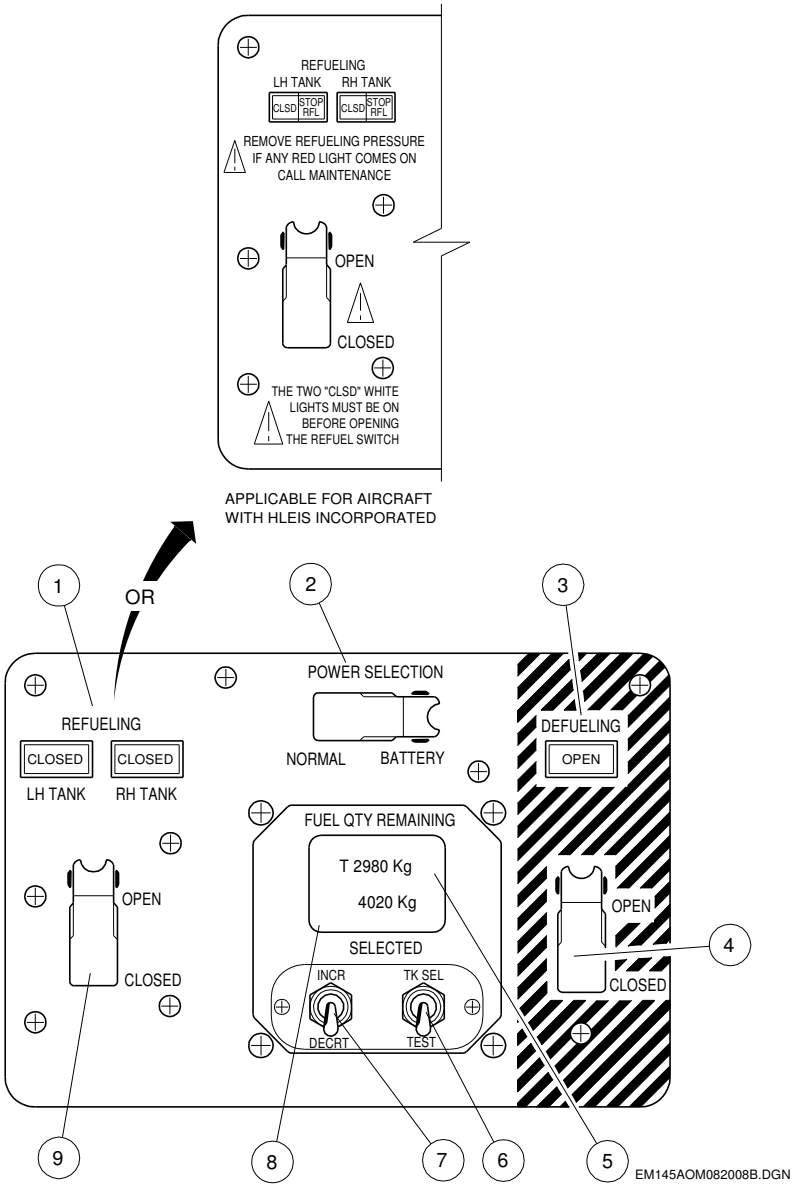

REFUELING PANEL

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FUEL MEASURING STICK

Two measuring sticks under each wing permit to check the fuel quantity in the tanks. Each measuring stick provides visual indication of the total fuel quantity of the associated wing tank.

Information about using the Fuel Measuring Stick can be found in the Ground Servicing Section (1-12-25).

NOTE: The EMB-145LR/LU, EMB-135LR, ERJ-140 and EMB-145XR models have two additional measuring sticks, one for each wing stub tank.

The table below provides minimum and maximum stick values:

STICK POSITION		AIRPLANES WITHOUT WING STUB TANK		AIRPLANES WITH WING STUB TANK	
		LITERS	*US GAL*	*LITERS*	*US GAL*
Wing Stub Tank	Min	--	--	7	2
	Max	--	--	783	207
Internal Point	Min	448	118	781	206
	Max	1553	410	2168	573
External Point	Min	1503	397	2163	571
	Max	2131	563	2791	737

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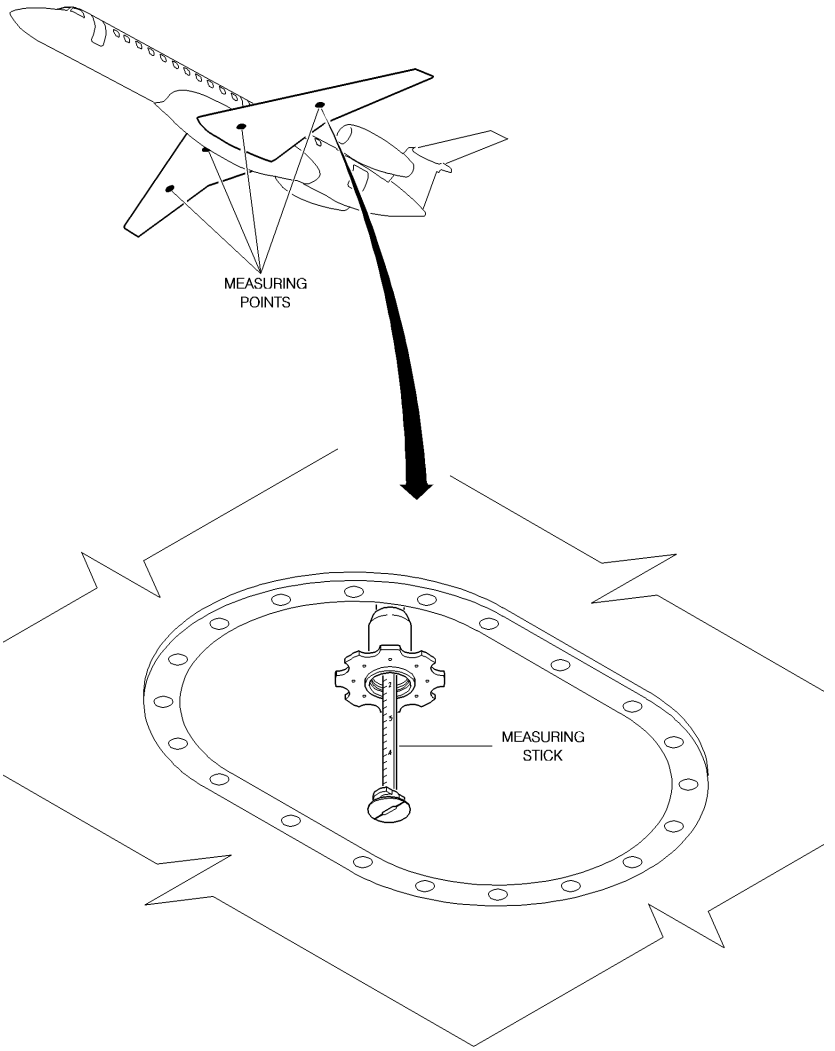

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MEASURING STICK POINTS

(AIRPLANES WITHOUT WING STUB TANK)

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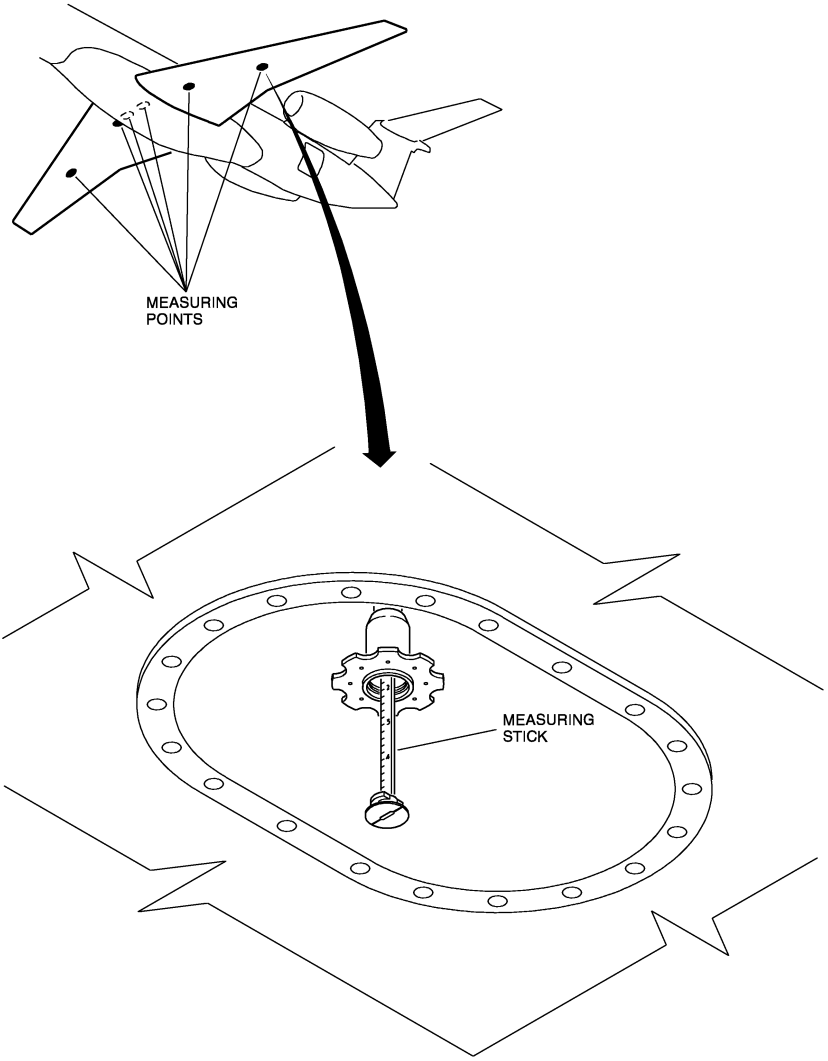

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MEASURING STICK POINTS

(AIRPLANES WITH WING STUB TANK)

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SECTION 2-09

AUXILIARY POWER UNIT

TABLE OF CONTENTS

Block Page

General ..... 2-09-05 ..01
Control System..... 2-09-05 ..04
APU Starting/Operation..... 2-09-05 ..08
EICAS Messages ..... 2-09-05 ..09
Controls and Indicators ..... 2-09-05 ..10
APU Control Panel ..... 2-09-05 ..10
EICAS Indications..... 2-09-05 ..11

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GENERAL

The APU is a source of pneumatic and electrical power to be used either simultaneously with or independent of airplane sources, while on the ground or in flight. Basically, it is a constant-speed gas turbine engine, consisting of a single-stage centrifugal compressor, a reverse-flow annular combustion chamber, and a single-stage radial turbine.

The airplane may be equipped with two APU models: T-62T-40C11 or T-62T-40C14. The Model T-62T-40C11 APU is controlled by the Electronic Sequence Unit (ESU), while the Model T-62T-40C14 APU is controlled by the Full Authority Digital Electronic Control (FADEC). Both control systems provide automatic, full-authority, fuel scheduling from start to full load operation, under all ambient conditions and operating modes. In addition, the ESU (or FADEC) automatically controls the APU to shut down should certain failures or events occur during start or operation.

An automatic APU shutdown may occur either on the ground or in flight, and takes place under the following conditions:

On the ground:

- fire;
- overtemperature;
- overspeed;
- underspeed;
- failure to start;
- failure to accelerate;
- failure to light;
- loss of speed data;
- external short;
- loss of ESU (or FADEC) signal;
- ESU (or FADEC) failure;
- bleed valve opening;
- low oil pressure;
- high oil temperature;
- oil pressure switch short;
- loss of EGT.

NOTE: In the event of fire, a 10 second delay is allowed before an automatic APU shutdown is initiated.

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In flight:

- overspeed;
- underspeed;
- failure to start;
- failure to accelerate;
- failure to light;
- loss of speed data;
- external short;
- loss of ESU (or FADEC) signal;
- ESU (or FADEC) failure.

The APU compartment is located in the airplane's tailcone, isolated by a titanium firewall. On the left side of the APU compartment, an inspection door allows access and inspection of the APU's components.

The APU starter-generator shaft drives an air-cooling fan. Air is drawn through an NACA air inlet located on the left side of the tailcone. APU draining is ducted to the airplane skin on the right side of the tailcone.

Control switches, alarms, and emergency shutdown means are provided on the cockpit overhead panel.

The normal APU indications and caution/warning messages are presented on the EICAS.

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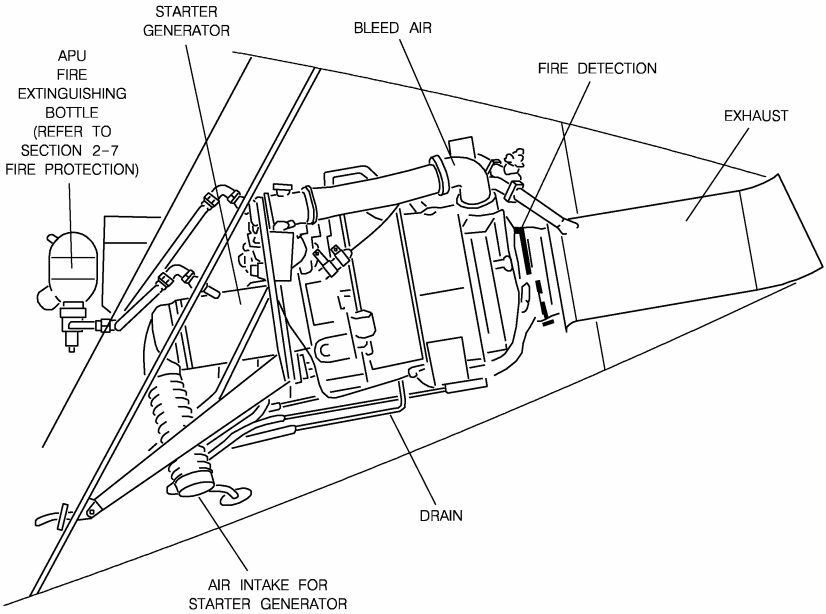

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APU INSTALLATION

CONTROL SYSTEM

The APU control systems include the electrical, fuel, ignition, lubrication, and pneumatic systems.

On the Model T-62T-40C11 APU, the electrical control system consists of the Electronic Sequence Unit (ESU) and electric accessories. On the Model T-62T-40C14 APU, the electrical control system consists of the Full-Authority Digital Electronic Control (FADEC). Both control systems incorporate the APU starting system, control logic, and failure indication. Electric accessories provide ESU (or FADEC) inputs and execute output commands.

For airplanes Pre-Mod. SB 145-49-0025 the APU ESU/FADEC is fed by CENTRAL DC BUS and by the ESS DC BUS 2. The APU shuts down if both buses are lost, but it remains on if only one is lost.

For airplanes Post-Mod. SB 145-49-0025 or equipped with an equivalent modification factory incorporated, the APU ESU/FADEC is electrically fed by HOT BUS 1. The APU control system (relays logic) is supplied by ESS DC BUS 2. The APU shuts down immediately if the HOT BUS 1 is lost, or shuts down after 6 seconds if the ESS DC BUS 2 is lost.

The fuel system is composed of the fuel pump, fuel solenoid valves (Start, Main, and Maximum), acceleration control, purge valve, fuel nozzles, fuel filter, and manifold. Acceleration control provides fuel in accordance with a preprogrammed schedule. Fuel from the right wing tank is normally used to supply the APU. Alternatively, fuel from the left wing tank may be used by means of the crossfeed valve.

NOTE: The fuel system for the Model T-62T-40C14 APU does not include a start and maximum fuel solenoid valves.

The ignition system provides the electrical power necessary during the APU starting sequence. It consists of an exciter, igniter plugs, and wiring.

The APU has a self-contained lubrication system totally integrated into the accessory gearbox. In addition to lubrication functions, the system provides the required oil cooling, with no need for an external heat exchanger. A thermostat, installed in the oil tank, sends a signal to the EICAS in case the oil temperature exceeds 166°C (331°F).

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The pneumatic control system consists of a flow limiting venturi (for APU Model T-62T-40C11 only), a bleed valve, and an anti-surge valve. The flow limiting venturi maintains the bleed flow below a set value, depending on air conditioning system requirements and atmospheric conditions, thus maintaining the EGT within acceptable levels. The anti-surge valve is controlled by the ESU (or FADEC), which monitors the signal from the APU bleed valve, the Air Turbine Starter (ATS) valve, and the Environmental Control System (ECS) valve.

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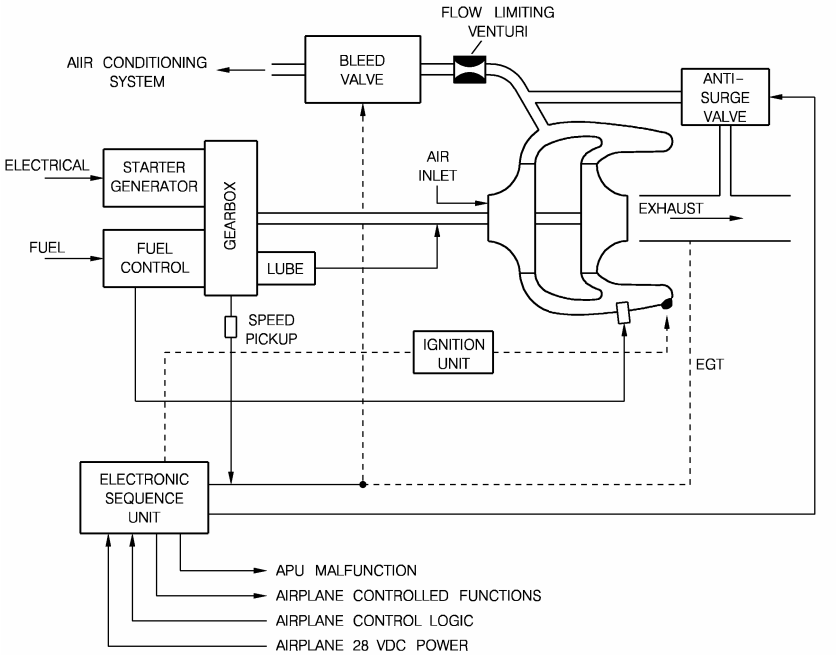

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APU MODEL T-62T-40C11 SCHEMATIC

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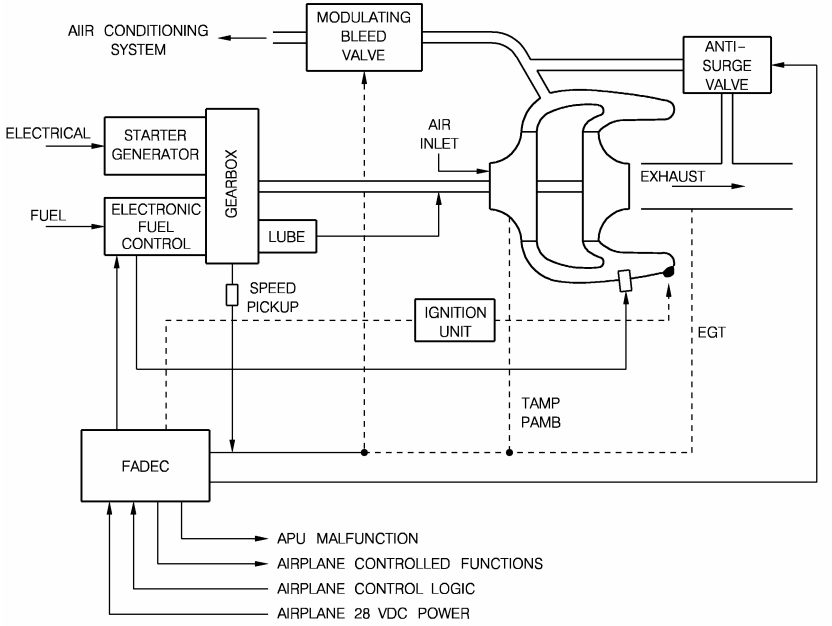

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APU MODEL T-62T-40C14 SCHEMATIC

APU STARTING/OPERATION

The APU starting cycle is initiated when the APU Master knob, located on the APU control panel, is moved to the ON position. At this moment, an EGT valid value is shown on the EICAS. On the Model T-62T-40C14 APU, at this time, the fuel shutoff valve is energized to open. When the Master switch is momentarily set to START, DC power is applied to the starter-generator, which will drive the APU compressor up to a speed high enough to obtain sufficient airflow for combustion.

On the Model T-62T-40C11 APU, at approximately 3% rotor speed on the ground (or 0% in flight), the ESU supplies power to the ignition unit as well as power to open the Start Fuel Solenoid Valve, allowing fuel to flow to the combustion chamber. At 14% rotor speed, the Main Fuel Solenoid Valve is energized. The APU continues accelerating up to the 70% rotor speed, when the ESU commands starter disengagement and Start Fuel Solenoid Valve and ignition deenergization.

On the Model T-62T-40C14 APU, at approximately 3% rotor speed on the ground (or 0% in flight), the FADEC supplies power to the ignition unit as well as power to open the Main Fuel Solenoid Valve, allowing fuel flow to the combustion chamber. The APU continues accelerating and, when rotor speed exceeds 50%, the FADEC de-energizes the starter and at 70% rotor speed the FADEC de-energizes the ignition exciter.

The APU acceleration continues by the APU's own means and, 7 seconds after having reached 95% rotor speed, the Maximum Fuel Solenoid Valve is energized (T-62T-40C11 Model) or the FADEC energizes the Ready-to-Load (RTL) output signal (T-62T-40C14 Model), allowing electrical and pneumatic power extraction through the starter-generator and the bleed valve, respectively.

If a failure in the control system occurs, associated with an APU overspeed, the Model T-62T-40C11 APU will automatically shutdown after the rotating parts reach 108% speed, while the Model T-62T-40C14 APU will automatically shutdown after the rotating parts reach 104% speed.

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The APU is shut down by pressing the APU Stop Button or by setting the Master switch to the OFF position. Normal shutdown of the APU should be accomplished by pushing the STOP switch on the cockpit APU control panel. On APU Model T-62T-40C11, a signal is sent to the ESU in order to simulate an overspeed condition, which, aside shutting the APU down, allows the ESU overspeed protection testing. On APU Model T-62T-40C14, a stop request signal is sent to the FADEC in order to execute the APU shutdown procedure; the FADEC overspeed protection is tested during the FADEC power-up.

NOTE: The APU FUEL SHUTOFF BUTTON when pressed also shuts the APU down by closing shutoff valve of the APU fuel feed-line.

EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	APU FAIL	APU has been automatically shut down.
	APU OIL LO PRESS	Oil pressure is below 6 psi.
	APU OIL HI TEMP	Oil temperature is above 166°C (331°F).

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CONTROLS AND INDICATORS

APU CONTROL PANEL

1 - APU MASTER KNOB

OFF - Deenergizes the ESU (or FADEC), closes the APU fuel shutoff valve, turns off APU indications and alarms whenever APU RPM is below 5%, and commands APU shutdown.

ON - Energizes the ESU (or FADEC), commands the fuel shutoff valve to open, enables indication and alarms on the EICAS and allows the APU to keep running after starting.

START (momentary position) - Initiates start cycle.

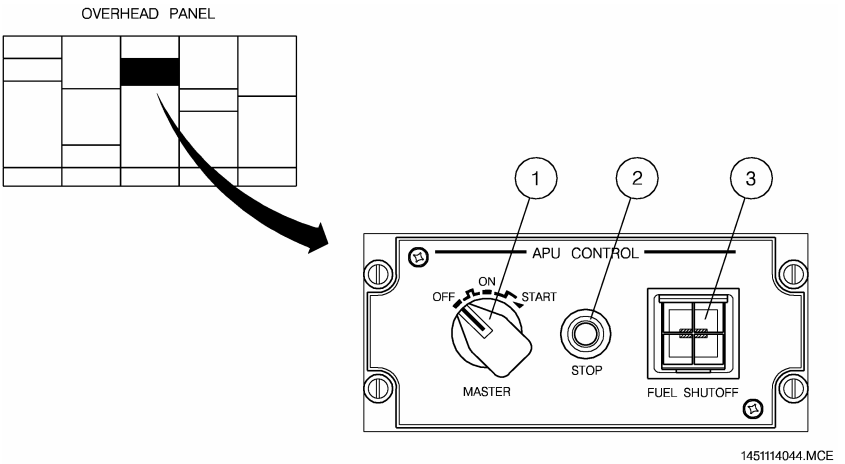
2 - APU STOP BUTTON

– Shuts the APU down.

NOTE: APU EICAS indications remain operational.

3 - APU FUEL SHUTOFF BUTTON (GUARDED)

– Cuts off fuel to the APU.
– A striped bar illuminates inside the button to indicate that it is pressed.



APU CONTROL PANEL

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EICAS INDICATIONS

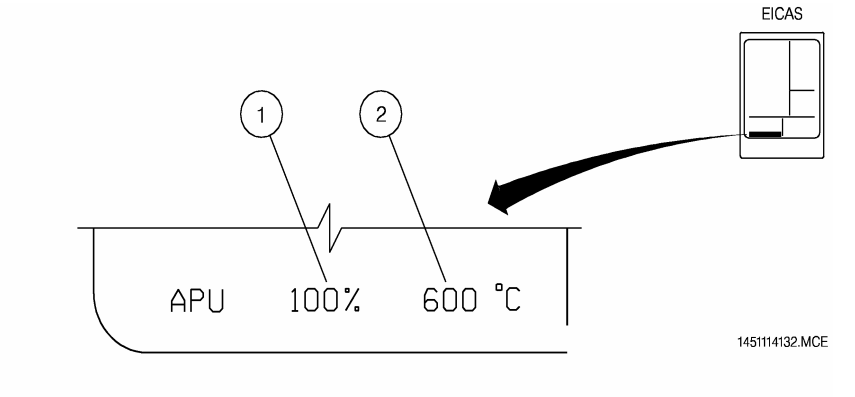
1 - APU RPM INDICATION

- Ranges from 0 to 120% speed.
- Green from 96 to 104%.
- Amber and boxed from 0 to 95% and from 105 to 110%.
- Red and boxed above 110%.

2 - APU EGT INDICATION

- NORMAL OPERATION
  - Ranges from -54 to 927°C.
  - Green from -54 to 680°C.
  - Amber and boxed from 681 to 717°C.
  - Red and boxed above 717°C.
- START SEQUENCE
  - Ranges from -54 to 927°C.
  - Green from -54 to 838°C.
  - Amber and boxed from 839 to 884°C.
  - Red and boxed above 884°C.

NOTE: After APU shutdown, the RPM and EGT indications are replaced by APU OFF inscription provided the APU Master Knob is set to OFF position and APU speed is below 5%.



EICAS INDICATIONS

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SECTION 2-10

POWERPLANT

TABLE OF CONTENTS

	Block	Page
Index	2-10-00	01
General	2-10-05	01
Main Assemblies	2-10-05	02
Fan Module	2-10-05	02
High-pressure Compressor	2-10-05	02
High-pressure Turbine (HPT)	2-10-05	02
Low-pressure Turbine (LPT)	2-10-05	02
Exhaust Cone and Mixer	2-10-05	02
Accessory Gearbox	2-10-05	03
Engine Fuel System	2-10-10	01
Fuel Pump and Metering Unit (FPMU)	2-10-10	01
Fuel Cooled Oil Cooler (FCOC)	2-10-10	02
Compressor Variable Geometry Actuation System	2-10-10	02
Fuel Nozzles	2-10-10	02
Lubrication System	2-10-15	01
Lubricating Oil Supply System	2-10-15	01
Oil Tank	2-10-15	01
Lube and Scavenge Pump	2-10-15	02
Oil Filter Unit	2-10-15	02
Air-Cooled Oil Cooler (ACOC)	2-10-15	02
Fuel-Cooled Oil Cooler (FCOC)	2-10-15	02
Engine Sumps	2-10-15	03
Lubricating Oil Scavenge System	2-10-15	03
Lubricating Oil Vent System	2-10-15	03
Engine Bleed	2-10-20	01
Engine Electrical System	2-10-25	01
Electrical Power Sources	2-10-25	01
Permanent Magnet Alternator (PMA)	2-10-25	01
Ignition System	2-10-30	01
Pneumatic Starting System	2-10-30	02
Air Turbine Starter (ATS)	2-10-30	02
Starting Control Valve (SCV)	2-10-30	02
Starting By Using Ground Equipment	2-10-30	03
Engine Indicating System (EIS)	2-10-35	01

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Engine Sensors ... 2-10-35 ...01
Pressure/Temperature Transducer Sensor ... 2-10-35 ...01
Low Oil-Pressure Sensor ... 2-10-35 ...01
Oil-Level and Low-Level System ... 2-10-35 ...01
Electrical Oil-Filter Impending-Bypass Indicator ... 2-10-35 ...01
Fuel Temperature Sensor ... 2-10-35 ...02
Electrical Fuel-Filter Impending-Bypass Indicator ... 2-10-35 ...02
Magnetic Indicating Plug ... 2-10-35 ...02
Igniter Spark-Rate Detector ... 2-10-35 ...02
Vibration Sensors ... 2-10-35 ...02
Fuel Flowmeter ... 2-10-35 ...02

Powerplant Control System ... 2-10-40 ...01
Full Authority Digital Electronic Control (FADEC) ... 2-10-40 ...01
N1TARGET Calculation ... 2-10-40 ...04
N1REQUEST Calculation ... 2-10-40 ...04
Ground/Flight Idle Thrust Schedule ... 2-10-40 ...05
Closed-Loop Fan Speed Control ... 2-10-40 ...05
N1/N2 Overspeed/Underspeed Protection ... 2-10-40 ...06
Interstage-Turbine Temperature (ITT) Limiting ... 2-10-40 ...06
Acceleration/Deceleration Limiting ... 2-10-40 ...06
Flameout Detection/Autorelight ... 2-10-40 ...07
N1 Reversionary Control Mode ... 2-10-40 ...07
FADEC Inputs Selection and Fault Accommodation ... 2-10-40 ...07
FADEC Discrete Outputs ... 2-10-40 ...08
Alternate FADEC Selection ... 2-10-40 ...08
FADEC Reset ... 2-10-40 ...08

Engine Operation ... 2-10-50 ...01
General ... 2-10-50 ...01
Engine Control ... 2-10-50 ...01
Thrust Ratings ... 2-10-50 ...02
Thrust Management ... 2-10-50 ...03
Thrust Mode Selection ... 2-10-50 ...03
Alternate Takeoff Thrust Control System ... 2-10-50 . 08
Fan-Speed Scheduling ... 2-10-50 ...11
Takeoff Data Setting ... 2-10-50 ...14
Engine Start ... 2-10-50 ...16
Engine Dry Motoring ... 2-10-50 ...17
Engine Shutdown ... 2-10-50 ...18
EICAS Messages ... 2-10-50 ...19

Controls and Indicators ... 2-10-60 ...01
Control Pedestal ... 2-10-60 ...01
Powerplant Control Panel ... 2-10-60 ...03

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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Fire Handle ..... 2-10-60 ... 05
Engine Indication on EICAS ..... 2-10-60 ... 05
Takeoff Page on MFD ..... 2-10-60 ... 10
First Engine Backup Page on RMU ..... 2-10-60 ... 12
Thrust Reverser (*) ..... 2-10-70 ... 01
General ..... 2-10-70 ... 01
Lock Protection ..... 2-10-70 ... 01
Operation ..... 2-10-70 ... 01
Operation Logic ..... 2-10-70 ... 02
EICAS Indication ..... 2-10-70 ... 02
Thrust Reverser Interlock ..... 2-10-70 ... 03
EICAS Messages ..... 2-10-70 ... 03

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NOTE: Optional equipment are marked with an asterisk (*) and its description may not be present in this manual.

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GENERAL

The airplane is powered by two fuselage-mounted Rolls-Royce turbofan engines. Engine denominations, thrust (installed, static sea level) and flat rates are as follows:

ENGINE	MODEL	MAX. T/O THRUST	FLAT RATE
AE3007A	EMB-145	7426 lb	ISA+15°C
AE3007A1/1	EMB-145	7426 lb	ISA+15°C
AE3007A1	EMB-145	7426 lb	ISA+30°C
AE3007A1P	EMB-145	8169 lb	ISA+19°C
AE3007A1E	EMB-145	8810 lb	ISA+19°C
AE3007A3	EMB-135	7057 lb	ISA+15°C
AE3007A1/3	EMB-135	7426 lb	ISA+30°C

NOTE: - Max T/O thrust and flat rate values for AE3007A1P and AE3007A1/3 are based on T/O RSV thrust.
- Max T/O thrust and flat rate values for AE3007A1E are based on E T/O RSV thrust.

The AE3007 is a high bypass ratio, two-spool axial flow turbofan engine. The main design features include:

- A single stage fan,
- A 14-stage axial-flow compressor with inlet guide vanes and five variable-geometry stator stages,
- A 2-stage high pressure turbine to drive the compressor,
- A 3-stage low pressure turbine to drive the fan,
- Dual, redundant, Full Authority Digital Electronic Controls (FADEC),
- Accessory gearbox,
- Air system for aircraft pressurization and engine starting.

Each engine is controlled by redundant FADECs. The FADECs also provide information to the EICAS, although some parameters signals are provided directly from engine sensors. All powerplant parameters are indicated on the EICAS, which also provides warning, caution and advisory messages.

The cockpit control stand incorporates two thrust levers, one for each engine, and four buttons for engine thrust rating selection.

Controls for ignition, FADEC, takeoff data setting, takeoff rating selection and engine Start/Stop are located on the overhead panel.

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MAIN ASSEMBLIES

FAN MODULE

Air enters the engine through the fan case inlet and is compressed by a 24-blade, single-stage fan. The compressed air is split into a bypass stream, which bypasses the core through the outer bypass duct, and a core stream that enters the high-pressure compressor.

HIGH-PRESSURE COMPRESSOR

The compressor rotor consists of 14 stages of individual wheel assemblies, compressor shaft, compressor-to-turbine shaft, and compressor tiebolt. Compressor Variable Geometry (CVG) stators are provided for stages 1 through 5 and for the inlet guide vanes. These stators are driven by servo actuators controlled by the FADECs. High-pressure compressor bleed air tappings are available at the 9^{th} and 14^{th} stages (compressor discharge).
A combustion liner assembly mixes air and fuel to support combustion, and delivers a uniform, high-temperature gas flow to the turbine.

HIGH-PRESSURE TURBINE (HPT)

The High Pressure Turbine converts the gas flow coming from the combustion liner into usable mechanical energy to drive the compressor.

LOW-PRESSURE TURBINE (LPT)

The Low-Pressure Turbine is located downstream of the High-Pressure Turbine and extracts energy from the gas path to drive the fan. The LPT is connected to the fan by means of a shaft extending through the entire high-pressure spool and the compressor assembly. Air exiting the LPT mixes with the bypass air and provides thrust.

EXHAUST CONE AND MIXER

The forced air mixer provides the mixing for the engine bypass and core gas-flow streams and sets the fan operating line for all operating envelope conditions. The Thrust Reversers deflect the exhaust providing reverse thrust.

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ACCESSORY GEARBOX

An accessory gearbox is driven by the high-pressure spool and provides driving pads for the following engine and airplane accessories:

- Engine accessories: Fuel Pump and Metering Unit (FPMU), Permanent Magnet Alternator (PMA), and oil pump.
- Airplane accessories: hydraulic pump, electrical generators, and pneumatic starter.

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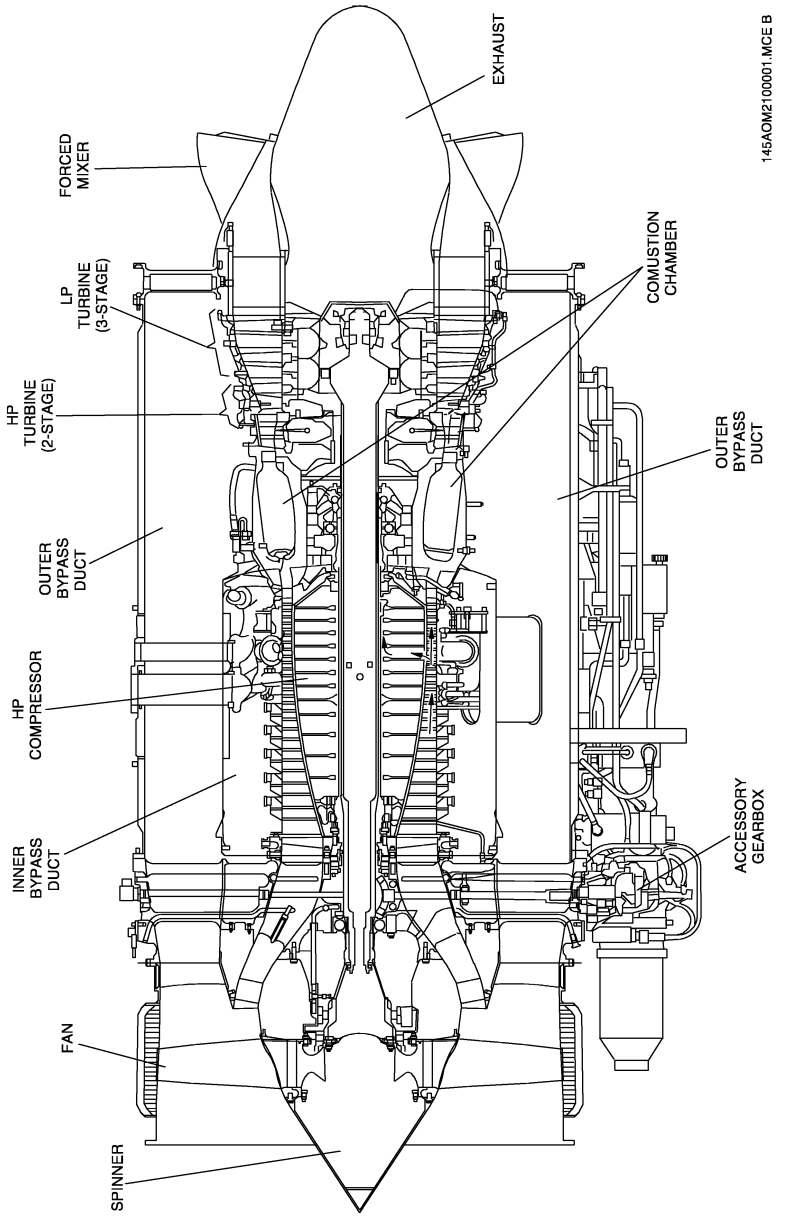

ROLLS-ROYCE AE 3007 ENGINE

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ENGINE FUEL SYSTEM

The Engine Fuel System has a distribution and an indicating system. The distribution system supplies filtered and metered fuel for combustion. Secondary functions include providing pressurized fuel to activate the Compressor Variable Geometry (CVG) system, and providing a cooling medium for lubrication oil. The indicating system components monitor the fuel supply and are located on the engines.

The engine fuel system comprises a Fuel Pump and Metering Unit (FPMU), a Fuel Cooled Oil Cooler (FCOC), a Compressor Variable Geometry (CVG) actuator and fuel nozzles.

FUEL PUMP AND METERING UNIT (FPMU)

The FPMU is an electrical-mechanical, fully-integrated line replaceable unit which incorporates the engine fuel pumping, filtering, and metering functions, and operates under authority of the engine FADECs. The FPMU controls and supplies fuel to the engine nozzles at correct pressure and flow rate for engine start, correct engine operation, engine stop, and also controls the compressor variable-geometry vanes.

The pump system contains a low-pressure centrifugal pump and a high-pressure gear pump. The centrifugal pump raises the pressure of incoming fuel high enough to meet the inlet pressure requirements of the high-pressure pump, with allowances for pressure losses in the fuel filter and the FCOC. The centrifugal pump also provides vapor-free fuel to the gear pump.

The main fuel filter, located upstream of the gear pump, protects the pump metering unit components and fuel nozzles from fuel contaminants. A fuel flow bypass valve allows continued operation in the event of complete filter blockage.

A fuel flow pressure relief valve across the pump protects the fuel system from overpressure conditions.

An air vent valve provides automatic venting of entrapped air or fuel vapor at the gear pump discharge during engine starting and/or motoring. The vent valve remains closed whenever the vent solenoid is not energized, thus preventing fuel leakage through the vent system if the airplane boost pumps are turned on while the engine is not running.

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The fuel-metering valve is controlled by the FADEC and controls fuel distribution from the gear pump to the engine fuel nozzles.

Downstream of the metering valve, a pressurizing valve (PRV) generates adequate system pressure for the proper functioning of the main metering valve and pressure drop servos and CVG hydraulic actuator. The PRV also provides the primary means for engine fuel shutoff, commanded through the Latching Shutoff Valve, that receives a Stop input from the cockpit through the FADEC.

FUEL-COOLED OIL COOLER (FCOC)

The FCOC is installed externally on the bottom of the outer bypass duct, aft region. Fuel flows from the FPMU's centrifugal pump to the FCOC where it simultaneously cools the engine's lubrication oil and warms the fuel. A thermal/pressure bypass valve bypasses oil flow to prevent fuel leaving the FCOC from being heated above 93.3°C (200°F). The oil is also bypassed if the differential oil pressure is greater than 50 psi due to hung or cold starts. After the FCOC, the fuel goes to the filter.

COMPRESSOR VARIABLE GEOMETRY (CVG) ACTUATION SYSTEM

The high-pressure compressor has a variable geometry vane system on its five stages to provide maximum engine performance over a wide range of engine speeds. The FADEC contains a schedule of vane positions versus corrected gas generator speed (N2) that has been selected to provide the optimum compressor efficiency of steady-state conditions and adequate stall margins during transients.

The FADEC senses the vane position and, by means of fuel pressure from the FPMU, commands the CVG actuator movement to position the compressor-inlet guide vanes and the first five rows of compressor vanes to the desired setting.

FUEL NOZZLES

Each engine has 16 fuel nozzles, that furnish atomized fuel to the combustor at the proper spray angle and pattern, for varying airflow conditions.

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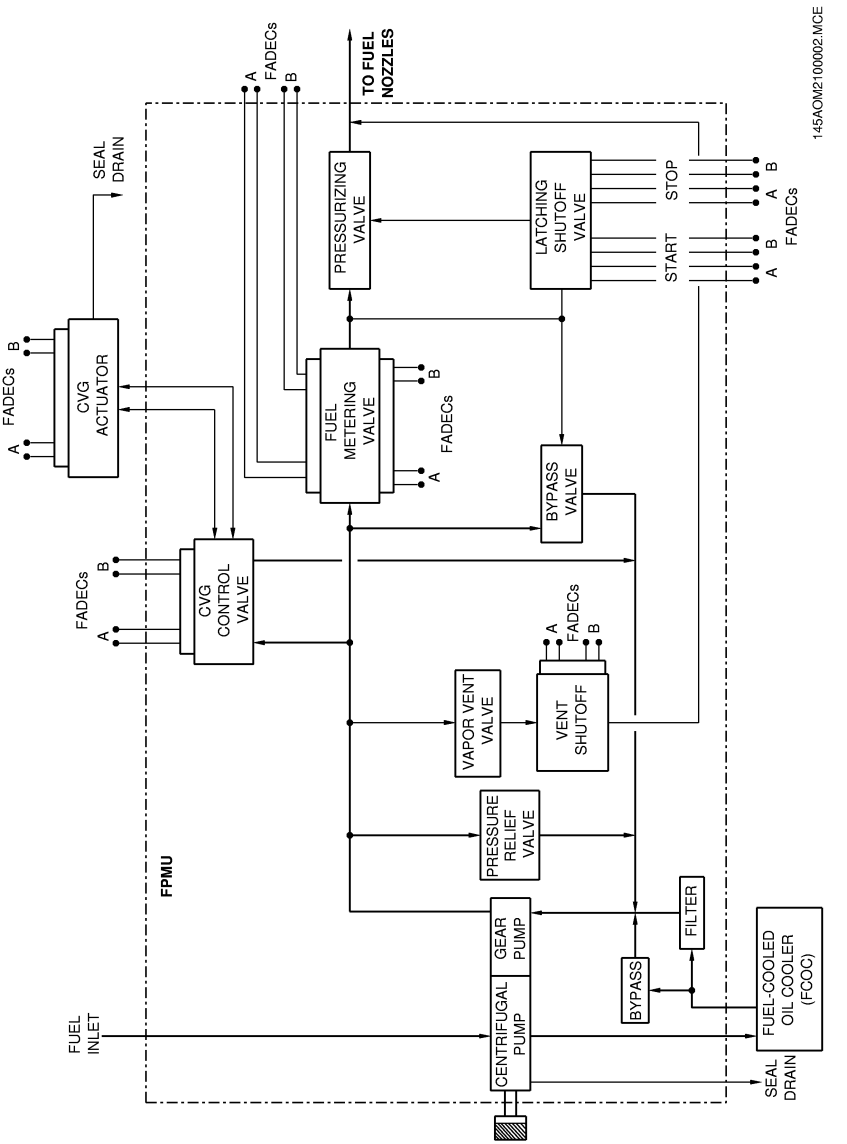

ENGINE FUEL SYSTEM SCHEMATIC

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LUBRICATION SYSTEM

The engine lubrication system is a self-contained, pressure-regulated and recirculating dry sump system. The system supplies filtered and pressurized oil to the various engine oil coolers, engine sumps and the accessories gearbox, at the proper temperature, to cool and lubricate the bearings, seals, and gear meshes.

The main subsystems of the oil system are: lubricating oil-supply, engine sumps, lubricating oil scavenge and lubricating oil vent.

LUBRICATING OIL-SUPPLY SYSTEM

Oil is supplied to the lube and scavenge pump from a pressurized oil tank and is pumped through an oil filter. The oil is then cooled while passing through two heat exchangers (ACOC and FCOC). Oil pressure is controlled by a pressure-regulating valve in the pump housing. A tank pressurizing valve maintains positive pressure in the oil tank to ensure an adequate oil supply to the lube and scavenge pump, and proper oil pressure at altitude. A separate Tank Vent Valve protects the tank from over-pressurization. Oil to the accessory gearbox is distributed through cast passages to the various gear meshes and bearings. Pressurized oil is divided inside the front frame and routed to the fan and front sumps. An external tube delivers oil from the front frame to the compressor diffuser and the rear turbine-bearing support.

The main components of this subsystem are as follows: oil tank, lube and scavenge pump, oil filter unit, air-cooled oil cooler (ACOC) and fuel-cooled oil cooler (FCOC).

OIL TANK

The oil tank is designed to store a sufficient amount of oil (12 quarts) for lubrication of the engine and the accessory gearbox. The tank has an oil level sight gage and an oil level/low level warning sensor. These sensors allow the oil level to be continuously read remotely, and includes a switch that is actuated when there are 5 quarts or less of usable oil remaining in the tank. A screen on the oil outlet and a chip collector plug at the tank bottom are protective devices that prevent debris from recirculating. The tank is protected from over-pressurization by the externally vented Pressure Relief Valve.

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LUBE AND SCAVENGE PUMP

The pressure and scavenge pumps are all mounted in a single integral unit. A single shaft drives six pumping elements. One pressure pumping element pumps oil from the tank to the system and five scavenge pumping elements pump oil from the sumps and the gearbox to the oil tank. The pump assembly also includes a pressure regulating valve which controls oil pressure. Main Oil Pressures varies with center sump air pressure. A line connecting one side of the regulating valve to the center sump enables the regulating valve to compensate for the air pressure inside the sump.

OIL FILTER UNIT

The filter unit includes a replaceable filter element, and mechanical and electrical impending-bypass indicators. A bypass valve opens and allows oil to bypass the filter during cold starts, or when the filter becomes excessively contaminated. A screen is located in the bypass inlet to prevent passage of particles. The electrical impending-bypass indicator provides the remote monitoring of the system.

AIR-COOLED OIL COOLER (ACOC)

The ACOC is a surface-type heat exchanger with a single plate-fin oil section. Filtered, pressurized oil enters a manifold and flows through the air-cooled heat exchanger. A thermal/pressure bypass valve senses ACOC outlet temperature. When open, this valve allows cold oil to bypass the ACOC and, once closed, forces hot oil to flow through the cooler. The bypass valve also opens if the cooler is obstructed.

FUEL-COOLED OIL COOLER (FCOC)

The FCOC is a heat exchanger that simultaneously cools the engine lubrication oil and warms the fuel upstream of the FPMU filter. A thermal/pressure bypass valve prevents fuel overheat. This valve also opens in case of cooler obstruction or cold starts.

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ENGINE SUMPS

There are four engine sumps that encompass five main-shaft bearings, four bevel-gear bearings, and six carbon seals. These sumps are as follows: fan sump, front sump, center sump and aft sump.

LUBRICATING OIL SCAVENGE SYSTEM

Air and oil are removed from each of the sumps and directed to individual scavenge inlets on the oil pump. The scavenge section of the pump includes five pumping elements and has separate inlets for each of the engine sumps and the accessory gearbox. Each of the sump inlets to the pump includes a debris monitor with magnetic chip collector and screen in order to protect the pumping elements. The gearbox sump inlet to the pump contains only a screen.

LUBRICATING OIL VENT SYSTEM

All the engine sumps are vented to the accessory gearbox. The oil tank also vents to the gearbox through a core-external line that contains a tank-pressurizing valve. A Tank Vent Valve is located upstream of the pressurizing valve and is vented to the atmosphere.
The gearbox acts as an air/oil separator removing any oil contained in the vent air. The air vented by the gearbox breather is conducted through a transfer tube and dumped to the core exhaust.

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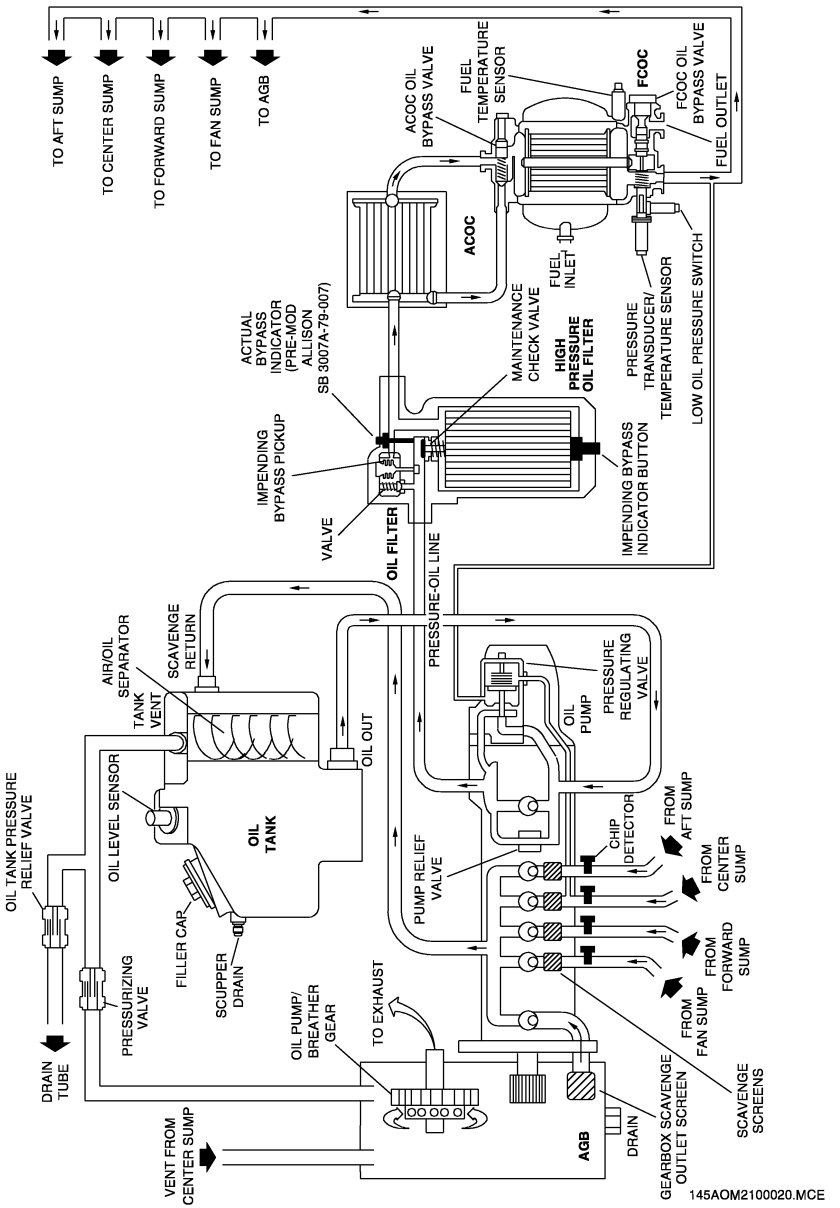

LUBRICATION SYSTEM SCHEMATIC

ENGINE BLEED

Air is bled from the compressor 9th stage during engine starting to assist with accelerating to idle rpm.

There are two different types of compressor acceleration bleed valves (CABV). The original type used two valves per engine, located externally on the HP compressor at approximately the 12:00 and 6:00 O'clock positions. The second type is a single valve at 6:00 O'clock position.

The engine also provides bleed air to the Pressurization and Air Conditioning system through the Engine Bleed Valve (EBV). Bleed air for this system is extracted from the 9th or 14th stages depending on the request. Refer to section 2-14-05 for more information.

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ENGINE ELECTRICAL SYSTEM

ELECTRICAL POWER SOURCES

Primary electrical power for engine control and the ignition system is provided by a permanent magnet alternator (PMA) that is driven by the engine accessory gearbox. Before the PMA attains sufficient speed to generate electrical power, the airplane 28 V DC system is used to power the FADEC. Aircraft 28 V DC is also used to energize a fail-safe ignition relay, so that in the event of aircraft power loss the ignition is turned on and the air vent valve is closed, thus preventing fuel leakage through the vent port.
The PMA is the only source of power for the igniters. If a PMA failure occurs there will not be any spark from the igniters.

PERMANENT MAGNET ALTERNATOR (PMA)

The PMA provides electrical power for both engine FADECs and to the redundant ignition systems.
The PMA provides sufficient power to drive the ignition system at all speeds above 10% N2, and powers the FADECs at a minimum of 50% N2. The PMA also provides power to the Thrust Rating Mode Buttons, in case of electrical emergency.
For starting and emergency backup, the engine control system requires aircraft supplied 28 V DC (GPU and/or batteries) power.

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IGNITION SYSTEM

The engine has a dual redundant ignition system composed of two ignition exciters, two high-tension igniter leads and two igniters.

The ignition system is turned on by the FADEC during engine starting cycle or when an engine flameout condition is detected (auto-relight).

Each ignition exciter is controlled by a separate FADEC and powered by a separate electrical winding of the PMA.

Continuous ignition or ignition off can be manually selected through the Ignition Selector Knob, located on the Powerplant Control Panel and connected to the FADECs. Ignition control is performed according to Ignition Selector Knob position, as follows:

- Ignition Selector Knob set to ON:
  - Both FADECs command associated ignition channel during start, as soon as the PMA provides sufficient power.
  - The ignition is not automatically deactivated when the start cycle is completed.
  - If the engine is already running, both FADECs activate their ignition channels.
- Ignition Selector Knob set to AUTO:
  - During ground start, only the FADEC in control activates the ignition system at the proper time. The engine start will be performed with only one exciter. The exciters will be alternately selected for each subsequent ground start.
  - The FADEC deactivates the ignition system when the engine starting cycle is completed.
  - The auto-relight function activates the ignition system.

NOTE: Engines with FADEC B8 software version or later may not turn off igniters during on-ground deceleration to IDLE.

- Ignition Selector Knob set to OFF:
  - If the engine is not running, the FADEC neither activates the ignition system nor actuates the engine fuel valve from closed to open position.
  - If the engine is already running, at least in IDLE thrust, the FADEC does not close the engine fuel valve.

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PNEUMATIC STARTING SYSTEM

The engine starting system comprises the Air Turbine Starter and the Starting Control Valve. The starting system has the function of supplying airflow for pneumatic engine starting, converting the pneumatic energy into gearbox driving torque.

Pneumatic power source can be selected from the APU, ground air supply source, or cross bleed from the opposite engine.

AIR TURBINE STARTER (ATS)

The ATS is installed in a dedicated engine accessory gearbox pad and consists basically of an air inlet, an impeller turbine, a reduction gearset, a clutch, and an output shaft.

The ATS converts pneumatic energy into driving torque for engine gas generator spool acceleration up to the self-sustained speed during the starting cycle. The air exhaust from the turbine is discharged into the engine nacelle compartment.

STARTING CONTROL VALVE (SCV)

The SCV regulates the pressure supplied to the ATS and provides isolation from the pneumatic system following start completion. The valve is electrically controlled and pneumatically actuated.

A SCV visual position indication is available on the valve housing.

A manual override adapter is available on the valve housing, enabling engine start in the case of a valve or associated electrical system failure. The valve is spring-loaded to the closed position.

If the ATS shutoff valve remains open after 53% N2, a caution message is presented on the EICAS.

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STARTING BY USING GROUND EQUIPMENT

The system is pressurized by pneumatic ground equipment connected to start the engine 2.

The SCV energizes to open when a starting switch ground signal energizes the engine 2 start relay.

When the engine gas generator attains 53% N2, a validation time of 10 seconds elapses before the message “E2 ATS SOV OPN” appears on the EICAS. At 56.4% N2 the FADEC sends a signal to engine 2 start relay be de-energized, thus the SCV is also de-energized and the airflow stops flowing to the ATS turbine. In normal operation conditions, 56.4% N2 is reached in less than 10 seconds.

The ATS turbine stops operating and the engine gas generator speed increases.

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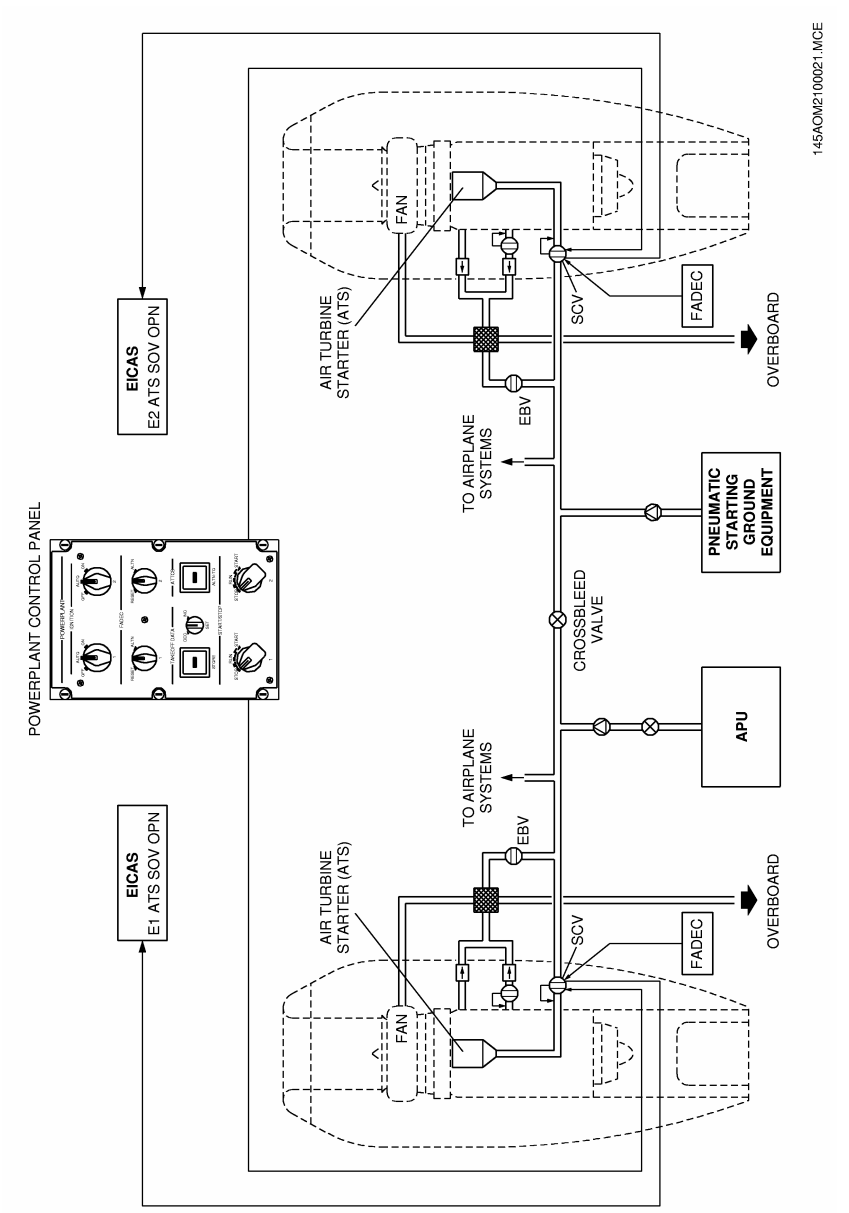

PNEUMATIC STARTING SYSTEM SCHEMATIC

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ENGINE INDICATING SYSTEM (EIS)

The EIS is composed of a wiring harness and a set of engine-mounted sensors. This system is directly connected to the EICAS, providing real time monitoring of the engine oil, fuel, and mechanical systems.

ENGINE SENSORS

PRESSURE/TEMPERATURE TRANSDUCER SENSOR

This sensor combines engine oil and temperature transducers in a single housing, mounted on the Fuel-Cooled Oil Cooler (FCOC). The pressure and temperature transducers are electrically independent and require separate signal conditioning.
Due to the characteristic of some pressure sensors, the EICAS may display approximately 90 psi for a 2 minutes period, for actual pressures between 90.5 and 155 psi. Considering this characteristic, pressure indication may jump suddenly from approximately 90 psi to the actual pressure value, after the 2 minutes period is expired.

LOW OIL-PRESSURE SENSOR

The function of the low oil-pressure sensor is to give an indication when oil pressure is low. This sensor is also mounted on the FCOC. A warning message is presented on the EICAS in case of low oil pressure.

OIL-LEVEL AND LOW-LEVEL SENSOR

The engine oil-level sensor is a transducer located in the oil tank that gives continuous and accurate oil level readings from 3 quarts to 12 quarts. The low-level sensor is electrically open with 5 quarts or less of oil remaining in the tank and remains closed otherwise. An indication of oil-level is provided on the Takeoff page on the MFD. The indication turns amber when oil level is at 5 quarts or below.

ELECTRICAL OIL-FILTER IMPENDING-BYPASS INDICATOR

The engine electrical oil-filter impending-bypass indicator is located in the oil-filter assembly. An advisory message is presented on the EICAS if the differential pressure across the oil filter exceeds its set point.

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FUEL TEMPERATURE SENSOR

The engine fuel-temperature sensor has an indication range of -54° to 176°C (-65° to 350°F) and is located on the FCOC. A caution message is presented on the EICAS in case of fuel low temperature (below 5°C in the engine).

ELECTRICAL FUEL-FILTER IMPENDING-BYPASS INDICATOR

The engine electrical fuel-filter impending-bypass indicator is located on the engine fuel pump and metering unit (FPMU). An advisory message is presented on the EICAS if the differential pressure across the filter exceeds its set point.

MAGNETIC INDICATING PLUG

The magnetic indicating plug is located in the oil tank. The magnetic plug contacts are normally open and are electrically closed when conductive material bridges the gap between them.

IGNITER SPARK-RATE DETECTOR

The engine igniter spark-rate detectors are outputs from the ignition exciters that indicate that an electric field has collapsed in the exciter circuit. A signal is available for each igniter circuit on the engine.

VIBRATION SENSORS

The engine vibration sensors are accelerometers that detect abnormal fan rotor and turbine rotor vibration. The transducers are connected through the engine wiring harness to the EICAS.

FUEL FLOWMETER

The fuel flowmeter is a turbine, mass flow sensor. A given fuel flow through the sensor causes the turbine to move to a calibrated position, providing a specific voltage output to the Data Acquisition Unit (DAU). The DAU converts the voltage signal from the sensor into a flow-rate value (pounds or kilograms per hour) for cockpit display. The fuel flowmeter is calibrated for a range between 130 to 4300 pph. During some starts, fuel flow may drop to values out of the flowmeter range. In this case a zero fuel flow will be displayed on EICAS for a few seconds.

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POWERPLANT CONTROL SYSTEM

Each AE 3007A engine series features a dual redundant electronic control system. The main components of the powerplant control system are the Full Authority Digital Electronic Controls (FADECs), the FPMU, the Permanent Magnetic Alternator (PMA), the Control Pedestal and the Powerplant Control Panel.

Thrust management logic schedules a corrected fan speed (N1) based on a signal from the ADC and cockpit, sending it to engine control logic, which controls the engine fuel flow and compressor variable geometry (CVG) to attain the required engine steady-state and transient response.

Engine control logic also incorporates engine protection logic that prevents engine damage attributable to excessive rotor speed at all times, and temperature limits after the engine has completed a start.

FULL AUTHORITY DIGITAL ELECTRONIC CONTROL (FADEC)

Each engine is controlled by one of two FADECs that are named FADEC A and FADEC B. All signals between each FADEC and its respective engine and between the FADECs and the airplane are completely redundant and isolated. This allows either A or B FADEC to control the engine independently.

The FADECs are interconnected by dedicated Cross-Channel Data Links. These buses are used to transmit engine data and FADEC status between the two FADECs.

Each FADEC is connected to one of the two FADECs on the opposite engine via data bus. Across this bus, the FADECs communicate the information necessary to implement thrust reverser interlock and Automatic Takeoff Thrust Control System (ATTCS).

Airplane electrical power is fed to the FADEC for engine start as a sole power source until N2 is approximately 50%. Primary electrical power source for each FADEC is generated by a dedicated set of windings in the permanent magnet alternator (PMA). The airplane power source is fed the FADEC as a backup in the event of a failure in the PMA. In the event of total loss of airplane power the pilot would control the engine normally.

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Each FADEC receives command signals from the Control Pedestal and from the Powerplant Control Panel and sends a command signal to the FPMU, which meters the fuel flow to the engine in order to reach the fan spool speed calculated by the FADEC thrust management section.

Both FADECs alternate powerplant control. While one FADEC controls the powerplant, the other remains in standby mode. The standby FADEC monitors all inputs, performs all computations, and performs built-in-test and fault detection. However, the output drivers (fuel flow and CVG control), that command the engine, are powered off.

The active FADEC is alternated at each engine ground start in order to minimize the probability of latent failure within the powerplant control system/airplane interface.

The selection logic resides within the FADECs that memorize which FADEC was used for the last engine start and commands the other one to perform the next start, regardless of which FADEC is used in flight.

For example: If FADEC B was used for the last start, when the pilot actuates the next start, the selection logic will select FADEC A, as shown in the following table:

Start	In flight (alternated)	Following start
FADEC A	FADEC B or A	FADEC B
FADEC B	FADEC A or B	FADEC A

For FADEC B9.4.1 and on, besides the automatic FADEC change on each engine ground start, the FADECs are also automatically reset and alternated after the engine start.

Transfer from active FADEC to standby FADEC may also be accomplished automatically, in response to a detected fault, or manually, through the FADEC Selector Knob, located on the overhead panel. The manual selection overrides the automatic selection of the controlling FADEC unless the manually selected FADEC is not capable of safely controlling the engine.

If a fault condition is detected in the engine sensor, actuator interface, or airplane interface of the controlling FADEC, it will maintain control by using data borrowed from the standby FADEC. If required data is not available, the controlling FADEC will use default data or switch to reversionary control mode.

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Control will be transferred to the standby FADEC only when the controlling FADEC detects a fault that will result in degraded engine operation or will render it unable to control the engine.

All measured powerplant control parameters, control system faults and status information are presented on the EICAS.

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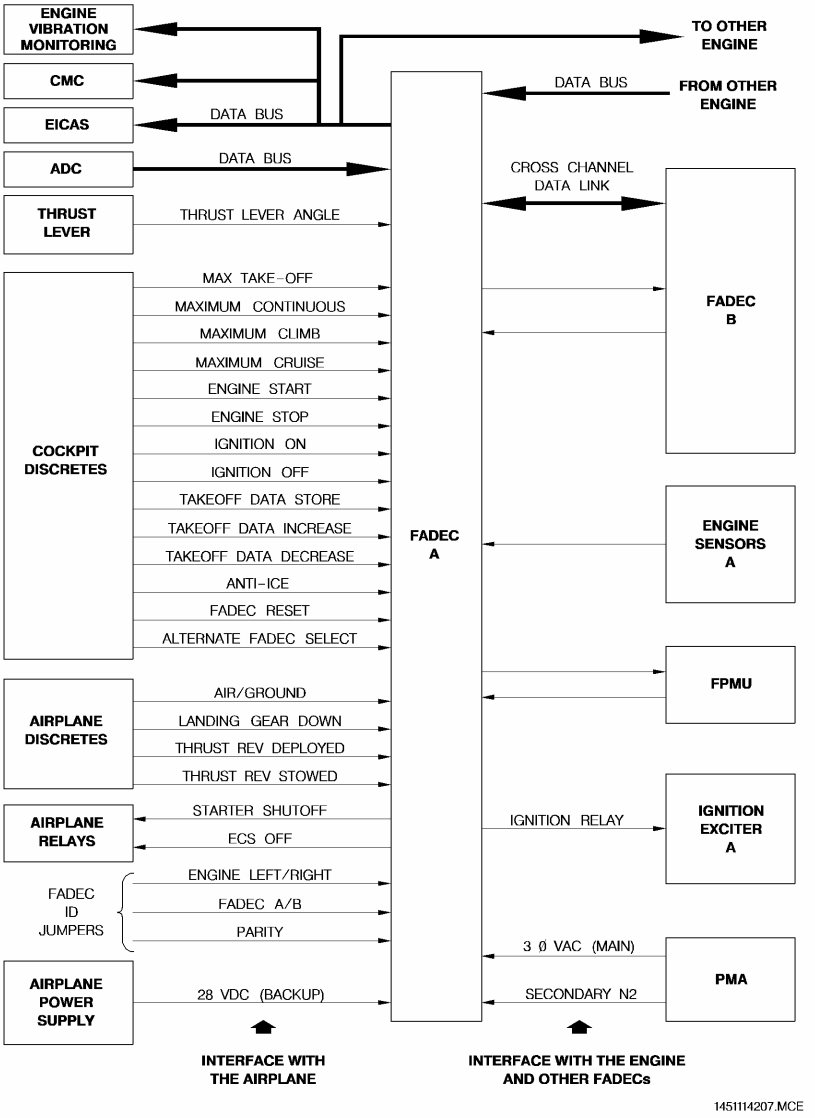

FADEC SCHEMATIC

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N1TARGET CALCULATION

The FADEC calculates the maximum available engine thrust for a given thrust rating mode, airspeed and ambient conditions, and bleed air configuration. Maximum thrust corresponds to N1TARGET displayed on the EICAS as a cyan bug on the N1 analogic indicator arc.

When the Thrust Lever is set to the THRUST SET position, the FADEC controls the engine at N1TARGET.

In normal mode (with no ADC faults) the following data are used as primary reference for the N1TARGET calculation:

- Pressure Altitude and Mach Number reference from ADCs.
- Temperature references (REF TO TEMP during takeoff and ADC TAT in flight).
- A-ICE condition (REF A-ICE during takeoff and actual A-ICE system feedback in flight).
- Takeoff mode.

N1REQUEST CALCULATION

The N1REQUEST is a function of N1TARGET and Thrust Lever Angle. The FADEC controls the engine to N1REQUEST at steady state, except if the thrust lever is at Ground Idle position. In this case, the engine is controlled according to the Ground Idle N2 schedule. N1REQUEST is shown as a green bug on the N1 analogic indication arc on the EICAS.

The following table presents the main Thrust Lever positions, corresponding Thrust Lever Angle bands, and N1REQUEST for ground operation.

POSITION	TLA	N1REQUEST
MAX REVERSE	0 to 4°	N1REV
MIN REVERSE	14° to 22°	N1IDLE
IDLE	22° to 28°	N1IDLE
THRUST SET	72° to 78°	N1TARGET
MAX THRUST	Above 78°	N1TARGET

N1REV is the N1 value for MAX REVERSE thrust.

Each thrust lever modulates engine thrust linearly between IDLE and THRUST SET position. There is no thrust modulation between IDLE and MIN REVERSE.

N1REQUEST is shown as a green bug on the N1 analogic indication arc on the EICAS.

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GROUND/FLIGHT IDLE THRUST SCHEDULE

There is only one IDLE position on the thrust lever control pedestal. However, there are two different IDLE ratings (ground and flight Idle), set as a function of the Air/Ground input to the FADEC:

– GROUND IDLE SPEED

During ground operations, the FADEC commands the engine to Ground Idle Speed, which is scheduled in order to:

- Avoid engine flameout, overtemperature or inability to accelerate.
- Provide the required air bleed flow pressure and temperature for the ECS.
- Provide the required gas generator speed to drive the accessories.

Ground Idle Speed is scheduled as a function of ambient temperature.

– FLIGHT IDLE THRUST

In flight operation, the FADEC will command the engine to Flight Idle Thrust, which is scheduled in order to:

- Avoid engine flameout, overtemperature or inability to accelerate.
- Provide the required bleed airflow pressure and temperature for the ECS and for the Anti-Icing System. If the FADECs receive an indication that the anti-icing system is on, Flight Idle thrust is rescheduled in order to provide the required air bleed flow, pressure and temperature. This automatic A-ICE Flight Idle rescheduling is inhibited below 15000 ft if the landing gear is down and locked.
- Enable the FADEC to accelerate the engine from Flight Idle Thrust to 100% of the Go-around thrust mode in 8 seconds or less, at or below 9500 ft.

CLOSED-LOOP FAN SPEED CONTROL

The primary control mode of the engine is closed-loop fan speed control. The fan speed requested by thrust lever is compared to the measured fan speed. An error signal proportional to the difference between the request and measured fan speed is used to adjust the commanded fuel flow to the engine to drive the fan speed error to zero.

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N1/N2 OVERSPEED/UNDERSPEED PROTECTION

The FADEC limits fuel flow to prevent the excessive rotor speed on both the low-pressure rotor (N1) and the high-pressure rotor (N2). If the fuel flow commanded by the closed-loop results in the surpassing of established rotor speed limits, fuel flow will be limited to that value which will result in rotor speed limit.

The FADEC also incorporates a logic to initiate an engine shutdown if the upper limits of N1 and N2 are exceeded, in order to avoid a potentially destructive overspeed condition.

For FADEC 9.4 and on, there is also a logic to shutdown the engine in case the fan shaft breaks between the N1 sensor and the LP turbine. This prevents undetected overspeed.

Logic within the FADEC incorporates a high-pressure rotor (N2) underspeed shutdown. This logic prevents damaging the turbine via an overtemperature condition if the engine attempts to operate at sub-idle speed. If N2 drops below 54% the FADEC will command a shutdown.

The maximum steady-state rotor speeds are 100% N1 and 102.5% N2 (103.7% N2 for A1E engines). There is no minimum N1 speed.

INTERSTAGE-TURBINE TEMPERATURE (ITT) LIMITING

The FADEC has provisions for limiting engine fuel flow to prevent exceeding ITT limits. If the fuel flow commanded by the closed-loop fan speed control exceeds established ITT limits, the FADEC will limit the fuel flow to that value that will result in operation within the ITT limit.

ACCELERATION/DECELERATION LIMITING

Acceleration and deceleration limits within the FADEC logic restrict the rate of commanded engine fuel flow to prevent surge during acceleration or lean blow out during deceleration.

For FADEC 9.4 and on, with Thrust Levers angle equal to or below idle, on ground the engine will be automatically shutdown in case an Uncontrollable High Thrust is detected.

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FLAMEOUT DETECTION/AUTORELIGHT

Flameout and autorelight detection logic within the FADEC detects an engine flameout and attempts an automatic relight before the engine loses power, if N2 is higher than 53%. In the event that a relight cannot be successfully executed, the FADEC commands an engine shutdown.

During in-flight restarts, both ignition systems are energized.

N1 REVERSIONARY CONTROL MODE

The FADEC provides a reversionary control mode to accommodate a total loss of fan-speed (N1) signal.

The FADEC stores data on the correlation between N1 and N2 of an average engine in its non-volatile memory, and in the event that all N1 signals are lost, it will control thrust governing N2 speed.

The engine control system is capable of modulating thrust in response to thrust lever movement in the reversionary control mode. However, transient response times may be greater, minimum thrust may exceed flight idle thrust and maximum thrust may be less than that expected during normal control operation.

This mode is evident to the pilot due to the absence of N1 indication on the EICAS.

FADEC INPUTS SELECTION AND FAULT ACCOMMODATION

For every FADEC input, there is a selection and fault accommodation logic, based on the inputs to both FADECs of the same engine.

The engine control system is highly fault tolerant. Because of redundant sensor inputs and outputs, the control system can accommodate multiple faults with no degradation in engine response. The fault accommodation philosophy is to maintain operation on the controlling FADEC for as long as possible before transferring control to the standby FADEC.

For every detectable fault, the FADEC provides a signal to the EICAS for the alerting message or to the Central Maintenance Computer for the maintenance message.

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FADEC DISCRETE OUTPUTS

Each FADEC provides two discrete output signals, as follows:

- N2 Speed Switch - Each FADEC activates a discrete output whenever the engine is assumed to be running, based on N2. This signal is activated whenever N2 reaches (accelerating) 56.4% and is deactivated whenever N2 drops below 53%.
- ECS OFF signal.

ALTERNATE FADEC SELECTION

AUTOMATIC SELECTION

- Whenever the FADEC in control is unable to safely control the engine, it signals the alternate FADEC to automatically take over engine control.

MANUAL SELECTION

- The alternate FADEC may be manually selected to control the engine, by momentarily setting the FADEC Control Knob, located on the overhead panel, in the ALTN position.

The FADEC that is in control (A or B) is indicated on the EICAS.

FADEC RESET

The FADEC may be reset through the FADEC Control Knob. Upon receiving the FADEC Control Knob input, the FADEC clears recorded inactive faults (faults not currently being detected).

In case any fault persists after the RESET command, it is not cleared.

Reset does not mean electrical power interruption to the FADEC.

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ENGINE OPERATION

GENERAL

The Rolls-Royce AE 3007 engine uses an electronic control system based on two Full Authority Digital Electronic Controls (FADECs) that control the engine. These FADECs interface with the engine, airframe, and flight deck. A complete description of the engine control system was presented in the previous chapter.

ENGINE CONTROL

The engine control system controls the operation of the engine throughout its operating envelope. The system modulates the fuel flow rate to the engine and the position of the variable geometry vanes (CVG) in response to inputs from the airplane's sensors and measurements of engine operating conditions. The engine control system will not command a fuel flow that would result in exceeding rotor speed or temperature operating limits.

The engine control system is designed in such a manner that a single electrical failure will not cause significant thrust changes, result in an uncommanded engine shutdown or prevent a commanded engine shutdown. In case of loss of both FADECs, the engine control system will shut off fuel flow and move the CVGs to the closed position.

The engine control system performs two categories of functions: thrust management and engine control. Thrust management logic interfaces with the airframe and schedules a corrected thrust based on air data and cockpit inputs. The fan speed request is passed to the engine control logic, which controls the engine fuel flow and Compressor Variable Geometry (CVG) in response to the measured parameters in order to attain the required engine response.

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THRUST RATINGS

The engine control system schedules the corrected fan speed as a function of pressure altitude, Mach number, ambient temperature, anti-ice system condition, thrust mode, and thrust lever angle to achieve the rated thrust conditions.

Thrust ratings modes for AE 3007 engines are:

Thrust ratings	Applicability					Selectable	ATTCS **
	A, A1/1, A3	A1	A1P	A1/3	A1E		
Alternate Takeoff-1	Yes					ALT T/O-1*	T/O-1*
Maximum Takeoff-1	Yes	Yes	-	-	-	T/O-1*	T/O-1*
Takeoff	-	-	Yes	Yes	Yes	T/O*	T/O RSV*
E Takeoff	-	-	-	-	Yes	E T/O*	E T/O RSV*
Takeoff Reserve	-	-	Yes	Yes	Yes	-	T/O RSV*
E Takeoff Reserve	-	-	-	-	Yes	-	E T/O RSV*
Maximum Continuous	Yes					CON	-
Maximum Climb	Yes					CLB	-
E Maximum Cllimb	-	-	-	-	Yes	E CLB	-
Maximum Cruise	Yes					CRZ	-

(*) Restricted to 5 minutes

(**) For A1E engines, E T/O RSV and T/O RSV modes are not intended for normal operation. Their use must be recorded in the maintenance logbook or be tracked by use of engine health monitoring.

For the respective takeoff rating, altitude, and Mach-number condition, fan speed is controlled to maintain constant thrust at any given ambient temperature below the flat-rated ambient temperature.

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THRUST MANAGEMENT

This section of the FADEC software is responsible for functions directly involved in the required thrust computation and management logic.
Thrust management logic is provided to reduce flight crew workload and enhance the airplane's operation.
Thrust management functions are as follows: thrust mode selection, fan speed (N1) scheduling, Automatic Takeoff Thrust Control (ATTCS), Takeoff Data Setting (TDS), and thrust reverser interlock.

THRUST MODE SELECTION

Thrust logic management includes several thrust-rating modes that are controlled through associated buttons on the cockpit, set during the takeoff data setting procedure, automatically triggered by the ATTCS or by advancing the Thrust Lever Angle (TLA) above the THRUST SET position.
Thrust-rating mode defines the available engine thrust at the existing ambient conditions.

The following thrust modes are available:

ALTERNATE TAKEOFF (ALT T/O-1)

- All engines:
  This mode is the normal all engines operating takeoff mode and is available only through the use of the Takeoff Data Setting procedure.
  Selection of this mode ensures the best engine durability and economy of operation. In this mode the ATTCS is active, so that T/O-1 mode is triggered in case of engine failure.

MAXIMUM TAKEOFF-1 (T/O-1)

- A, A1, A1/1 and A3 engines:
  This mode is the maximum, all engines operating takeoff mode. For engine durability and economy of operation, this mode should only be selected when ALT T/O-1 is not authorized. The engine will produce the maximum rated thrust for the existing ambient conditions in T/O-1 mode. This mode is automatically selected when ATTCS is triggered during operation in ALT T/O-1 mode. T/O-1 is automatically selected at FADEC power up and at the initiation of the Takeoff Data Setting procedure. T/O-1 is also automatically selected in flight below or descending through 15000 ft provided the landing gear is down and locked.

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T/O-1 is selected if there is weight on wheels, the TLA is at 50° or less and the T/O thrust-rating button is pushed. This mode is also selected if both engines do not agree on the thrust mode or when the thrust mode of the remote engine cannot be determined. Besides, this mode is selected when the T/O thrust-rating button is pushed and the pressure altitude is greater than 1700 ft above takeoff. The T/O-1 mode is automatically selected whenever the TLA is advanced above the THRUST SET position regardless of the mode previously selected. ATTCS is not active in this mode.

– A1P and A1/3 engines:
This is the One Engine Inoperative (OEI) mode for the normal, all engines operating, ALT T/O-1 mode. In addition to being selected by an ATTCS trigger, it may also be selected from ALT T/O-1 mode, at or below 1700 ft above takeoff pressure altitude, by pushing the T/O thrust-rating button. It is not a normal pilot selectable takeoff mode.

– A1E engine:
This is the One Engine Inoperative (OEI) mode for the normal, all engines operating, ALT T/O-1 mode. The FADECs will select T/O-1 mode if the T/O switch is pressed and the current mode is ALT T/O-1 during takeoff phase, if the ATTCS is triggered and the current mode is ALT T/O-1 or if the thrust lever is moved beyond THRUST SET position and the current mode is ALT T/O-1.

TAKEOFF (T/O)

– A1P and A1/3 engines:
This mode is the maximum, all engines operating takeoff mode. For engine durability and economy of operation, this mode should only be selected when ALT T/O-1 is not authorized.
ATTCS is active in this mode, so that ATTCS triggers upon detection of an engine failure, commanding a thrust increase to T/O RSV mode. The T/O mode is automatically selected at FADEC power up, and at the initialization of the Takeoff Data Setting procedure. T/O is also automatically selected in flight below or descending through 15000 ft provided the landing gear is down and locked. T/O is selected if there is weight on wheels, the TLA is at 50° or less and the T/O thrust-rating button is pushed. This mode is also selected when the T/O thrust-rating button is pushed and the pressure altitude is greater than 1700 ft above takeoff altitude.

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– A1E engine:
This is a medium thrust level, selectable through the Takeoff Data Setting procedure, for all engines operating. For engine durability and economy this mode should be selected if conditions do not permit use of ALT T/O-1 but do not require E T/O mode.

EXTENDED TAKEOFF (E T/O)

– A1E engine:
This mode is the highest level, all engines operating, takeoff mode. For engine durability and economy of operation, this mode should only be selected when T/O mode is not authorized. In case of engine failure the ATTCS triggers the E T/O RSV mode. The E T/O is automatically selected at FADEC power-up and also at initiation of the Takeoff Data Setting procedure. E T/O is also automatically selected in flight, at or below 15000 ft, when the landing gear down and locked is received by the FADECs on both engines. This mode is also selected when the T/O button is pushed and the pressure altitude is greater than 1700 ft above takeoff altitude. The FADECs will select E T/O mode if the T/O switch is pressed after takeoff phase, if the T/O switch is pressed and the current mode is T/O-1 or if the thrust lever is moved beyond THRUST SET position in flight or after takeoff phase.

TAKEOFF RESERVE (T/O RSV)

– A1P and A1/3 engines:
This mode is the corresponding OEI mode for all engines operating in T/O mode. The engine will produce the maximum rated thrust for the existing ambient conditions in this mode. T/O RSV is automatically selected when ATTCS is triggered during operation in T/O mode. T/O RSV is also selected if both engines do not agree on the thrust mode or when the thrust mode of the remote engine cannot be determined. This mode will also be selected from the T/O mode, at or below 1700 ft above takeoff altitude, when the T/O thrust-rating button is pushed.

NOTE: T/O RSV is manually selected by advancing one or both TLA above THRUST SET position, regardless of any mode previously selected.

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– A1E engine:
This is the corresponding OEI mode for all engines operating in T/O mode. This mode is accessible through a FADEC command in response to an ATTCS triggering event. The FADECs will select T/O RSV mode if the T/O switch is pressed and the current mode is T/O during takeoff phase, if the ATTCS is triggered and the current mode is T/O or if the thrust lever is moved beyond THRUST SET position and the current mode is T/O. This mode is also accessible by pressing the takeoff button while in T/O and the airplane is in post takeoff condition or on the ground.

NOTE: The use of this mode requires a notation in the airplane maintenance log.

EXTENDED TAKEOFF RESERVE (E T/O RSV):

– A1E engine:
This mode is the corresponding OEI mode for all engines operating in E T/O mode. E T/O RSV is automatically selected when ATTCS is triggered during operation in the E T/O mode. The FADECs will select E T/O RSV mode if the T/O switch is pressed and the current mode is E T/O or T/O RSV during takeoff phase, if the ATTCS is triggered and the current mode is E T/O, if the thrust lever is moved beyond THRUST SET position and the current mode is E T/O or if the thrust lever is moved beyond the THRUST SET position and the takeoff button is pressed.

NOTE: Use of this mode requires a notation in the airplane maintenance log.

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MAXIMUM CONTINUOUS (CON)

– All engines:
This mode is selected by pushing the CON push button. CON mode is available when the pressure altitude is greater than 300 ft above takeoff altitude and there is no landing gear down and locked, or when the pressure altitude is greater than 1700 ft above takeoff altitude. The CON mode switch inputs to the FADECs are inhibited on ground.

MAXIMUM CLIMB (CLB)

– All engines:
This mode is selected by pushing the CLB push button. CLB mode is enabled when the pressure altitude is greater than 500 ft above takeoff altitude, there is no landing gear down and locked signal and there is no OEI signal, or when pressure altitude is greater than 1700 ft above takeoff altitude and there is no OEI signal. The CLB mode switch inputs to the FADECs are inhibited on ground. For A1E engines CLB is the default mode when T/O or ALT T/O-1 is selected for takeoff.

EXTENDED CLIMB (E CLB)

– A1E engine:
This mode is enabled under the same CLB conditions described above. However, E CLB is the default mode when E T/O is selected. Pressing the CLB button while in CLB mode toggles the climb thrust to E CLB and vice-versa.

MAXIMUM CRUISE (CRZ)

– All engines:
This mode is selected by pushing the CRZ push button. CRZ mode is enabled when the pressure altitude is greater than 500 ft above takeoff altitude, there is no landing gear down and locked signal, and there is no OEI signal, or when pressure altitude is greater than 1700 ft above takeoff altitude and there is no OEI signal.

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ALTERNATE TAKEOFF THRUST CONTROL SYSTEM

During a takeoff, if an engine failure is detected, the ATTCS automatically resets thrust on the remaining engine from Alternate Takeoff thrust to Maximum Takeoff thrust. In addition, depending on takeoff thrust setting and ambient conditions, the FADECs generate an ECS OFF signal to close the Pack Valves. (Refer to ECU operation on Section 2-14). The conditions to arm, trigger, or disarm the ATTCS are described as follows.

ATTCS ARMING CONDITIONS

ATTCS is armed when:

- Both engines are ATTCS capable,
- Associated thrust lever angle is equal to or higher than 45°.

NOTE: ATTCS capable is defined as E T/O (A1E engine), T/O (A1P, A1/3 or A1E engines) or ALT T/O-1 (all engines) mode selected, with the airplane on ground and the engine running.

ATTCS TRIGGERING CONDITIONS

After being armed, the ATTCS is triggered under any of the following conditions:

- The thrust lever for the opposite engine is reduced to below 38° TLA.
- Either FADEC for the on-side engine receives an opposite engine or on-side engine inoperative condition, or a Thrust Lever Angle limited to idle signal.
- The opposite engine does not indicate ATTCS being armed, within 2 seconds after the on-side engine ATTCS has armed.
- The opposite engine disarms ATTCS and the on-side engine does not disarm within 2 seconds.

If ATTCS is armed and either FADEC A or B detects an opposite engine inoperative condition, the controlling FADEC commands the on-side engine to a higher takeoff thrust, as shown in the following table:

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Engines	Takeoff Selection Two Engines Operation	ATTCS Triggered One Engine Operation
A, A1, A1/1, A3	ALT T/O-1	T/O-1
A1P, A1/3	ALT T/O-1	T/O-1
	T/O	T/O RSV
A1E	ALT T/O-1	T/O-1
	T/O	T/O RSV
	E T/O	E T/O RSV

ATTCS DISARMING CONDITIONS

The ATTCS disarms if any of the following conditions is met:

- After being armed, the Thrust Lever Angle is reduced below 42°.
- ATTCS is triggered on either engine.
- No ATTCS capable takeoff mode is selected.

NOTE: If thrust lever is moved beyond the THRUST SET position the FADEC automatically commands the engine to the maximum available thrust (T/O-1 mode for A, A1/1, A1 and A3 engines, or T/O RSV mode for A1/3 and A1P engines), disregarding the takeoff mode selected, except for A1E engine (see A1E engine Thrust Mode Selection section).

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AE3007A1E THRUST MODE SELECTION

Thrust mode selection on A1E engines is a bit more complex than on the other engines. The following tables illustrate how the thrust modes can be selected by pressing the T/O button, by advancing Thrust Levers above THRUST SET, or by the ATTCS.

ADVANCING THRUST LEVERS ABOVE THRUST SET POSITION

Thrust Lever Angle above Thrust Set (TLA>78°) ATTCS NOT triggered		
Current Mode	**During takeoff phase**	**Post takeoff phase**
ALT T/O-1	T/O-1	E T/O
T/O	T/O RSV	E T/O
E T/O	E T/O RSV	E T/O
CON, CLB, E CLB CRZ	-	E T/O
T/O-1 (1)	T/O-1	E T/O
T/O RSV (1)	T/O RSV	E T/O RSV
E T/O RSV (1)	E T/O RSV	E T/O RSV

(1) If the ATTCS is not triggered, these three modes are only accessible by pressing the T/O button after selecting normal engine takeoff modes through the Takeoff Data Setting procedure.

THE ATTCS

Thrust Lever Angle above Thrust Set (TLA>78°) ATTCS triggered			**TLA>78° and T/O button pressed**
Current Mode	**After ATTCS trigger**	**TLA > 78°**	
ALT T/O-1	T/O-1	T/O-1	E T/O RSV
T/O	T/O RSV	T/O RSV	E T/O RSV
E T/O	E T/O RSV	E T/O RSV	E T/O RSV

Pushing the T/O Button with the Thrust Lever above Thrust Set will select E T/O RSV mode regardless of the current takeoff mode or flight phase.

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PRESSING TAKEOFF BUTTON

Current Mode	During takeoff phase (1)	Post takeoff phase
ALT T/O-1	T/O-1	E T/O
T/O-1	E T/O	E T/O
T/O	T/O RSV	E T/O (2)
T/O RSV	E T/O RSV	E T/O (3)
E T/O	E T/O RSV	E T/O (3)

(1) Takeoff phase is configured when altitude is less than 1700 ft above takeoff altitude, five minutes or less time has been elapsed since thrust set selection for takeoff and current thrust mode is one of the takeoff modes.

(2) T/O RSV to E T/O is a thrust decrease.

(3) If current thrust is E T/O RSV, flight altitude is between 1700 ft above takeoff altitude and 15000 ft and the takeoff button is pressed, thrust will decrease to E T/O.

FAN-SPEED SCHEDULING

The thrust management logic calculates the corrected fan-speed request at any point in the flight envelope. The scheduled, corrected fan speed is computed as a function of pressure altitude, Mach number, air temperature and other airplane signals.

The thrust lever quadrant has five significant thrust positions defined as:

Thrust Lever Position	Thrust Level Angle
Maximum Reverse	0-4°
Minimum reverse	14-22°
Idle	22-28°
Thrust Set	72-78°
Maximum Thrust	78-85°

Maximum reverse and maximum thrust are defined by mechanical stops at either extremes of the thrust lever movement. Idle is defined by a mechanical gate that must be lifted to allow the trust lever to transition from forward flight to the reverse flight region. The THRUST SET position on the thrust lever is delineated by a detent at 75°. For any given pressure altitude, Mach number and air temperature the

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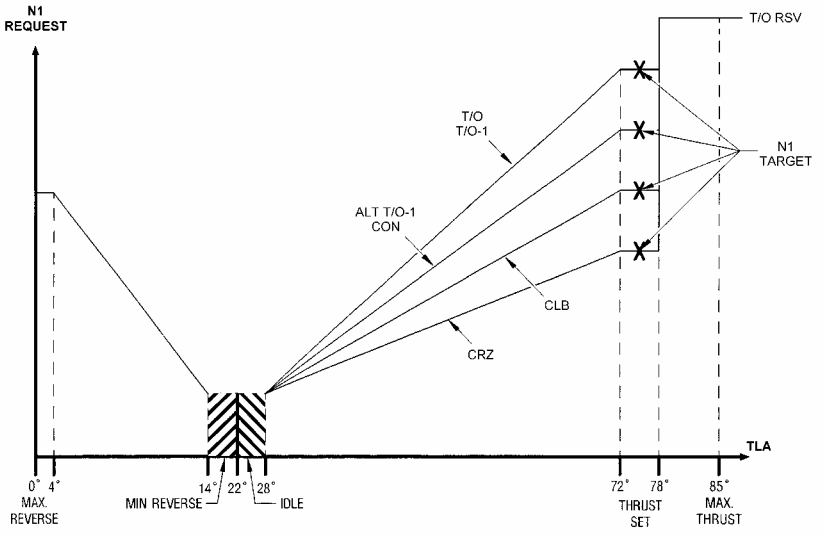
FADEC computes a corrected fan speed corresponding to the thrust lever position. The fan speed computed for the thrust lever position is dependent upon the selectable thrust mode. The Target Thrust (N1 Target) is defined as the thrust corresponding to the corrected fan speed scheduled with the thrust lever at the THRUST SET position. A target thrust is computed for each thrust mode. Flight idle thrust corresponds to the corrected fan speed with the TL at the idle position and is independent of the thrust mode. The FADEC schedules thecorrected fan speed as a function of the thrust lever angle and the thrust mode to result in the following linear relationships:



A1P and A1/3 Engines

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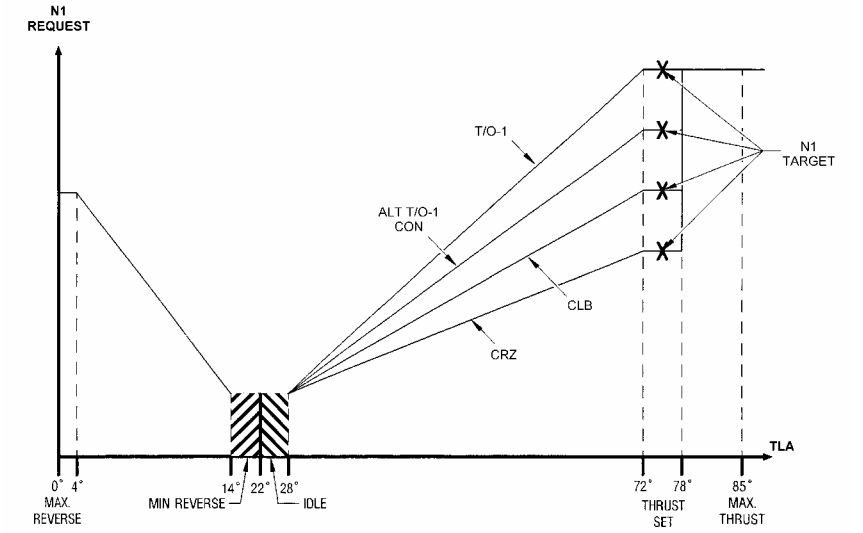

A, A1, A1/1 and A3 Engines

Any movement of the thrust levers above the THRUST SET position results in the scheduling of the maximum takeoff thrust, regardless of the current thrust mode, except for A1E engines (refer to A1E Thrust Mode Selection). A thrust lever position below the idle gate schedules reverse thrust provided such action is enabled by the thrust reverser interlock logic.

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TAKEOFF DATA SETTING

The Takeoff Data Setting function is provided in order to enable the pilot to input reference data into the FADEC prior to takeoff. Such data will be used to calculate N1TARGET during takeoff. The following data has to be input:

- Takeoff Mode (T/O MODE), which corresponds to:
  - T/O-1 or ALT T/O-1 (A, A1/1, A1 or A3 engines).
  - T/O or ALT T/O-1 (A1P or A1/3 engines).
  - E T/O, T/O or ALT T/O-1 (A1E engine).
- Reference Takeoff Temperature (REF TO TEMP), which shall correspond to the Static Air Temperature (SAT) on the ground provided by the Air Traffic Control Tower, ATIS (Automatic Terminal Information Service) or other accurate source.
- Reference Takeoff Anti-Ice Condition (REF A-ICE), which is the anti-ice system condition (ON/OFF) that the FADEC will consider to calculate N1TARGET.

This function is enabled during ground operations only and with thrust lever angle below 50°, before or after engine start.

The takeoff data setting is performed through the Takeoff Data Setting controls (STORE button and SET control) on the overhead panel.

After selecting the takeoff page on the MFD, The Takeoff Data Setting procedure shall be as follows:

a) After the first pressing of the STORE button, the MFD indicates the following initial values for the three takeoff data:

- T/O MODE: T/O-1 for A, A1, A1/1 and A3 engines;
  T/O for A1P or A1/3 engines;
  E T/O for A1E engine.
- REF TO TEMP: T2SYN (if engine is running) or
  ISA Temperature (otherwise).

NOTE: - T2SYN is the synthesized total air temperature at the engine fan inlet.
- T2.5 is the fan discharge total air temperature.

- REF A-ICE: OFF.

An arrow points to T/O MODE line. Through the SET Control the takeoff mode ALT T/O-1 may be selected.

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b) At the second pressing of the STORE button, the arrow points to REF TO TEMP, indicating that this parameter may be adjusted. Through the SET control, the initial value may be adjusted to the required temperature. Each momentary command of the SET control will increase (INC) or decrease (DEC) the current value by 1°C. If the SET control is held at the command position for more than 1 second, the REF TO TEMP is changed by 5°C/sec.

NOTE: The acceptable REF TO TEMP value range is limited to T2SYN ± 10°C.

c) At the third pressing of the STORE button, the arrow points to REF A-ICE line, indicating that this parameter may be adjusted. Through the SET control, the initial condition (OFF) can be switched to ON and back to OFF alternately.

d) At the fourth pressing of the STORE button:

- If the engines are running and the REF TO TEMP is within limits (T2SYN ± 10°C):
  - The FADECs accept the takeoff data and successfully terminate the procedure.
  - The MFD displays the takeoff data.
  - The FADEC begins to calculate and display the N1TARGET based on the takeoff data.
- If the engines are not running, the adjusted takeoff data will remain displayed in amber color, which means that they have not been accepted yet. Then:
  - After engines start, if the adjusted REF TO TEMP is within limits, the FADECs accept the takeoff data and successfully terminate the procedure, the MFD displays the takeoff data, and the FADEC begins to calculate and display the N1TARGET based on the takeoff data.
  - Otherwise, the takeoff data will not be accepted by the FADECs and the MFD will display dashed lines for all takeoff data in amber color, and a caution message (ENG NO TO DATA) is presented on the EICAS if TLA > 45°.
  - In order to enter the correct takeoff data, the procedure must be started again, through the STORE button.

e) If, after takeoff data had been successfully entered, the pilot needs to correct any of them, the STORE button must be commanded again in order to restart the procedure.

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f) In case of disagreement between the REF A-ICE condition selected by the pilot and the actual Anti-Ice system condition, a caution message (ENG REF A/I DISAG) is displayed on the EICAS, provided the Parking Brake is released (OFF) or with any Thrust Lever Angle above 45°.

g) If any thrust lever is set to an angle above 45° before takeoff data successfully entered, a caution message (ENG NO TO DATA) is presented on the EICAS.

ENGINE START

Engine start, commanded through the Start/Stop Knob, is automatically managed by the FADEC as follows:

- The FADECs A and B alternate as FADEC in control on every subsequent ground start. If the Ignition Selector Knob is set to AUTO position, a single ignition system, corresponding to the FADEC in control, will be used.
- The FADEC activates the ignition system when N2 is at approximately 14% and commands the fuel solenoid valve to open when N2 is at approximately 31.5% (28.5% for airplanes equipped with FADEC B7.4 and on) or 12 seconds after ignition is activated, if the Ignition Selector Knob is set to AUTO or ON position.
- Whenever the start cycle is completed, the FADEC deactivates the ignition system and provides a discrete signal to command the Starting Control Valve (SCV) to close.
- If the Ignition Selector Knob is set to OFF position, the FADEC neither activates the ignition system nor actuates the fuel valve from closed to open position, in order to enable ground/flight dry motoring.

  NOTE: If the engine is already running with TLA above IDLE thrust, the fuel valve is not closed, even if the Ignition Selector Knob is set to OFF position.

- When the engine is started on ground, only the FADEC in control commands ignition, if the Ignition Selector Knob is set to AUTO position. During an in flight start, both FADECs command ignition.

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- If a flameout is detected, the FADEC turns on the ignition system, provided the ignition switch is in the AUTO position, until the engine is restarted.
- During ground starts, the FADEC B7.5 and on monitors N2 speed start limit override. If the N2 speed exceeds 500 rpm, the FADEC starts a timer and if a successful start is not declared within 113 seconds (130 seconds for FADEC 9.4 and on), the FADEC commands an engine shutdown.

  NOTE: This is a backup protection only and does not preclude crew to monitor N2 and timely comply with Abnormal Engine Start procedure.

- During ground starts, the FADEC B8.0 and on provides two ways of over-temperature protection:
  - It limits ITT by controlling the engine fuel flow. While the FADEC is able to keep this limit, it is up to the pilot to determine how long the start attempt may continue.
  - In case the temperature limit is exceeded and the pilot does not take action to manually abort the start attempt, the FADEC shuts down the engine to minimize damage by over-temperature.

  NOTE: The FADEC auto-shutdown logic is a backup protection only. It does not preclude crew to monitor ITT and timely comply with Abnormal Engine Start procedure.

- During ground starts, the FADEC B9.4 and on will command a shutdown if no lightoff is detected after 30 seconds of fuel introduction.

ENGINE DRY MOTORING

An Engine Dry Motoring must be performed for at least 30 seconds after any aborted start to assure that no unburned fuel remains in the combustion chamber and/or to reduce residual ITT prior to attempting another start.

Ignition switch must be rotated to OFF position in order to disable ignition and fuel flow prior to rotating the Stop/Run/Start switch to the start position.

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ENGINE SHUTDOWN

Normal engine shutdown, through the Start/Stop Knob, is managed by the FADEC, which commands the engine fuel solenoid valve to close. The normal sequence only occurs with the thrust levers positioned at Idle. Thrust levers should be positioned at IDLE before the Start/Stop Knob is positioned at Stop.

A shutdown sequence is also performed whenever N2 is below 54%.

NOTE: The Engine Fire Extinguishing Handle, when actuated, also shuts the engine down by closing the respective fuel shutoff valve, interrupting fuel supply from the wing tanks.

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
WARNING	ENG 1-2 OUT	N2 has dropped below 8500 rpm on both engines (underspeed shutdown limit) uncommanded.
	ATTCS FAIL (if applicable)	ATTCS failure associated with a low N1.
	E1 (2) ATTCS NO MRGN	The engine has no ITT or N2 margin to achieve higher thrust if ATTCS is trigged.
	E1 (2) OIL LOW PRESS	Oil pressure has dropped below 34 psi and the engine is running or the pressure switch has failed at the closed position and the engine is not running.
	E1 (2) LOW N1	Engine does not achieve requested N1.
CAUTION	E1 (2) FUEL LO TEMP	The fuel temperature in the engine has dropped below 5°C.
	E1 (2) ATS SOV OPN	The engine ATS shutoff valve (SCV) remained open above 53% N2.
	ENG REF A/I DISAG	Disagreement between the REF A-ICE condition selected by the pilot and the actual anti-icing system condition has been detected by the engine control associated with Parking Brake released (OFF) or with any TLA above 45°.

(Continued)

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TYPE	MESSAGE	MEANING
CAUTION	E1 (2) CTL A (B) FAIL	A failure in the Engine control system has been detected.
	E1 (2) CTL FAIL (if applicable)	A failure in the Engine control system has been detected.
	ENG1 (2) TLA FAIL	Thrust Lever Angle sensor has failed.
	ENG NO TO DATA	Takeoff Data has not been successfully entered with engine running and above 53% N2.
	FADEC ID NO DISP (if applicable)	There are different FADEC applications installed in the airplane.
	ENG 1 (2) OUT (if applicable)	N2 has dropped below 8500 rpm (underspeed shutdown limit) uncommanded.
	E1(2) NO DISP (if applicable)	Associated FADEC has detected a non-dispatch failure condition.
	E1 (2) EXCEEDANCE (if applicable)	ITT or N2 exceeded the current ITT or N2 limit during an interval of the flight leg.
	E1 (2) FPMU NO DISP (if applicable)	An incompatible FPMU was installed on a A1E engine.
ADVISORY	E1 (2) OIL IMP BYP	The differential pressure across the oil filter has exceeded the normal range.
	E1 (2) FUEL IMP BYP	The differential pressure across the fuel filter has exceeded the normal range.

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TYPE	MESSAGE	MEANING
ADVISORY	E1 (2) ADC DATA FAIL	Loss of either ADC data or synthesized T2 used as temperature source.
	E1 (2) FADEC FAULT (if applicable)	A dispatchable MMEL FADEC fault was detected.
	E1 (2) CTL A (B) DEGRAD (if applicable)	A dispatchable MMEL FADEC fault was detected.
	E1 (2) SHORT DISP (if applicable)	A dispatchable MMEL FADEC fault was detected.
	CHECK XXX PERF (XXX=A, A1, A1/1, A1P, A3, A1/3, A1E) (if applicable)	Inform the FADEC application installed in the airplane. Displayed only on ground with flaps 0° and parking brakes applied.

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CONTROLS AND INDICATORS

CONTROL PEDESTAL

1 - GUST LOCK LEVER

Limits thrust lever movement and locks the elevator control surfaces when set in LOCKED position.
Refer to Section 2-13 – Flight Controls.

2 - THRUST LEVER

MAX - Provides maximum takeoff thrust.

THRUST SET - Provides N1TARGET thrust setting.

IDLE - Provides ground and flight idle thrust settings.

MAX REV - Provides maximum reverse thrust.

NOTE: Protection against inadvertent thrust reverser command in flight is provided through the mechanical idle stop and the electrical flight idle stop.

3 - FRICTION LOCK

Rotated clockwise, thrust lever movement becomes progressively more resistant, so that thrust levers will not slip.

4 - THRUST RATING MODE buttons

T/O - Selects maximum takeoff thrust-rating mode.

CON - Selects maximum continuous thrust-rating mode.

CLB - Selects maximum climb thrust-rating mode.

CRZ - Selects maximum cruise thrust-rating mode.

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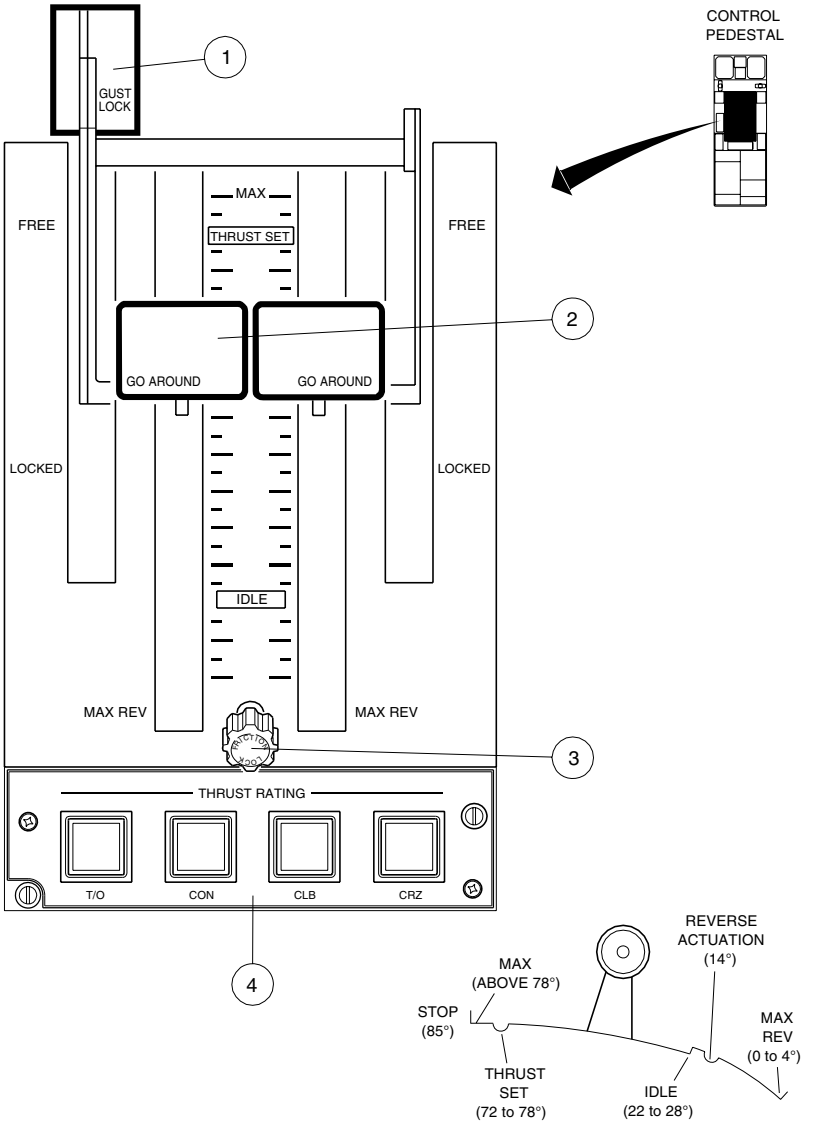

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CONTROL PEDESTAL

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POWERPLANT CONTROL PANEL

1 - IGNITION SELECTOR KNOB

OFF - Deenergizes the ignition system.

AUTO - FADECs control the ignition system automatically, depending on the engine requirement.

ON - Commands the FADEC to activate continuously the two ignition channels.

2 - FADEC CONTROL KNOB (SPRING-LOADED TO NEUTRAL)

RESET - Resets the FADECs, and clears faults.

ALTN - Alternates the FADEC in control.

NOTE: The knob becomes inoperative if held in any position for more than 3 seconds.

3 - TAKEOFF DATA STORE BUTTON

- Initiates and terminates takeoff data setting.
- At the first pressing, an arrow points to T/O MODE line.
- At the second pressing allows REF TO TEMP adjustment.
- At the third pressing allows REF A-ICE to be input.
- At the fourth pressing, if REF TO TEMP is within limits, the takeoff data is accepted and the procedure is successfully accomplished.
- For complete procedures refer to Takeoff Data Setting paragraph.

NOTE: The button becomes inoperative if held pressed for more than 3 seconds.

4 - TAKEOFF DATA SET CONTROL

- When turned, selects the T/O MODE, increases (INC) or decreases (DEC) the REF TO TEMP value and also switches the A-ICE condition state presented on the MFD during takeoff data setting.
- Momentary actuation changes the REF TO TEMP values by 1°C. If the control is held for more than 1 second at the INC or DEC position, REF TO TEMP is changed by 5°C/sec.
- The mode T/O-1 can be switched to ALT T/O-1 and back to T/O-1 alternately (A, A1, A1/1, and A3 engines).
- The mode T/O can be switched to ALT T/O-1 and back to T/O alternately (A1P and A1/3 engines).
- The modes E T/O, T/O or ALT T/O-1 can be switched alternately (A1E engine).
- The A-ICE initial condition (OFF) can be switched to ON and back to OFF alternately.

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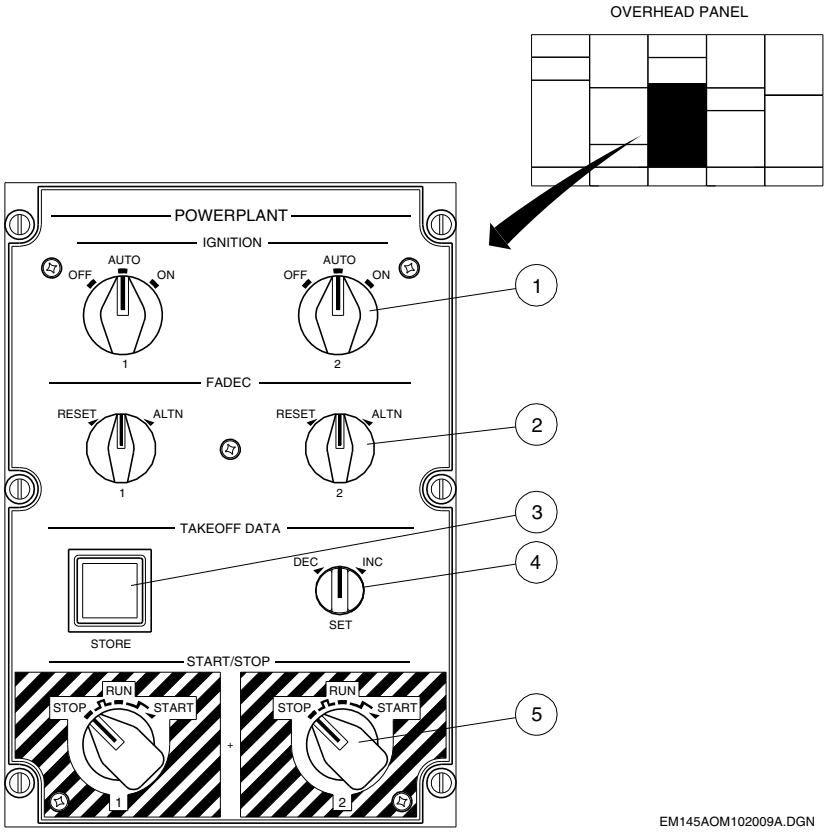
5 - START/STOP SELECTOR KNOB

STOP - Commands the FADEC to shut the engine down, provided associated Thrust Lever is at IDLE.

RUN - Allows normal engine operation.

START - This is a momentary position that initiates the engine start cycle.

NOTE: On airplanes Post-Mod. SB 145-71-0003 or S/N 145.075 and on, each Start/Stop selector knob is equipped with a transparent protection guard over the knob for better engine identification.



POWERPLANT CONTROL PANEL

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FIRE HANDLE

The Fire Handle, located on the Fire Protection Control Panel, allows engine emergency shutdown. For further information on fire controls, refer to Section 2-07 – Fire Protection.

ENGINE INDICATION ON EICAS

1 - N1 TARGET INDICATION

- Corresponds to the maximum available engine thrust for a given thrust-rating mode, airspeed, ambient condition, and bleed air status.
- Digits are cyan.
- Ranges from 0 to 100% RPM with a resolution of 0.1%.
- Indicated by a cyan T-shaped bug.
- Indication is removed from the display for request values greater than 100% or less than 0%.

2 - THRUST-RATING MODE ANNUNCIATION

- Indicates the current thrust-rating mode.
- Labels: T/O-1 or ALT T/O-1 (A, A1, A1/1, A3 engines);
  T/O or ALT T/O-1 (A1P or A1/3 engines);
  E T/O, T/O or ALT T/O-1 (A1E engine);
  CON, CLB, or CRZ.
- Color: cyan
- When engines operate in alternate takeoff mode a green ATTCS annunciation is presented below the takeoff label to indicate that the ATTCS system is armed.

3 - THRUST REVERSER ANNUNCIATION (OPTIONAL)

- Indicates the position of the upper and lower Thrust Reverser doors.
- Label: REV
- Color:
  - Fully open: green
  - In transition: amber (if applicable)

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4 - N1 INDICATION

- Displays N1 in RPM percentage.
- Scale:
  - Ranges from 0 to 100%. Extends up to 110% if exceeding the red line.
  - Colors: green from 0 to 99.9%
    red line at 99.9%
- Digits:
  - Ranges from 0 to 120% RPM, with a resolution of 0.1%.
  - Colors: green from 0 to 99.9%
    red at 100.0% and above

5 - FADEC IN CONTROL ANNUNCIATION

- Indicates the FADEC channel that is controlling the engine.
- Labels: A or B
- Color: green

6 - IGNITION CHANNEL ANNUNCIATION

- Indicates the ignition channel that is enabled.
- Labels: IGN A, IGN B, IGN AB, or IGN OFF
- Color: green

7 - INTERTURBINE TEMPERATURE INDICATION

- Scale:
  - During engine start:
    - green from 300 to 800°C
    - red line at 801°C
  - Takeoff mode:
    - green from to 921°C(A and A1/1 engines).
      from 300 to 947°C (A1/3, A1, A1P and A3 engines).
      from 300 to 992°C (A1E engine).
    - red line at 922°C (A and A1/1 engines).
      at 948°C (A1/3, A1, A1P and A3 engines).
      at 993°C (A1E engine).

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- CON, CLB and CRZ modes:
  - green: from 300 to 867°C (A and A1/1 engines).
    from 300 to 900°C (A1/3, A1, A1P and A3 engines).
    from 300 to 935°C (A1E engine).
  - amber: from 868 to 921°C (A and A1/1 engines).
    from 901 to 947°C (A1/3, A1, A1P and A3 engines).
    from 936 to 970°C (A1E engine).
  - red line at 922°C (A and A1/1 engines).
    at 948°C (A1/3, A1, A1P and A3 engines).
    at 971°C (A1E engine).
- If the red line is exceeded, the scale extends a further 50°C.
- Digits:
  - Ranges from -65 to 1999°C with a resolution of 1°C.
  - Color: corresponds to the color of the scale.

8 - N2 INDICATION

- Displays N2 in RPM percentage.
- Digits:
  - Ranges from 0 to 120% RPM with a resolution of 0.1%.
  - Colors:
    EICAS 18.5 and before:
    - green from 0 to 102.4%.
    - red from 102.5% and above.

    EICAS 19 and on with A1, A1/1, A3, A1/3, A1P engines:
    - green from 0 to 102.5%.
    - red from 102.6% and above.

    EICAS 19 and on with A1E engines:
    - green from 0 to 103.8%.
    - red from 103.9% and above.

9 - FUEL FLOW INDICATION

- Ranges from 0 to 2020 KPH (or 4450 PPH) with a resolution of 10 KPH (or 10 PPH).
- Color: green

10 - LOW-PRESSURE AND HIGH-PRESSURE TURBINE VIBRATION INDICATION

- Ranges from 0 to 2.5 inches per second (IPS).
- Low-pressure scale and pointer colors:
  - green from 0 to 1.8 IPS.
  - amber above 1.8 IPS.
- High-pressure scale and pointer colors:
  - green from 0 to 1.1 IPS.
  - amber above 1.1 IPS.

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11 - OIL TEMPERATURE INDICATION

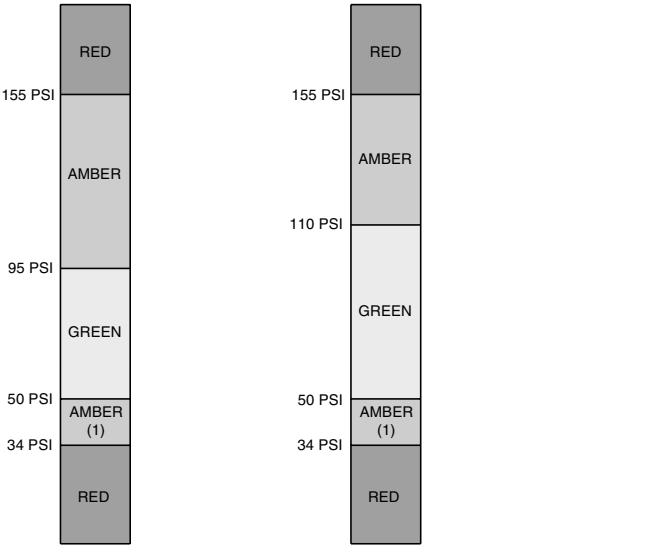
- Ranges from -54°C to 180°C with a resolution of 1°C.
- Scale, pointer, and digit colors:
  - amber below 21°C.
  - green from 21 to 126°C.
  - red above 126°C.

12 - N1 REQUEST BUG

- Indicates N1 requested by the Thrust Lever position.
- Indicated by a green filled triangle.
- Ranges from 0 to 100% RPM.
- Indication is removed from the display for request values greater than 100% or less than 0%.

13 - OIL PRESSURE INDICATION

Scale, pointer, and digit colors depend on the FADEC version as shown below:



(1) For N2 < 88% the amber band between 34 psi and 50 psi does not exist, and the green band lower limit is 34 psi.

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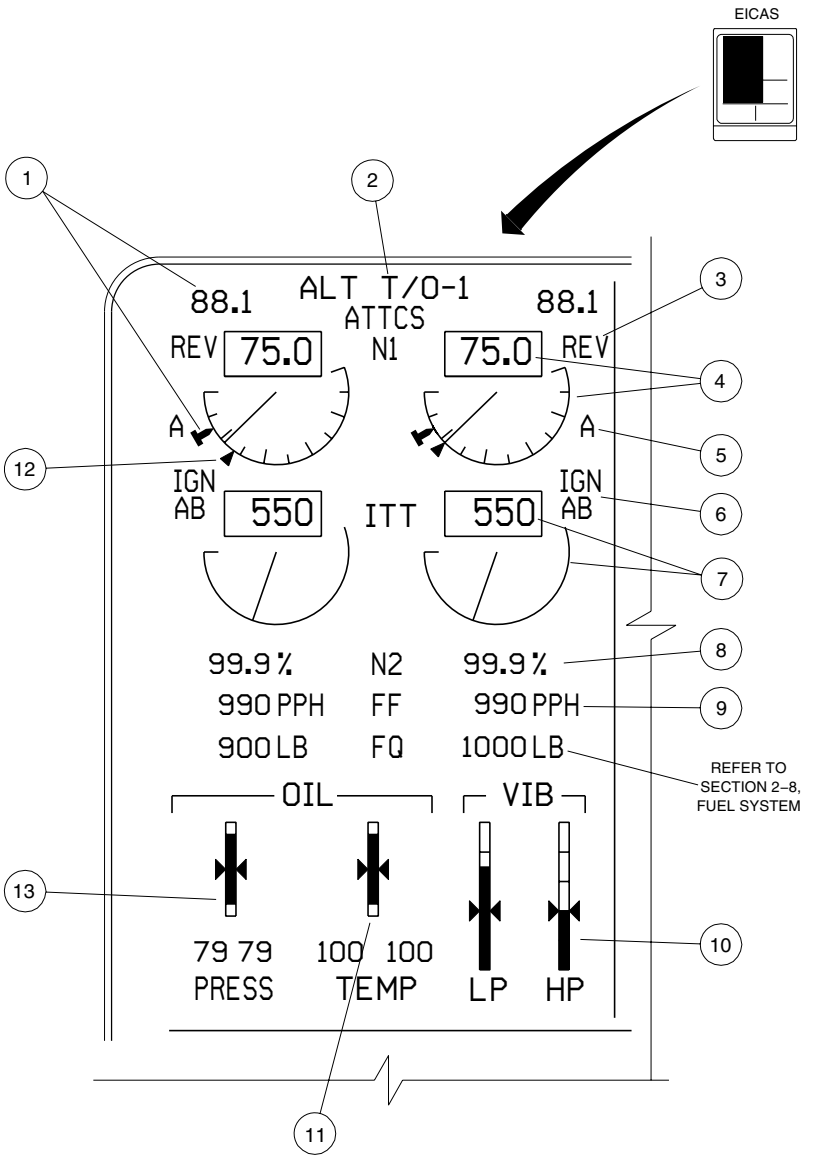

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ENGINE INDICATION ON EICAS

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TAKEOFF PAGE ON MFD

1 - TAKEOFF MODE INDICATION

- Indicates Takeoff Mode as selected through the Takeoff Data Set Control.
  - Labels: T/O-1 or ALT T/O-1 (A, A1, A1/1, A3 engines);
    T/O or ALT T/O-1 (A1P or A1/3 engines);
    E T/O, T/O or ALT T/O-1 (A1E engine);
- In flight, the indication is removed from the display.

2 - REFERENCE TAKEOFF TEMPERATURE INDICATION

- Indicates reference takeoff temperature as adjusted through the takeoff data set control.
- In flight, the indication is removed from the display.

3 - REFERENCE ANTI-ICE STATUS INDICATION

- Indicates reference anti-ice status as selected through the takeoff data set control.
- Labels: ON or OFF
- In flight, the indication is removed from the display.

4 - OIL LEVEL INDICATION

- Ranges from 0 to 13 US Quarts for left engine and from 0 to 14 US Quarts for right engine with a resolution of 1 US Quart.
- Digits:
  - green from 6 to 14 US Quarts
  - amber below 6 US Quarts

NOTE: The right engine is capable of measuring a higher oil level due to sensor position.

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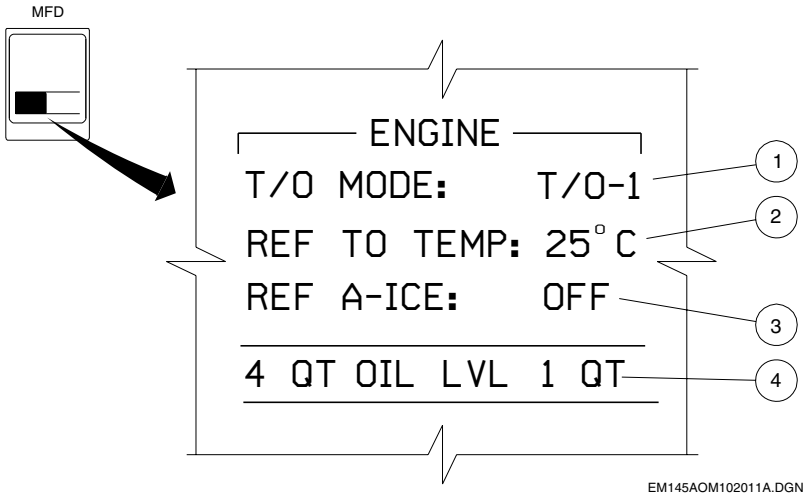

TAKEOFF PAGE ON MFD

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FIRST ENGINE BACKUP PAGE ON RMU

- Contains thrust modes, N1, ITT, N2, Fuel Flow, Oil Pressure and Oil Temperature indications.
- Only the N1 indication contains analog and digital indication. The other indications are in digital format.
- Label and legend color: white
- Data color limits: same as the EICAS display.

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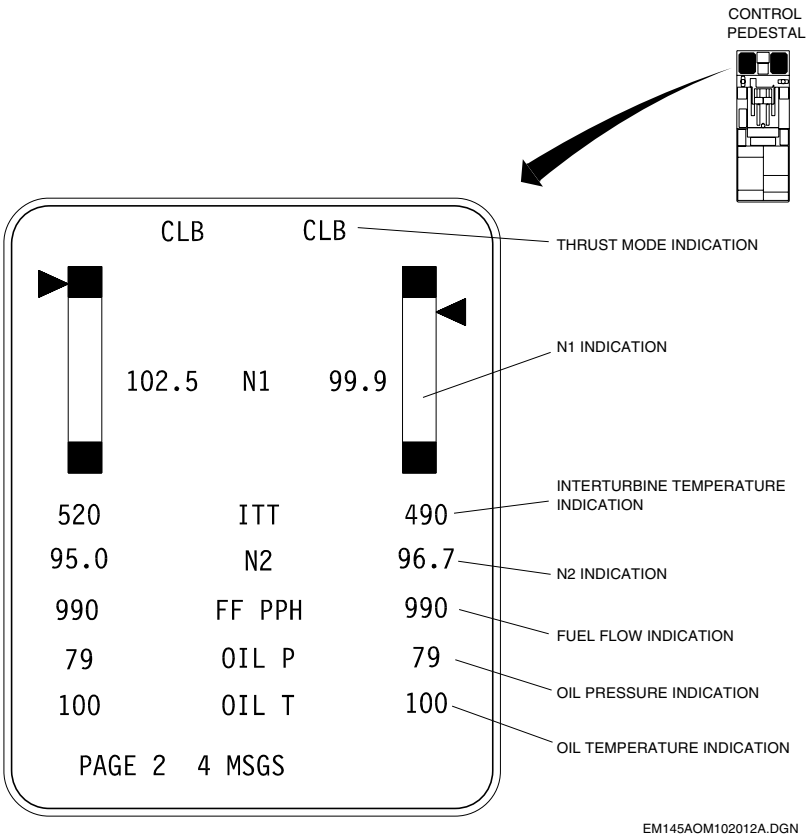

FIRST ENGINE BACKUP PAGE ON RMU

THRUST REVERSER (OPTIONAL)

GENERAL

Each engine may be equipped with an optional thrust reverser.

The thrust reverser is for ground operation only, and its function is to direct engine exhaust gases forward and outwards to produce deceleration of the airplane.

The thrust reverser system consists of an electric control/indication, an hydro-mechanical actuation system, and two pivoting doors.

When stowed, the thrust reverser is part of the exhaust nozzle.

LOCK PROTECTION

The system incorporates three locking systems to avoid inadvertent in-flight deployment. The actuators and doors are mechanically locked in the stowed position through the primary and secondary locks. In case the primary and secondary reverser locks fail, the tertiary lock prevents the door from deploying. In the stowed position, the doors are held by the primary lock only, with the secondary and tertiary locks remaining unloaded. The primary and secondary locks are electrically commanded/controlled and hydraulically powered to unlock. The tertiary lock is electrically commanded/controlled and electrically powered to unlock, thus providing a separate and fully independent locking system.

OPERATION

The thrust reverser is commanded by the backward movement of the Thrust Lever. Upon selection, the mechanical locks are removed and hydraulic pressure is applied to deploy the thrust reverser doors. In reverser mode, the doors rotate about a fixed axis. Rotation of the doors is controlled by extension and retraction of the hydraulic door actuators.

After pivoting, the rearmost part of the doors blocks the normal nacelle discharge path and directs the flow through the aperture created by its rotation.

The loss of electrical and/or hydraulic power does not result in inadvertent deployment.

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OPERATION LOGIC

Each FADEC will command Maximum Reverse thrust on ground only, when the associated thrust reverser is deployed and associated thrust lever is requesting reverse thrust whenever either of the following conditions are met:

- Airplane on the ground indication from both main landing gears, and main landing gear wheels running above 25 kt, or
- Airplane on the ground indication from both main landing gears and from nose landing gear.

During landing, when the Thrust Levers are set to below IDLE, the FADEC commands reverse thrust only after the Thrust Reverser doors (both engines) are completely deployed. If the Thrust Lever is requesting forward thrust, the FADEC will command IDLE thrust if the associated engine thrust reverser indicates that there is a ¨not stowed¨ or a ¨deployed¨ condition.

If one engine is inoperative or one thrust reverser is not deployed, the FADEC of the operative side will only command Reverse Thrust if the associated Thrust Lever is requesting reverse thrust and the Thrust Lever of the affected side is set to IDLE. Such a feature is provided to avoid uncommanded thrust asymmetry.

EICAS INDICATION

An indication of right and left thrust reversers deployed is presented on the EICAS. If a failure or a disagreement is detected, a caution message is presented on the EICAS.

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THRUST REVERSER INTERLOCK

The FADECs interface with the thrust reverser system of the corresponding engine.

Each FADEC receives two pieces of information from the thrust reverser system:

– Stowed: If all doors of the corresponding engine are stowed.

– Deployed: If all doors of the corresponding engine are deployed.

For flight operation there is also a flat between IDLE and MAX REVERSE position. The FADEC enables reverse thrust depending on the position of the reverser doors and on the position of the engine thrust lever, and reduces the engine thrust to IDLE, if there is an indication of an inadvertent thrust reverser deployment in flight, which normally is not possible due to the Flight Idle electrical stop.

EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	ENG1 (2) REV FAIL	-Thrust reverser doors not stowed and in transit with Thrust Levers set at or above IDLE, or -Thrust Levers set below IDLE in flight.
	ENG1 (2) REV DISAGREE	-At least one thrust reverser door not fully open, or -Thrust reverser system not isolated from hydraulic system (Thrust Lever set at or above IDLE), or -Door locking or position switch signal failure with Thrust Levers set at or above IDLE (ground only).
ADVISORY	E1 (2) IDL STP FAIL	Idle stop has failed.

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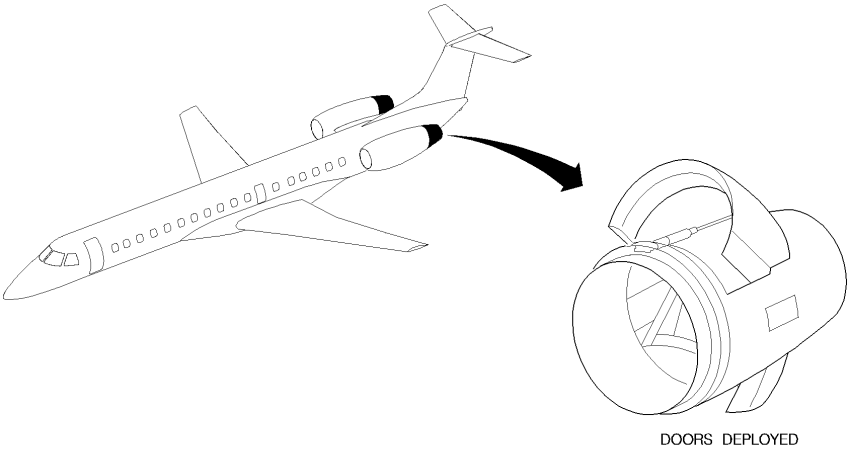

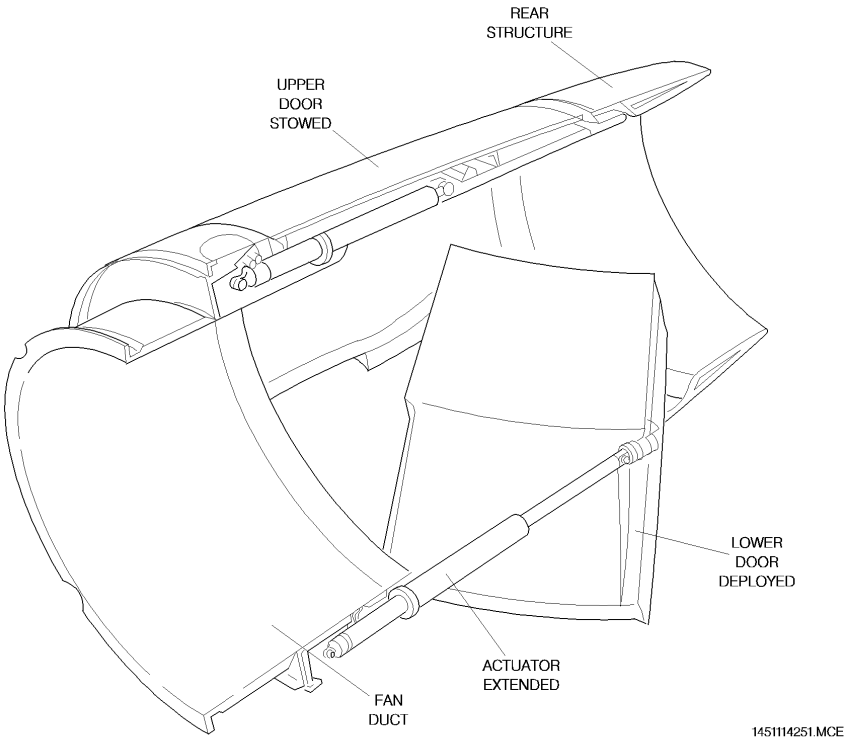

THRUST REVERSER

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SECTION 2-11

HYDRAULIC

TABLE OF CONTENTS

Block Page

General ..... 2-11-05 ..01
System Description ..... 2-11-05 ..02
EICAS Messages ..... 2-11-05 ..05
Controls and Indicators ..... 2-11-05 ..06

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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GENERAL

The airplane is equipped with two independent hydraulic systems, each powered by one engine driven-pump and one electric motor-driven pump. Both hydraulic systems are identical, except for the services each system provides and a priority valve installed in the hydraulic system 1.

There are ground connections for refilling and ground tests purposes. Indications of hydraulic system parameters are provided on the MFD and EICAS displays.

The services provided by each hydraulic system are presented below:

SYSTEM	HYDRAULIC POWER SUPPLY
Ailerons	SYSTEM 1 and 2
Rudder	SYSTEM 1 and 2
Landing Gear	SYSTEM 1
Main door	SYSTEM 1
Steering	SYSTEM 1
Brakes (Outboard Wheels)	SYSTEM 1
Brakes (Inboard Wheels)	SYSTEM 2
Emergency/Parking Brake	SYSTEM 2
Thrust Reverser 1	SYSTEM 1
Thrust Reverser 2	SYSTEM 2
Outboard Spoilers	SYSTEM 2
Inboard Spoilers	SYSTEM 1

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SYSTEM DESCRIPTION

Each hydraulic system consists of a hydraulic fluid reservoir, a manifold, one engine-driven pump, one electric motor-driven pump, one shutoff valve, one accumulator and a priority valve installed in the hydraulic system 1.

RESERVOIR

The hydraulic fluid stored in the reservoir is pressurized, to avoid pump cavitation. This pressurization function is performed by fluid drained from the pressure line. The reservoir is equipped with a quantity indicator which transmits information to the MFD and EICAS displays for indication and warning purposes. A thermal switch is responsible for the high temperature message, if the fluid temperature increases above 90°C.

SHUTOFF VALVE

A shutoff valve is installed between the reservoir and the engine-driven pump. It cuts the hydraulic fluid supply to the engine-driven pump, if there is a fire on the related engine or in case of hydraulic fluid overheat. This valve may be closed either through the engine fire extinguishing handle or through a dedicated button on the overhead panel.

ENGINE-DRIVEN PUMP

The engine-driven pump provides continuous fluid flow at 3000 psi for operation of the various airplane hydraulically-powered systems. The pump is connected to the engine accessory gearbox and, as long as engine is running, it generates hydraulic pressure. During engine start, the fluid remaining in the suction line is sufficient to avoid pump cavitation and provide reservoir pressurization.

ELECTRIC MOTOR-DRIVEN PUMP

The electric motor-driven pump has the same connections as the engine-driven pump, but has a lower flow capacity. The pump normally operates in the automatic setting mode, turning on when the associated hydraulic pressure drops below 1600 psi or the associated engine N2 drops below 56.4%.

If the pump starts operating in the automatic mode, it will be turned off after the pressure or N2 are reestablished to normal values. The electric pump may be turned on at pilot command, through the selector knob on the overhead panel, furnishing continuous fluid flow at 2900 psi.

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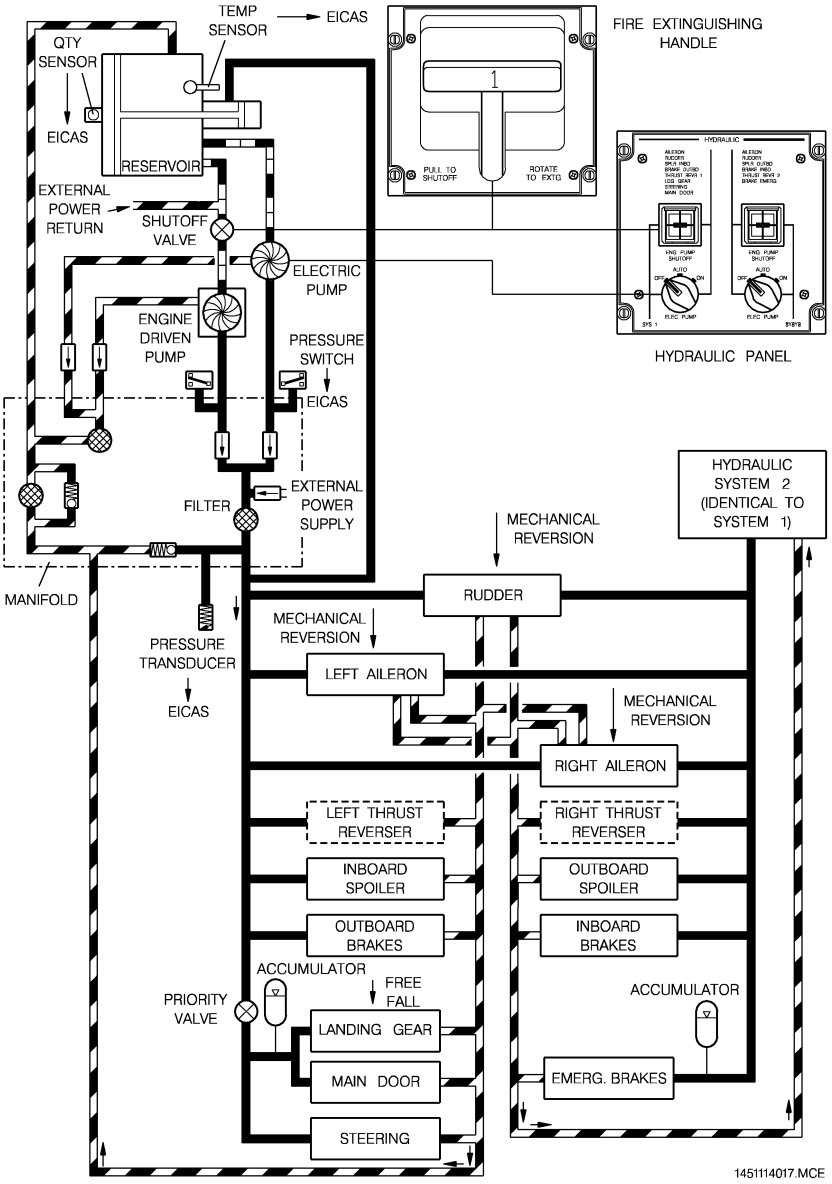

HYDRAULIC SYSTEM SCHEMATIC

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MANIFOLD

The manifold provides the following functions:

-Fluid filtering (pressure and return lines).

-Overpressure relief (main and electrical pumps).

-Pressure indications (main and electrical pumps).

Fluid leaving the pump flows to the manifold, where it is filtered and then routed to the airplane systems. Inside the manifold, a check valve prevents the fluid from returning to the pump, while a relief valve diverts the excess fluid to the return line. The return line is supplied by the fluid coming from the airplane systems, fluid drained from the pump, fluid from the relief valve, and fluid refilled by the maintenance personnel. Under any situation the fluid is filtered and returned to the reservoir. The manifold incorporates two pressure switches to detect low hydraulic pressure, and a pressure transducer to indicate system pressure. Signals from the pressure switches and pressure transducer are sent to the MFD and EICAS displays.

PRIORITY VALVE

The hydraulic system 1 incorporates a priority valve. If the system is powered by the electric motor-driven pump and the landing gear is commanded to retract, the valve will provide minimum flow to the landing gear system and give priority to the flight control services. In this case, the landing gear will operate through the accumulator pressure.

ACCUMULATOR

Each hydraulic system has one accumulator. The function of the accumulator is to keep the surges of the hydraulic pumps at a minimum, and to keep a 3000 psi pressure available for operation of the landing gear and main door (system 1) or operation of the emergency parking brake (system 2).

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	HYD SYS 1 (2) FAIL	Associated hydraulic system is not pressurized (inhibited when the airplane is on the ground, engine is shut down and parking brake is applied).
	HYD SYS 1 (2) OVHT	Associated hydraulic system fluid temperature is above 90°C.
ADVISORY	E1 (2) HYD PUMP FAIL	Engine-driven pump is not generating pressure with associated engine running.
	E1 (2) HYDSOV CLSD	Associated hydraulic shutoff valve is closed.
	HYD1 (2) LO QTY	Fluid level in the associated reservoir is below one liter. Report to the maintenance personnel if the hydraulic reservoir operates empty.
	HYD PUMP SELEC OFF	Associated electric pump selected OFF with the parking brake released.

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CONTROLS AND INDICATORS

HYDRAULIC SYSTEM PANEL

1- ENGINE PUMP SHUTOFF BUTTON (guarded)

- Closes (pressed) or opens (released) the associated engine pump shutoff valve.
- A striped bar illuminates in the button to indicate that it is pressed.

2- ELECTRIC HYDRAULIC PUMP CONTROL KNOB

OFF - Associated pump is turned off.

AUTO - Associated pump is kept in standby mode, ready to operate if the engine-driven pump outlet pressure drops below 1600 psi or the associated engine N2 drops below 56.4%.

ON - Associated pump is turned on.

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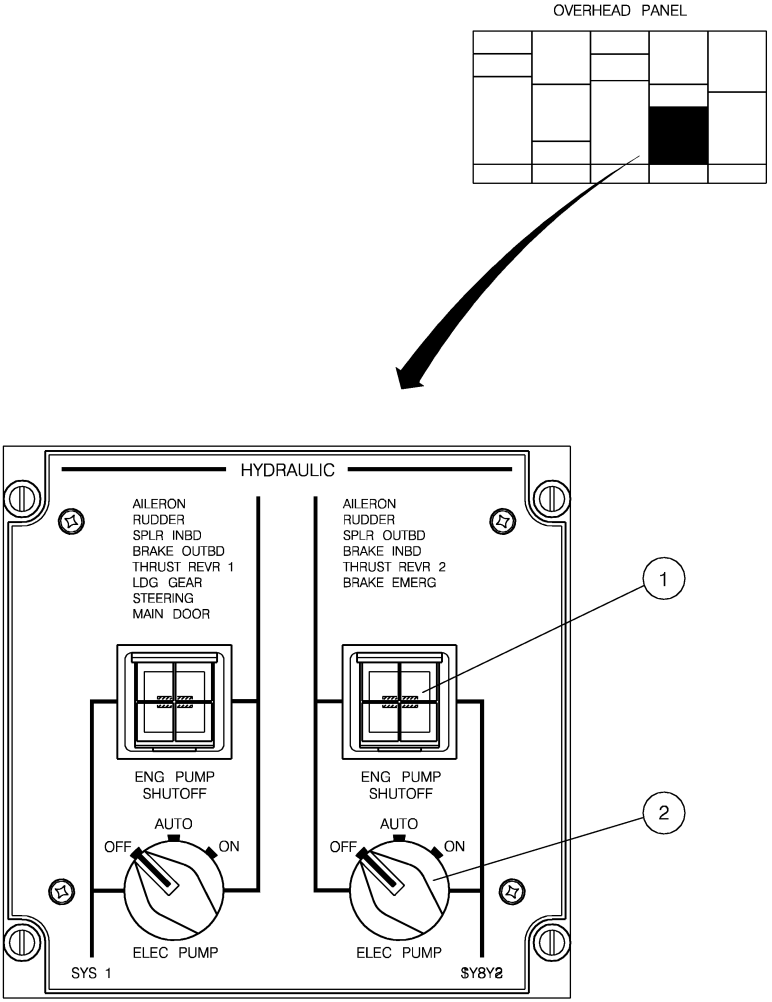

NOTE: For airplanes not equipped with Thrust Reverser, the THRUST REVR 1 and THRUST REVR 2 inscriptions are not presented on the Hydraulic System Panel.

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HYDRAULIC SYSTEM PANEL

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HYDRAULIC PAGE ON MFD

1- FLUID QUANTITY INDICATION

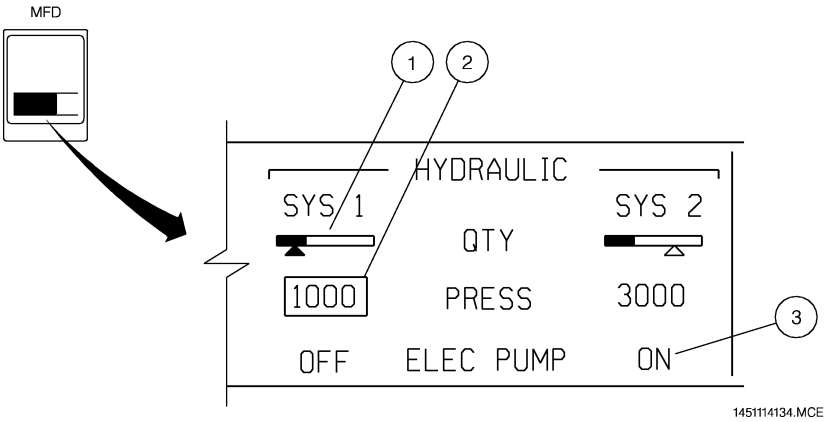
- Ranges from zero to maximum hydraulic fluid quantity.
- Scale (horizontal line) and pointer:
  - green when greater than 1 liter.
  - amber when equal to or less than 1 liter.
- Pointer disappears if data is invalid.

2- PRESSURE INDICATION

- Ranges from 0 to 4000 psi, with a resolution of 100 psi.
- Digits:
  - green from 1300 to 3300 psi.
  - amber and boxed below 1300 and above 3300 psi.
- Digits are replaced by amber dashes if data is invalid.

3- ELECTRIC PUMP STATUS

- Indicated by the green label ON or OFF.



HYDRAULIC PAGE ON MFD

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

SECTION 2-12

LANDING GEAR AND BRAKES

TABLE OF CONTENTS

Block Page

General ..... 2-12-05 .. 01
Air/Ground Indication System ..... 2-12-05 .. 02
Landing Gear Operation ..... 2-12-05 .. 03
Landing Gear Retraction ..... 2-12-05 .. 03
Landing Gear Extension ..... 2-12-05 .. 05
Landing Gear Warning ..... 2-12-05 .. 06
EICAS Messages ..... 2-12-05 .. 07
Controls and Indicators ..... 2-12-05 .. 07
Brake System ..... 2-12-10 .. 01
Normal Brake System ..... 2-12-10 .. 02
Emergency/Parking Brake System ..... 2-12-10 .. 08
EICAS Messages ..... 2-12-10 . 10
Controls and Indicators ..... 2-12-10 . 10
Nose Wheel Steering System ..... 2-12-15 .. 01
EICAS Messages ..... 2-12-15 .. 02
Controls and Indicators ..... 2-12-15 .. 04
EMB-145 Minimum Turning Radii ..... 2-12-15 .. 07
EMB-135 Minimum Turning Radii ..... 2-12-15 .. 09
EMB-140 Minimum Turning Radii ..... 2-12-15 .. 11

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GENERAL

The EMB-145 landing gear incorporates braking and steering capabilities. The extension/retraction, steering and braking functions are hydraulically assisted, electronically controlled and electronically monitored. EICAS indications and messages alert crew to system status and failures. Each landing gear is equipped with alternate means of actuation in case of normal actuation system failure.

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AIR/GROUND INDICATION SYSTEM

Air/ground indication is determined by a system that detects landing gear shock absorber compression and relays information to the landing gear electronic unit for gear control. The system consists of five weight-on-wheel proximity switches. Two of them are installed on each main landing gear leg and one on the nose landing gear leg.

The Landing Gear Electronic Unit (LGEU) processes the main landing gear proximity switches' signals information in four independent channels and controls various equipment operations. Logic processing includes the position signal and its validity. If all proximity switch signals are valid, four signals are processed to assure that at least three signals indicate identical status for releasing the air/ground signal output.

Should one proximity switch signal be invalid, the logic will process the remaining three signals so that at least two indicate the same status. If a second proximity switch is invalid, the two remaining signals are processed only if both send the same signal. Disagreement between these two remaining proximity switches causes the Landing Gear Electronic Unit to de-energize the channels and provide a default output signal.

The nose landing gear proximity switch signal is sent only to the thrust reverser logic (if installed) and steering control.

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LANDING GEAR OPERATION

Landing gear retraction and extension are powered by the hydraulic system 1. An accumulator prevents pressure fluctuations and assists gear retraction after takeoff. The main landing gear legs retract inboard, while the nose landing gear retracts forward. Each main gear leg is mechanically linked to its respective door, which remains open when the gear is down. The doors close automatically when the main landing gear is retracted. The nose landing gear doors are hydraulically actuated and operate in sequence with the nose gear.

Gear retraction and extension are electrically commanded. If normal extension fails, the landing gear can be extended through an electrical override system. If the electrical override is not available, a free-fall system allows gear extension. Gear position is indicated on the EICAS display.

LANDING GEAR RETRACTION

Landing gear retraction is commanded through the Landing Gear Lever, installed on the main panel. Positioning the lever to the UP position signals the LGEU to command the Nose Gear Door Solenoid Valve and the Landing Gear Electrovalve. This allows pressure from the hydraulic system 1 to simultaneously reach landing gear and down unlock actuators. All gear legs are then retracted into their respective wheel wells.

The LGEU logic only allows the nose gear doors to close after the nose landing gear is locked in the UP position. When the uplock boxes are actuated, the proximity switches signal the LGEU that the gear is up and locked and that the Landing Gear Electrovalve may be deenergized. Nose landing gear door actuators are kept pressurized, but the gear actuator lines are connected to the return.

To preclude an inadvertent retraction command while on the ground, the air/ground system provides a signal to a solenoid inside the Landing Gear Lever. This locks the lever and prevents movement towards the UP position. For emergency purposes only, a lock release button is provided beside the lever, allowing this protection to be overriden.

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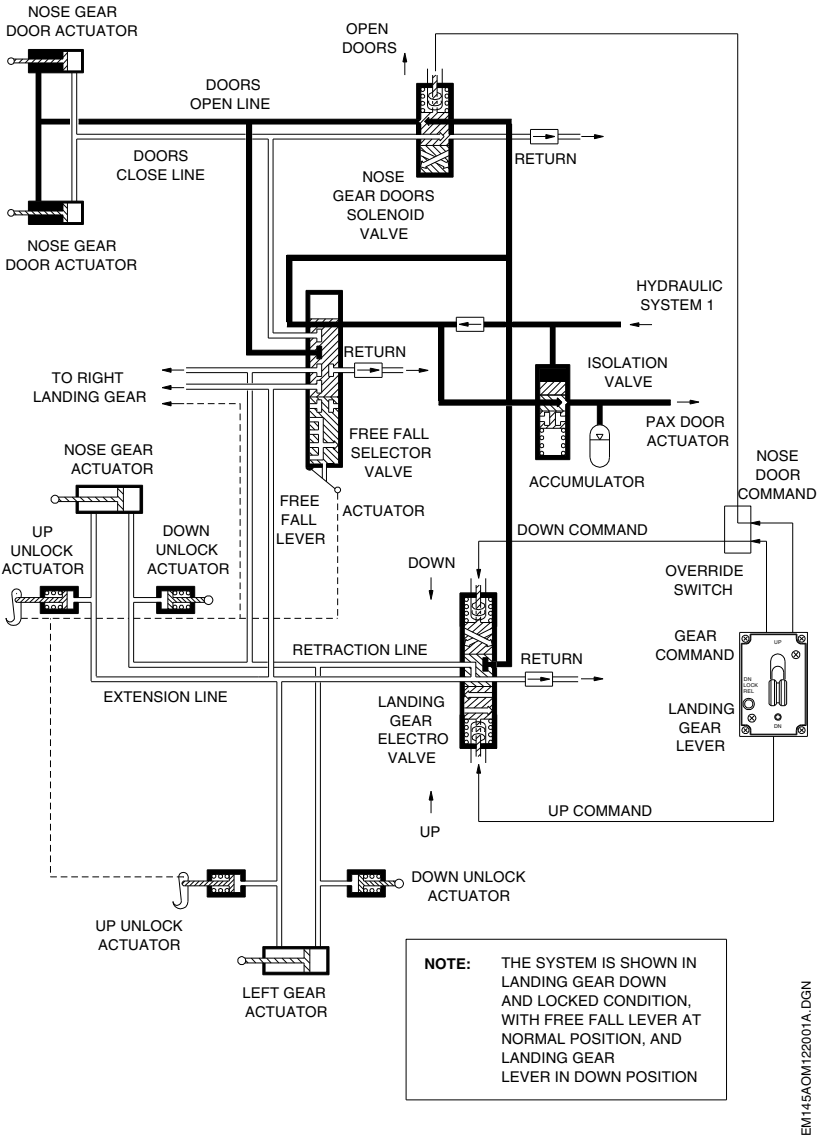

LANDING GEAR SCHEMATIC

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LANDING GEAR EXTENSION

NORMAL EXTENSION

Positioning the Landing Gear Lever to the DOWN position signals the LGEU to command the Landing Gear Electrovalve and the Nose Gear Doors Solenoid Valve. This allows pressure from the hydraulic system 1 to simultaneously reach the landing gear and door actuators, and also the up unlock actuators.

When the gear legs reach the down position, the down lock boxes are actuated. The proximity switches signal the LGEU that the gear is down and locked and that the Landing Gear Electrovalve may be de-energized.

ELECTRICAL OVERRIDE EXTENSION

The Electrical Override system is used to extend the landing should there occur a normal landing gear extension failure. This system bypasses the LGEU and actuates directly the Landing Gear Electrovalve and the Nose Gear Doors Solenoid Valve. The control switch is installed inside the free-fall lever compartment, on the floor, beside the copilot's seat. Extension through override is made in steps, first opening the doors and then extending the gear. When extension is completed, selecting the override switch to normal position deenergizes the Landing Gear Electrovalve and depressurizes all lines. The switch is safeguarded, being in the non-actuated position whenever the compartment door is closed.

FREE-FALL EXTENSION

Free-Fall extension is available in case of failure of both normal extension and electrical override extension. Actuation of free-fall landing gear extension is performed by pulling up the lever installed inside the free-fall lever compartment, on the floor, beside the copilot's seat.

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This mechanically actuates the Free-Fall Selector Valve and unlocks the three landing gear legs uplocks. The Free-Fall Selector Valve isolates the hydraulic system pressure and connects the landing gear system hydraulic lines to the return. With the system unpressurized and the uplocks deactivated, all gear legs fall by gravity until they reach their downlock devices. If one main gear does not lock down, increase the aerodynamic drag by side slipping the airplane to help lock the affected leg.

Once actuated, the free-fall lever remains locked in the vertical position until mechanically released.

LANDING GEAR WARNING

A LANDING GEAR voice message is provided to alert pilots any time the airplane is in a landing configuration and the gear legs are not locked down. The warning may be activated under one of three conditions:

1. Radio Altitude below 1200 ft, Flap Selector Lever set lower than 22°, one thrust lever set below 59° and the other thrust lever set below 45° (or the associated engine inoperative).

   NOTE: In case of Radio Altimeter loss, the message may be activated at any altitude, but may be canceled through the Landing Gear Warning Cutout Button.

2. Radio Altitude below 1200 ft, Flap Selector Lever between 22° and 45°, one thrust lever set below 59° and the other thrust lever set below 45° (or the associated engine inoperative).

   NOTE: - The Voice message cannot be canceled.
   - In case of Radio Altimeter loss, the message may be activated at any altitude.

3. Flap Selector Lever set at 45°.

   NOTE: The Voice message cannot be canceled.

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
WARNING	LG/LEVER DISAGREE (1)	After 20 seconds of gear command, at least one landing gear is not in the selected position. After 20 seconds of gear command to the UP position, once "NLG UP/DOOR OPN" is displayed on EICAS.
CAUTION	LG AIR/GND FAIL (2)	LGEU failure, failure of two weight-on-wheel proximity switches, or nose weight-on-wheel proximity switch in disagreement with air/ground system indication.
	NLG UP/DOOR OPN (if applicable)	Nose LG is locked up and nose LG door is open.

NOTE: 1) For airplanes Post-Mod. SB 145-34-0125, the message is displayed when the Landing Gear in Transit position remain unchanged for more than 20 seconds.

2) If the message is displayed for about 3 or 5 seconds during the landing gear extension only and extinguishes when the landing gear is down and locked, it could be considered a false indication and should be disregarded.

CONTROLS AND INDICATORS

LANDING GEAR CONTROL BOX

1 - LANDING GEAR LEVER

UP - Selects landing gear retraction.

DOWN - Selects landing gear extension.

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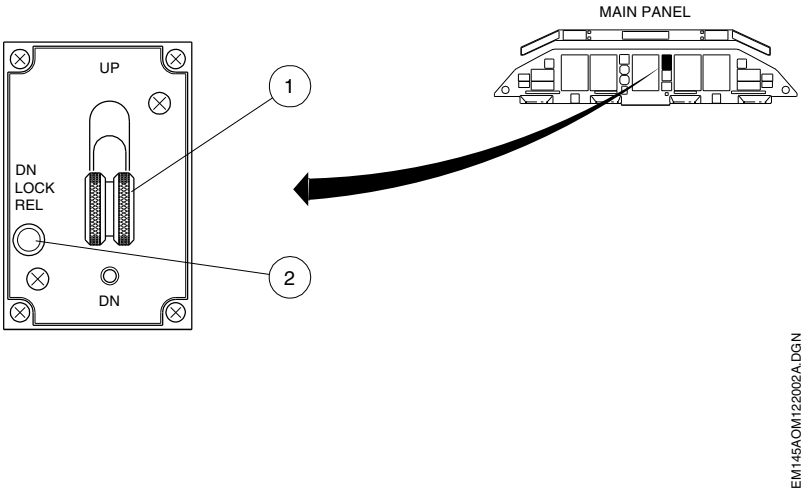
2 - DOWNLOCK RELEASE BUTTON

- Mechanically releases the lever lock, allowing the landing gear lever to be moved to the UP position when on the ground or in case it cannot be moved to the UP position after takeoff.



LANDING GEAR CONTROL BOX

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FREE-FALL LEVER COMPARTMENT

1 - FREE-FALL LEVER

- When pulled up, depressurizes the landing gear hydraulic line and releases all gear uplocks.
- The lever is kept at the actuated position by a mechanical lock.

2 - FREE-FALL LEVER UNLOCK BUTTON

- When pressed, unlocks the free-fall lever, allowing it to be returned to the normal position, thus restoring the hydraulic operation of the landing gear.

3 - ELECTRICAL OVERRIDE SWITCH (GUARDED)

NORMAL - Landing gear retraction and extension are automatically performed and controlled by the Landing Gear Electronic Unit.

DOORS - Opens the nose landing gear doors.

GEAR/ DOORS - Extends the landing gear.

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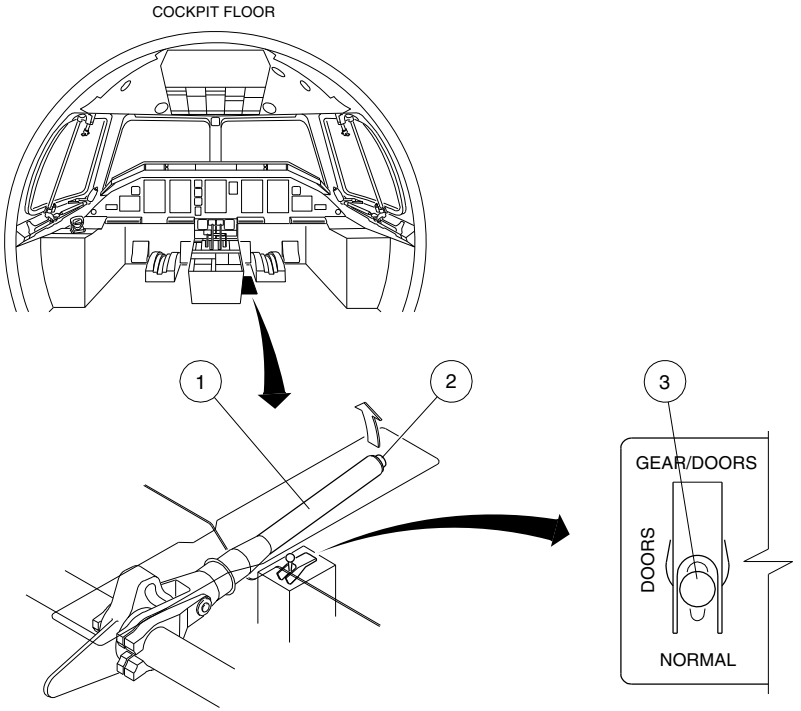

FREE-FALL LEVER COMPARTMENT

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LANDING GEAR WARNING CUTOUT BUTTON (guarded)

- When pressed, this button cancels the landing gear warning voice message if the Radio Altimeter is inoperative with Flap Selector Lever set lower than 22°, one thrust lever set below 59° and the other thrust lever set below 45° (or the associated engine inoperative).
- An amber indication bar illuminates inside the button and remains illuminated to indicate that a cancel action was performed.
- The amber indication bar extinguishes if the Thrust Levers are advanced or Flap Selector Lever is set at 22° or higher or landing gear is down and locked.

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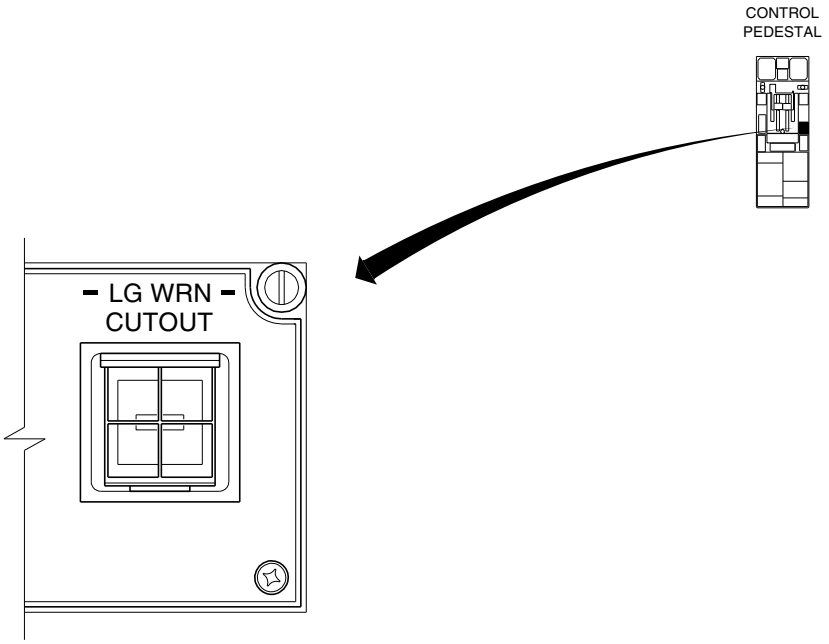

NOTE: THE LANDING GEAR WARNING CUTOUT BUTTON MAY ALSO BE LOCATED ON THE MAIN PANEL.

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LANDING GEAR WARNING CUTOUT BUTTON

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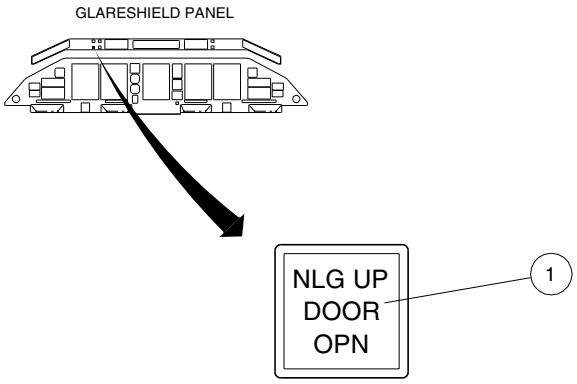
GLARESHIELD PANEL

1 - NOSE LANDING GEAR DOORS INDICATION LIGHT (IF INSTALLED)

– Illuminates to indicate that the nose landing gear is locked in the retracted position and at least one door is not closed.



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GLARESHIELD PANEL

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EICAS INDICATIONS

1 - LANDING GEAR POSITION

- Position is indicated by three boxes, one for each gear.
- Landing gear down and locked is indicated by a green DN label inside a green box.
- Landing gear in transit is indicated when the box is crosshatched in amber and black.

  For airplanes Post-Mod. SB 145-34-0125, when the conditions for Landing Gear in Transit position remain unchanged for more than 20 seconds, the following occurs:
  - The indication crosshatched in amber and black turns to red and black, and
  - The EICAS message LG/LEVER DISAGREE is displayed.
- Landing gear up and locked is indicated by a white UP label inside a white box.
- Landing gear lever disagreement (landing gear is not in the selected position after 20 seconds) is indicated by a box cross-hatched in red and black or by a red label (UP or DN) inside a red box.
- Indication of landing gear downlocked is also presented on the RMU through the green LG DOWN LOCKED legend.

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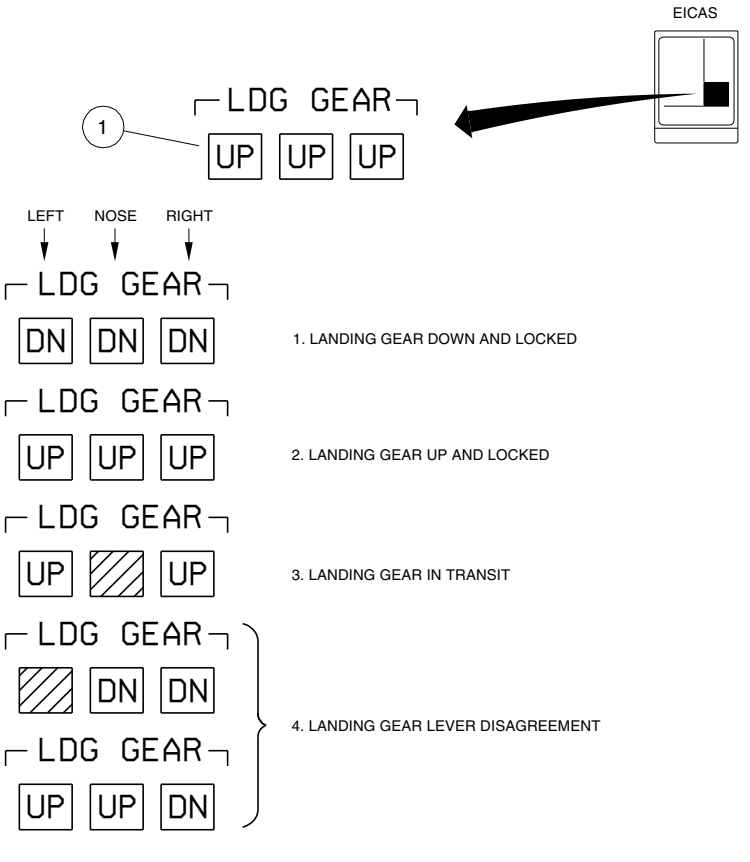

LANDING GEAR POSITION INDICATION ON EICAS

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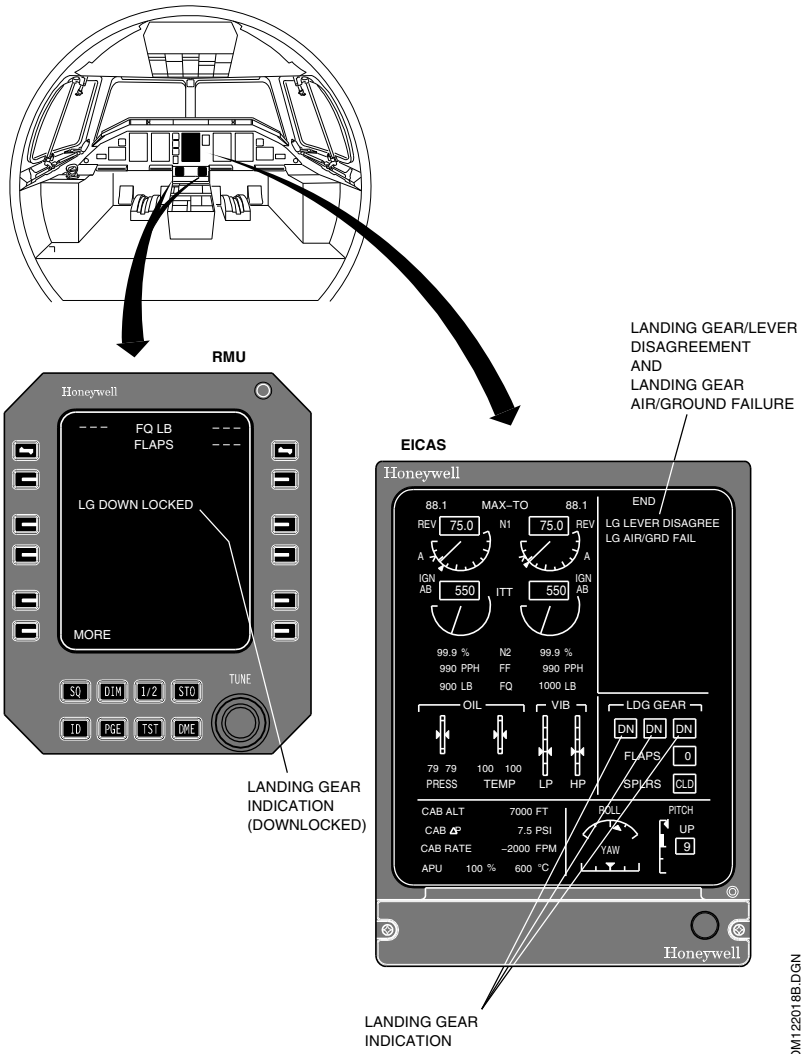

LANDING GEAR INDICATIONS

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BRAKE SYSTEM

The braking system consists of the normal brake system, emergency/parking brake system, and gear-retracting-in-flight braking.

The normal brake system is supplied by hydraulic systems 1 and 2. It is electronically commanded and monitored. The emergency/parking brake system is supplied only by hydraulic system 2 and is mechanically actuated. Normal braking is controlled by the pedals. Emergency braking is controlled by the emergency/parking brake handle. Gear-retracting-in-flight braking is controlled by both hydraulic systems and by a mechanical stop within the nose gear wheel well. This braking is electronically commanded and monitored.

Braking through the pedals incorporates some protections not available when using the emergency brake handle. Brake temperature is shown on the MFD Hydraulic Page.

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NORMAL BRAKE SYSTEM

Normal brake system is operated by rudder pedal inputs. The brakes are powered by two independent hydraulic systems. It is controlled and monitored by the Brake Control Unit (BCU). The BCU receives signals from the pedal position transducers and commands the four Brake Control Valves (BCV) to modulate required pressure to the wheel brakes. BCVs 1 and 4 control the hydraulic pressure from system 1 to the outboard wheels. BCVs 2 and 3 control the hydraulic pressure from system 2 to the inboard wheels.

The hydraulic system 1 and the ESS DC BUS 1 supply the main brake system for the control of the outboard wheels. The hydraulic system 2 and the ESS DC BUS 2 supply the main brake system for the control of the inboard wheels.

Pressure and wheel speed transducers send signals to the BCU so that it can monitor brake performance and send the appropriate signals to the crew alerting system and other systems. The BCU also receives signals from the landing gear position and condition, air/ground situation, and hydraulic system status. The system displays messages on the EICAS to indicate a failure in one pair of brakes or a failure in a single wheel brake (brake degraded performance). In the event of brake system failure, the BCU will shut down the affected hydraulic system through the shutoff valves. The shutoff valves are energized whenever the landing gear is extended and de-energized after landing gear retraction.

Protective functions controlled by the normal braking system include anti-skid protection, locked wheel protection, and touch-down protection.

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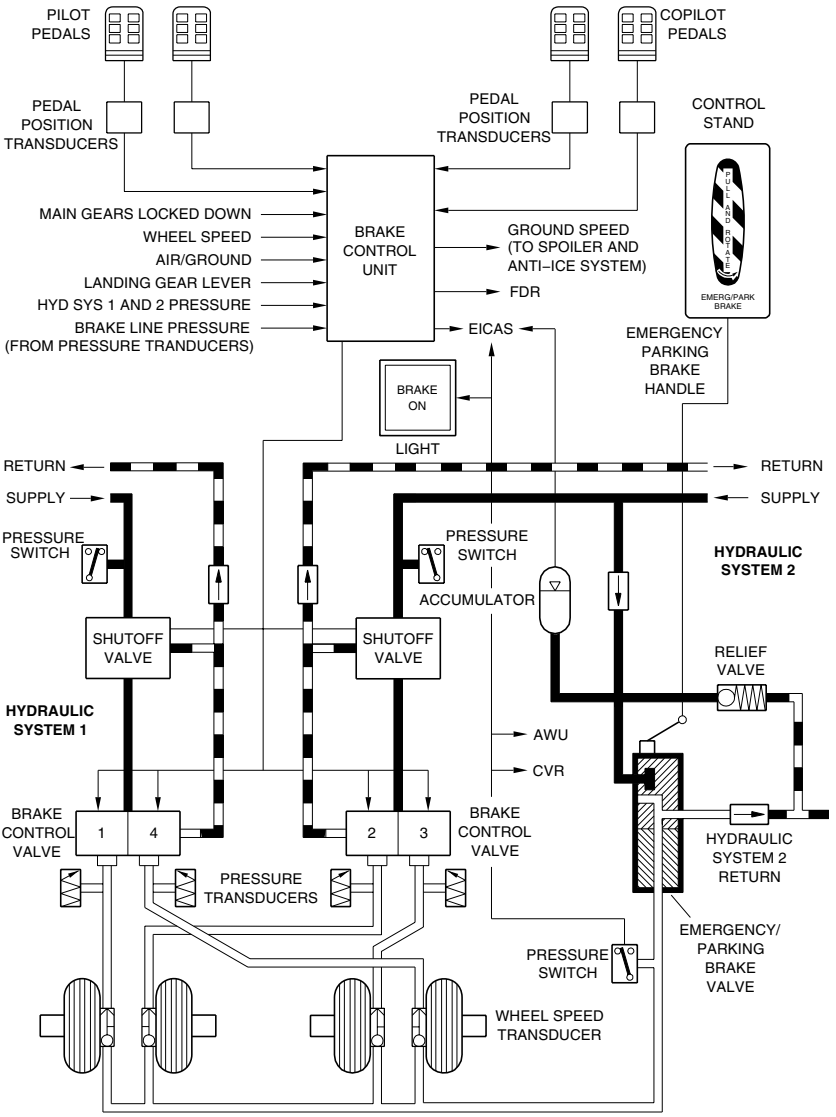

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BRAKE SYSTEM SCHEMATIC

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ANTI-SKID PROTECTION

The anti-skid protection controls the amount of hydraulic pressure applied by the pilots on the brakes. The anti-skid provides the maximum allowable braking effort for the runaway surface in use. It minimizes tire wear, optimizes braking distance, and prevents skidding.

To perform this function, the BCU computes the wheel speed signal from the four speed transducers.

BCU monitors constantly wheels velocity through wheel speed transducers. If a skid occurs, then wheel velocity decreases suddenly compared with a calculated deceleration ratio proportional of the pedal deflection, then BCU will command brake pressure release until the wheel velocity returns to the expected one. This anti-skid protection is monitored and controlled for each wheel, independently.

When one of such signals decreases below the average of the remaining wheels, a skidding is probably occurring, and braking pressure has to be relieved. After that wheel speed has returned to the average speed, normal braking operation is restored.

The anti-skid does not apply pressure on the brakes, but only relieves it. So, to perform a differential braking technique, the pilot should reduce pressure on the side opposite to the turn, instead of applying pressure to the desired side.

The anti-skid system incorporates the locked wheel protection and touchdown protection features.

LOCKED WHEEL PROTECTION

Locked wheel protection is activated for wheel speeds above 30 kt. It compares wheel speeds signals. If one wheel speed is 30% lower than that of another, a full brake pressure relief is commanded to the associated wheel, allowing wheel speed recovery. The 30% tolerance between the wheel speeds is provided to permit an amount of differential braking, for steering purposes.

For wheel speeds below 30 kt, the locked wheel protection is deactivated and the brake system actuates without the wheel speed comparator. For wheel speeds below 10 kt, the anti-skid protection is deactivated, allowing the pilot to lock and pivot on a wheel.

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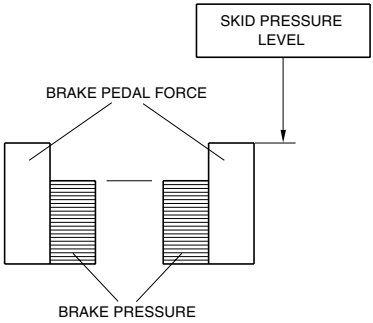
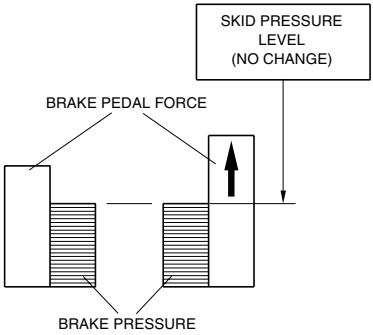
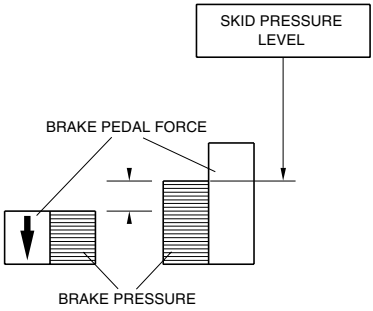
THE ANTI–SKID FUNCTION MODULATES THE BRAKE PRESSURE TO A LEVEL WHICH PREVENTS THE WHEELS FROM SKIDDING. IF ONE OF THE WHEELS LOCKS, THE ANTI–SKID FUNCTION REDUCES THE BRAKE PRESSURE OF THE ASSOCIATED PAIR, THUS ELIMINATING THE SKIDING.



IF THE PILOT APPLIES DIFFERENTIAL PEDAL FORCE TO STEER THE AIRPLANE THROUGH DIFFERENTIAL BRAKING, THE ANTI–SKID FUNCTION MAINTAINS THE SKID PRESSURE LEVEL, THUS PRECLUDIND THE AIRPLANE FROM TURNING.



THE CORRECT ACTION CONSISTS IN A REDUCTION OF THE OPPOSITE PEDAL FORCE TO A POINT BELOW THE SKID LEVEL, WHICH PERMITS THE REDUCTION OF THE CORRESPONDING BRAKE PRESSURE.



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DIFFERENTIAL BRAKING TECHNIQUE

TOUCHDOWN PROTECTION

The touchdown protection system inhibits brake actuation before the main wheels spin up during landing. Brake actuation will be allowed only after 3 seconds from the latest touchdown or after the wheels have spun-up to 50 kt. In bouncing landings, the countdown is reset after each runway contact.

Touchdown protection is provided by the brake system receiving signals from main landing gear weight-on-wheel proximity switches. If one landing gear proximity switch fails at the air position, the brake system will operate normally. However, if both proximity switches fail at the air position, braking capacity will be available only for wheel speeds above 10 kt.

Below 10 kt, a loss of the main brake capacity will occur, but emergency braking is still available.

GEAR-RETRACTING-IN-FLIGHT BRAKING

Gear-retracting-in-flight braking prevents the landing gear from being retracted when the wheels are turning. This system computes signals from the air/ground indicating system and from the landing gear lever position. As soon as the airplane is airborne and the gears are commanded to retract, it applies braking pressure to the main wheels. The nose wheels are braked by a stop within the nose landing gear wheel well.

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EMERGENCY/PARKING BRAKE SYSTEM

The emergency/parking brake system is used when parking the airplane or when the normal braking system has failed. The emergency/parking brake system is mechanically commanded and hydraulically actuated. It is totally independent of the BCU, so it has none of the normal braking system protections.

The emergency/parking brake is controlled through a handle located on the left side of the control pedestal. This modulates the Emergency/Parking Brake Valve. When the Emergency/Parking Brake Valve is actuated, hydraulic pressure coming from a dedicated accumulator is equally applied to the four main landing gear brakes. Braking capacity is proportional to the handle displacement. A BRAKE ON indicating light illuminates to indicate that pressure is being applied to the wheel brakes. A locking device allows the handle to be held in the actuated position, for parking purposes.

The accumulator is supplied by hydraulic system 2. A caution message is displayed on the EICAS in case of accumulator hydraulic low pressure. After the message is displayed, if no leakage exists, at least one full emergency/parking brake application is available. If overpressure occurs due to overheating, a thermal relief valve allows hydraulic system communication with the return. A refilling connection is provided to allow pressurization of the accumulator.

The accumulator allows 6 complete emergency actuation or at least 24 hours of parking brake actuation.

NOTE: To prevent transfer of hydraulic fluid from one system to the other, normal braking should be applied and held while the parking brake is fully applied or released.

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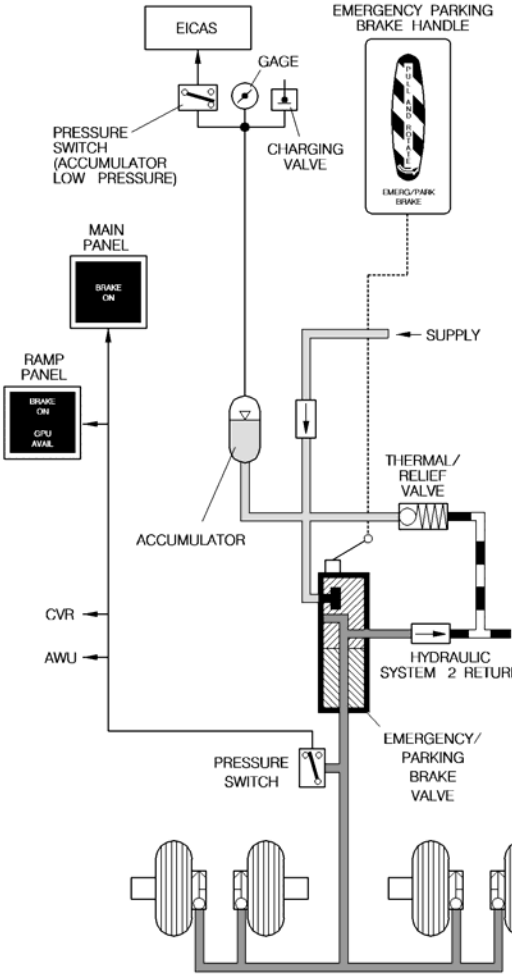

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EMERGENCY/PARKING BRAKE SYSTEM SCHEMATIC

EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	EMRG BRK LO PRES	Emergency/parking brake accumulator presents a low pressure condition.
	BRK OUTBD (INBD) INOP	Outboard and/or inboard pair of brakes is inoperative.
	BRAKE OVERHEAT	Any brake temperature has exceeded 420°C.(*)
	BRAKE DEGRADED	Total or partial loss of braking capability of one outboard wheel (1 or 4) and/or one inboard wheel (2 or 3), or internal BCU failure.

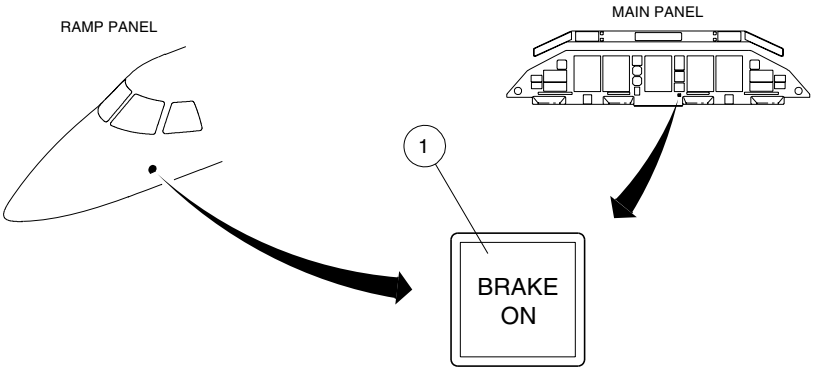
NOTE: (*) For EMB-145 airplanes equipped with LR brakes, the brake overheat set point is 450°C.

CONTROLS AND INDICATORS

MAIN PANEL/RAMP PANEL

1 - BRAKE ON LIGHT

– Illuminates when emergency/parking brake is applied.



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BRAKE ON LIGHT

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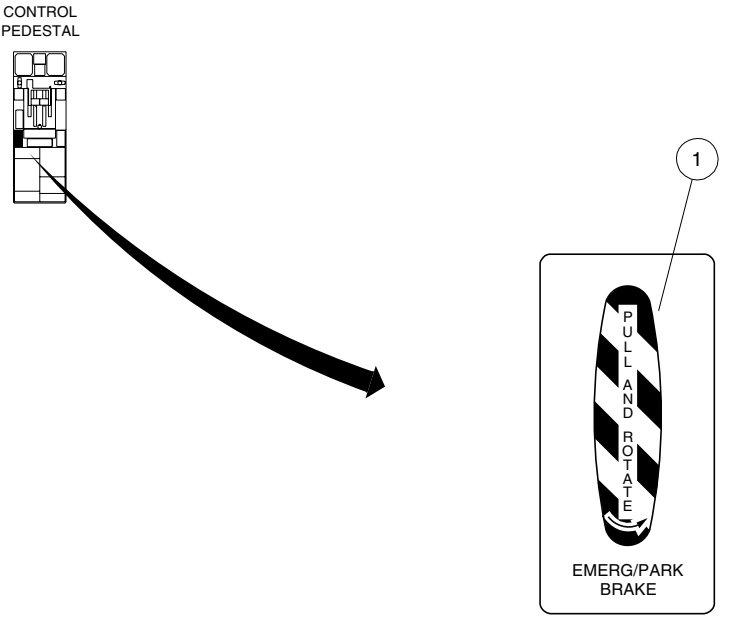
CONTROL PEDESTAL

1 - EMERGENCY/PARKING BRAKE HANDLE

- Actuates the emergency/parking brake valve.
- Pull the handle and rotate to lock in the fully-actuated position.



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EMERGENCY/PARKING BRAKE HANDLE

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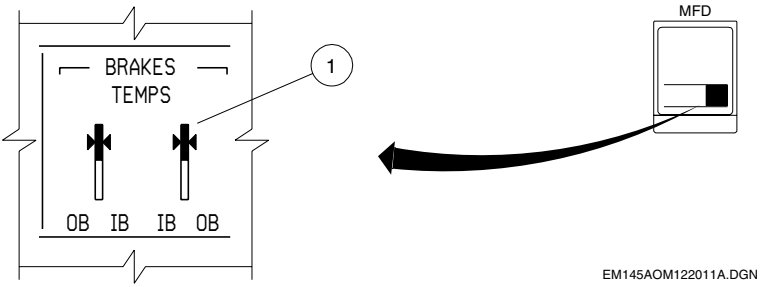
MFD INDICATIONS

1 - BRAKE TEMPERATURE INDICATION

- Temperature is indicated by two vertical bars (one for each main landing gear) and four pointers (one for each brake).
- The scale ranges from 0 to 500°C.
- The scale and pointer are green when temperature is below 200°C, and amber when equal or greater than 200°C.
- The temperature indication pointer is removed from the display in case of loss of temperature sensor signal.

NOTE: For EMB-145 airplanes equipped with LR brakes, the scale and pointer are green when temperature is below 250°C, and amber when equal or greater than 250°C.



BRAKE TEMPERATURE INDICATION

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NOSE WHEEL STEERING SYSTEM

The nose wheel steering system is electronically controlled and hydraulically operated. It is powered by the hydraulic system 1. The Electronic Control Module is energized when the landing gear is down and locked, with the airplane on ground. In this condition, steering can be controlled by either the pedals or the steering handle. In either case, the commanded displacement is measured by a potentiometer box, which transmits the signal to the Electronic Control Module. The Electronic Control Module signals the hydraulic manifold to pressurize the steering actuator in the commanded direction. For monitoring purpose, a feedback potentiometer in the nose landing gear leg transmits nose wheel displacement information to the Electronic Control Module.

Maximum nose wheel displacement values due to actuation of the steering handle and pedals are presented in the table below in degrees:

CERTIFICATION	APPLICABILITY	PEDALS ONLY	STEERING HANDLE ONLY	HANDLE AND PEDALS
CTA/JAA	All Airplanes	5°	71°	76°
FAA	Pre-Mod. SB 145-32-0002	5°	50°	55°
	Post-Mod. SB 145-32-0002 or S/N 145.029 and on	5°	71°	76°

NOTE: Steering handle actuation with nose wheels beyond their operational limits may cause damage to the nose wheel steering system.
Check if the nose wheel position indication mark is within the nose wheel position indication scale limits.

A position sensor set to 7° disengages the system if the nose wheel is rotated above this limit by using the rudder pedals. To reengage the system, resume command through the handle.

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The steering system may be manually disengaged through buttons located on the pilots' control wheels and allows free steer of the nose wheel. The STEER INOP message appears when the Steering Disengage Button is pressed. This is a system characteristic and not a malfunction. Automatic system disablement occurs as soon as the airplane is airborne. Nose wheel centering with the nose gear shock absorber extension is provided by a cam. The nose wheel is also centered by caster effect whenever the system is disengaged.

If the Electronic Control Module detects a failure, the EICAS is signaled to present a caution message. In these cases, for airplanes Post-Mod. SB 145-32-0104 or with an equivalent modification factory incorporated, the tiller commands will be inhibited if wheel speed is above 25 kt.

Optionally, some airplanes are equipped with an external Steering Disengagement Switch which allows ground personnel to disengage steering prior to towing operations. The switch actuates directly on the steering system, shutting its power down. The disengagement switch inhibits the steering actuation commanded by the steering handle and the rudder pedals. A caution message is displayed on the EICAS whenever the steering system is disengaged by the external switch. Steering Disengagement Switch is installed in a compartment on the left front fuselage.

EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	STEER INOP	Steering system is inoperative. Message is presented only on ground.

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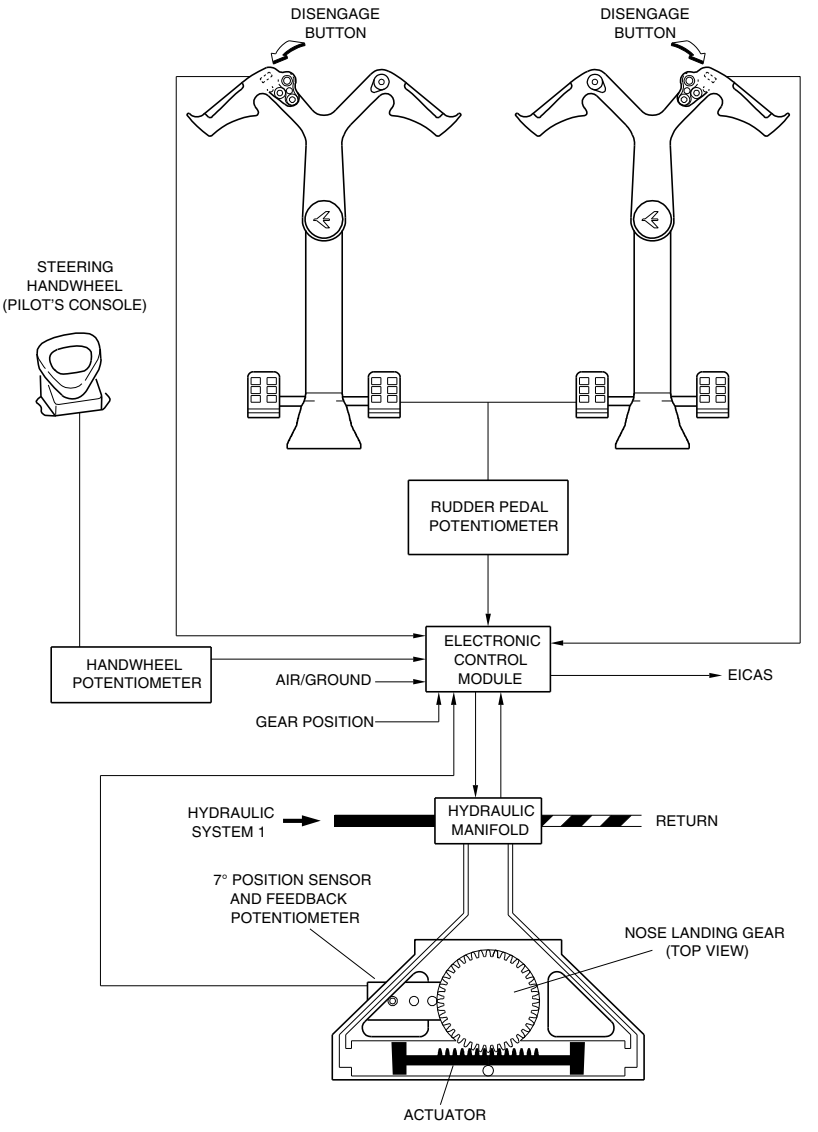

NOSE WHEEL STEERING SCHEMATIC

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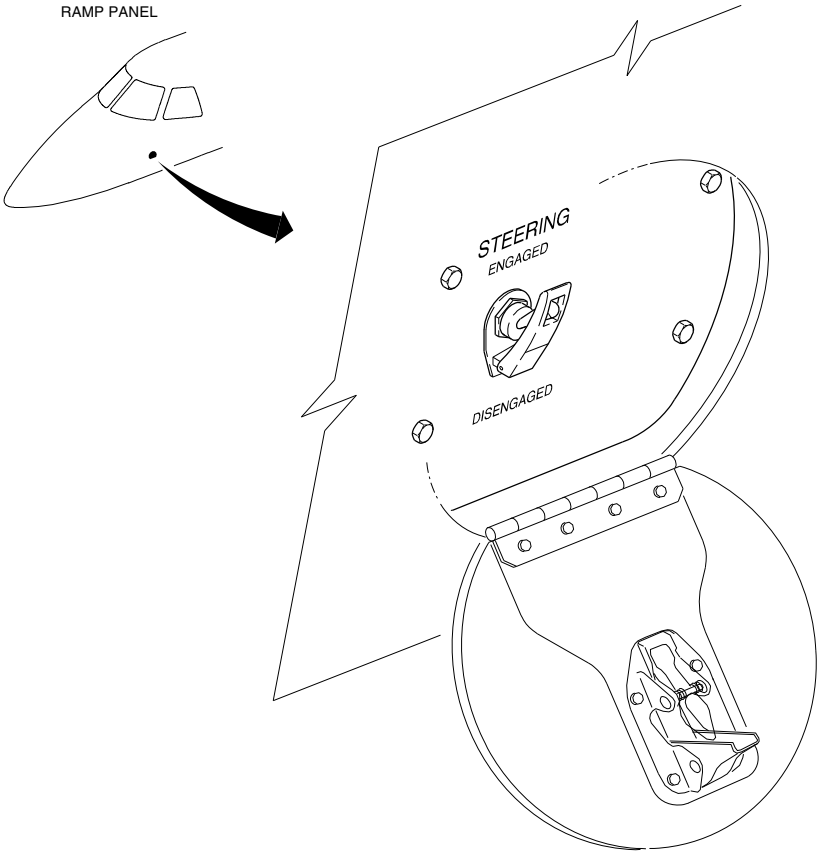
CONTROLS AND INDICATORS

STEERING DISENGAGEMENT SWITCH (GUARDED)

- ENGAGED - Allows normal steering system operation.
- DISENGAGED - Disables steering system operation.



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STEERING DISENGAGEMENT SWITCH COMPARTMENT

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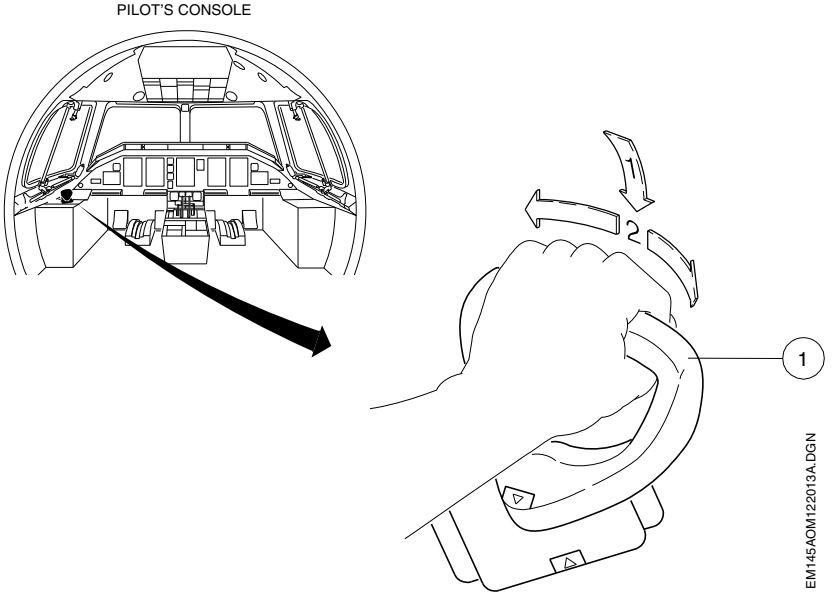
PILOT'S CONSOLE

1 - STEERING HANDLE

- Commands nose wheel steering, allowing 71° deflection to either sides.
- The steering handle can be moved downward and to either sides. When steering handle is moved downward the handle potentiometer output signal is connected to the Electronic Control Module. Push the handle down (step 1) to enable the command or to reset the steering system after disconnection. Rotate left or right (step 2), with the steering handle on down position, to command steering.

NOTE: - For airplanes operating under FAA certification and Pre-Mod SB 145-32-0002 the nose wheel steering deflection is limited to 50° to either sides.

- The Steering Handle has priority over the Steering Disengage Button when both are pressed (in case of jammed rudder, the Steering Handle is used to control the airplane and the pilot must keep the Steering Disengage Button pressed to avoid undesired pedal command once on ground).



STEERING HANDLE

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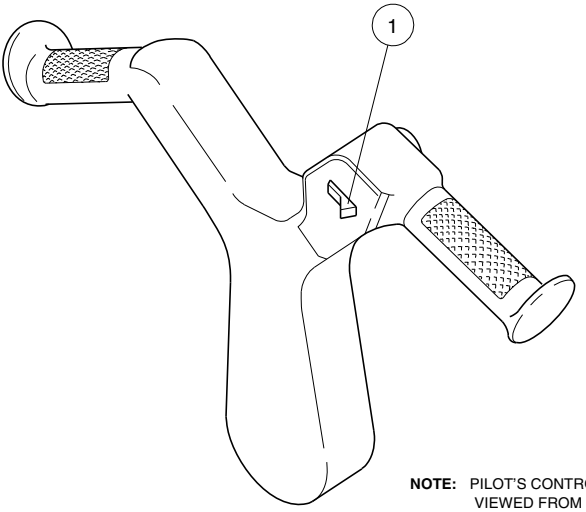
CONTROL WHEEL

1 - STEERING DISENGAGE BUTTON

– When pressed disengages the nose wheel steering system.



NOTE: PILOT'S CONTROL WHEEL SHOWN, VIEWED FROM BEHIND.

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STEERING DISENGAGE BUTTON

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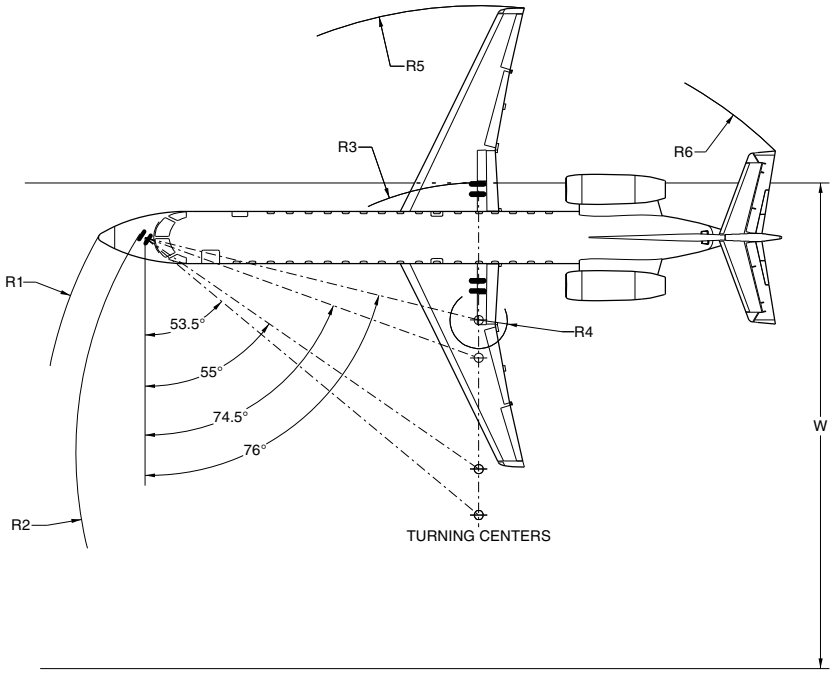
EMB-145 MINIMUM TURNING RADII



STEERING ANGLE	NOSE R1	NOSE GEAR R2	OUTBOARD GEAR R3	INBOARD GEAR R4	RIGHT WINGTIP R5	RIGHT TAILTIP R6	WIDTH W
53.5°	19.79 m	18.19 m	13.08 m	8.31 m	20.81 m	19.43 m	31.27 m
	64 ft 11 in	59 ft 8 in	42 ft 3 in	27 ft 3 in	68 ft 3 in	63 ft 9 in	102 ft 6 in
55°	19.48 m	17.86 m	12.50 m	7.74 m	20.24 m	19.00 m	30.36 m
	63 ft 11 in	58 ft 7 in	41 ft 0 in	25 ft 5 in	66 ft 5 in	62 ft 4 in	99 ft 6 in
74.5°	17.10 m	15.21 m	6.39 m	1.62 m	14.17 m	15.12 m	21.94 m
	56 ft 1 in	49 ft 11 in	21 ft 0 in	5 ft 4 in	46 ft 6 in	49 ft 7 in	72 ft 0 in
76°	17.01 m	15.11 m	5.99 m	1.25 m	13.77 m	14.92 m	21.21 m
	55 ft 9 in	49 ft 7 in	19 ft 8 in	4 ft 1 in	45 ft 2 in	48 ft 11 in	69 ft 7 in

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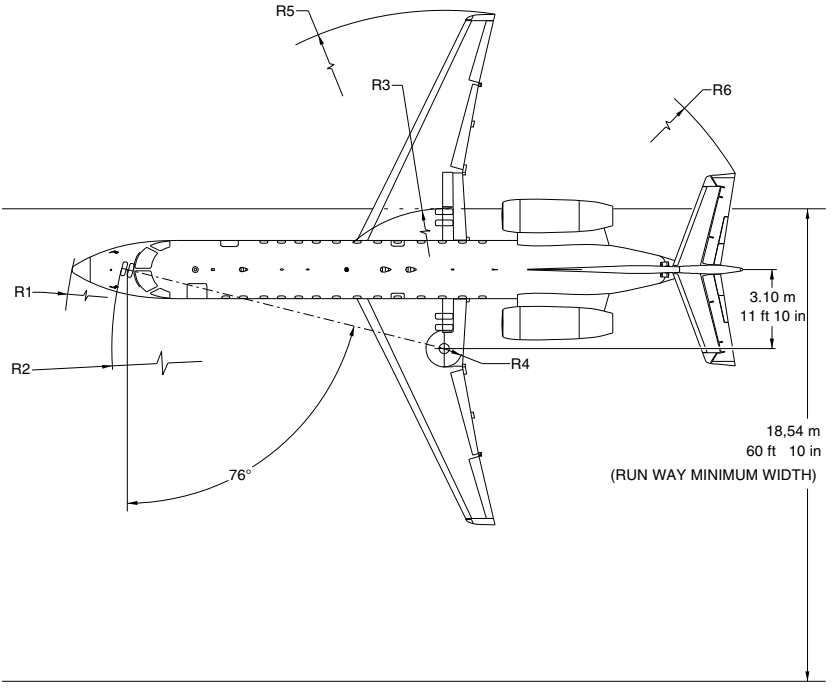
EMB-135 MINIMUM TURNING RADII



STEERING STEEL	NOSE R1	NOSE GEAR R2	OUTBOARD GEAR R3	INBOARD GEAR R4	RIGHT WINGTIP R5	RIGHT TAILTIP R6
76°	14.94 m	13.05 m	5.49 m	0.72 m	13.27 m	13.34 m
	49 ft 0 in	42 ft 10 in	18 ft 0 in	2 ft 4 in	43 ft 7 in	43 ft 9 in

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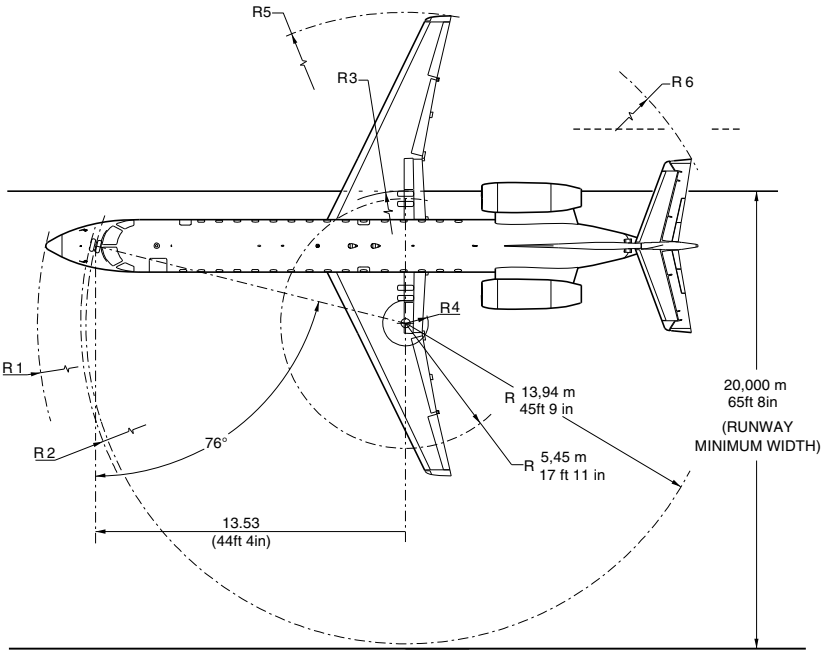
EMB-140 MINIMUM TURNING RADII



STEERING STEEL	NOSE R1	NOSE GEAR R2	OUTBOARD GEAR R3	INBOARD GEAR R4	RIGHT WINGTIP R5	RIGHT TAILTIP R6
76°	16.05 m	14.16 m	5.74 m	0.98 m	13.53 m	14.40 m
	52 ft 8 in	46 ft 6 in	18 ft 10 in	3 ft 3 in	44 ft 5 in	47 ft 3 in

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SECTION 2-13

FLIGHT CONTROLS

TABLE OF CONTENTS

Block Page

General ..... 2-13-05 .. 01
Pitch Control ..... 2-13-10 .. 01
General ..... 2-13-10 .. 01
Elevator ..... 2-13-10 .. 02
General ..... 2-13-10 .. 02
Jammed Elevator ..... 2-13-10 .. 02
Jammed Elevator Operation ..... 2-13-10 .. 02
Tabs ..... 2-13-10 .. 02
General ..... 2-13-10 .. 02
Servo Tabs ..... 2-13-10 .. 02
Spring Tabs ..... 2-13-10 .. 03
Pitch Trim System ..... 2-13-10 .. 05
General ..... 2-13-10 .. 05
System Components ..... 2-13-10 .. 05
Horizontal Stabilizer Control Unit (HSCU) ..... 2-13-10 .. 05
Horizontal Stabilizer Actuator (HSA) ..... 2-13-10 .. 05
System Operation ..... 2-13-10 .. 06
Pitch Trim Channels Priority ..... 2-13-10 .. 08
Pitch Trim System Protection ..... 2-13-10 .. 08
Switch Protection ..... 2-13-10 .. 08
Runaway Protection ..... 2-13-10 .. 08
Inadvertent Actuation Protection ..... 2-13-10 .. 09
HSA Excessive Load Protection ..... 2-13-10 .. 09
EICAS Messages ..... 2-13-10 .. 10
Controls and Indicators ..... 2-13-10 .. 12
Control Stand ..... 2-13-10 .. 12
Control Wheel ..... 2-13-10 .. 14
Control Pedestal Aft Panel ..... 2-13-10 .. 15
EICAS Indication ..... 2-13-10 .. 17
Roll Control ..... 2-13-15 .. 01
Aileron Control System ..... 2-13-15 .. 02
Roll Trim System ..... 2-13-15 .. 04

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

EICAS Messages ..... 2-13-15 .. 06
Controls and Indicators ..... 2-13-15 .. 06
Flight Controls Panel ..... 2-13-15 .. 06
Control Stand ..... 2-13-15 .. 07
Control Pedestal Aft Panel ..... 2-13-15 .. 08
EICAS Indications ..... 2-13-15 .. 09
Yaw Control ..... 2-13-20 .. 01
Rudder Control System ..... 2-13-20 .. 02
Automatic Shutoff Through the Speed Switch ..... 2-13-20 .. 04
Rudder Hardover Protection ..... 2-13-20 .. 04
Rudder Deflection ..... 2-13-20 .. 05
Airplanes Under CTA and FAA Certification ..... 2-13-20 .. 05
Airplanes Under JAA Certification ..... 2-13-20 .. 05
Yaw Trim System ..... 2-13-20 .. 06
EICAS Messages ..... 2-13-20 .. 08
Controls and Indicators ..... 2-13-20 .. 09
Flight Controls Panel ..... 2-13-20 .. 09
Control Pedestal Aft Panel ..... 2-13-20 .. 10
Main Panel ..... 2-13-20 .. 11
EICAS Indications ..... 2-13-20 .. 12
Gust Lock System ..... 2-13-25 .. 01
Mechanical Gust Lock System ..... 2-13-25 .. 01
Electromechanical Gust Lock System ..... 2-13-25 .. 01
Locking Operation ..... 2-13-25 .. 02
Unlocking Operation ..... 2-13-25 .. 04
Controls and Indicators ..... 2-13-25 .. 06
Glareshield Panel ..... 2-13-25 .. 06
Control Stand ..... 2-13-25 .. 07
Flap System ..... 2-13-30 .. 01
Flap System Operation ..... 2-13-30 .. 02
EICAS Messages ..... 2-13-30 .. 04
Controls and Indicators ..... 2-13-30 .. 04
Control Pedestal Aft Panel ..... 2-13-30 .. 04
EICAS Indications ..... 2-13-30 .. 06
Spoiler System ..... 2-13-35 .. 01
Ground Spoiler ..... 2-13-35 .. 02
Speed Brake ..... 2-13-35 .. 02
EICAS Messages ..... 2-13-35 .. 04
Controls and Indicators ..... 2-13-35 .. 04
Control Stand ..... 2-13-35 .. 04
EICAS Indications ..... 2-13-35 .. 06

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GENERAL

The primary flight control system consists of elevators, ailerons and rudder. Elevators are mechanically actuated. The ailerons and rudder are hydraulically powered and may also be mechanically actuated in case of loss of both hydraulic systems.

Trim system is provided in all axis. Tabs are provided for pitch control only, and are not available for ailerons and rudder.

A gust lock system blocks elevator controls on the ground, avoiding damage to the control systems in case of strong wind gusts. The rudder and ailerons are hydraulically damped for the same purpose.

An electrically operated flap system is provided with five discrete positions.

Speed brakes installed overwing allow increased descent rate and help in decelerating the airplane. Ground spoilers destroy lift, thus providing better braking effectiveness.

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FLIGHT CONTROL SURFACES

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PITCH CONTROL

GENERAL

Pitch control is provided by mechanically-actuated elevators and an electrically-positioned horizontal stabilizer which is commanded through the Pitch Trim System. Tabs are automatically positioned, thus reducing pilots effort.

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ELEVATOR

GENERAL

The primary pitch control system is performed by the elevators, which are actuated through a fully duplicated set of command circuits.

JAMMED ELEVATOR

In case of jamming of one of the circuits (left or right), both elevator panels may be disconnected through a handle located on the control pedestal. This procedure will release the free elevator panel from its jammed counterpart, allowing the free panel to be commanded.

When disconnected, an amber light illuminates on the control stand. Controls cannot be reconnected during flight, requiring maintenance action.

JAMMED ELEVATOR OPERATION

The autopilot elevator servo and the stick pusher servo are connected on the left side of the disconnection device. Once disconnection is actuated, the stick pusher will actuate only on the left side and autopilot must not be used.

TABS

GENERAL

There are four tabs, two on each elevator panel, located near the elevator root. The outer tabs are servo tabs and the inner tabs are spring tabs.

SERVO TABS

The deflection of the servo tabs is proportional to the elevator deflection. Since the servo tabs proportionally deflects in the opposite direction to the elevators, it promotes a reduction in the forces required.

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SPRING TABS

The spring tabs are connected in such a way that elevator deflection in one direction causes the spring tab to move in the opposite direction, thus reducing the amount of force required to move the elevator.

Spring tab deflection is proportional to the control column force and, therefore, to the aerodynamic load imposed on the elevator. At low speeds, the spring tab remains in the neutral position. At high speeds, where the aerodynamic load is greater, the tab functions as an aid in moving the elevator.

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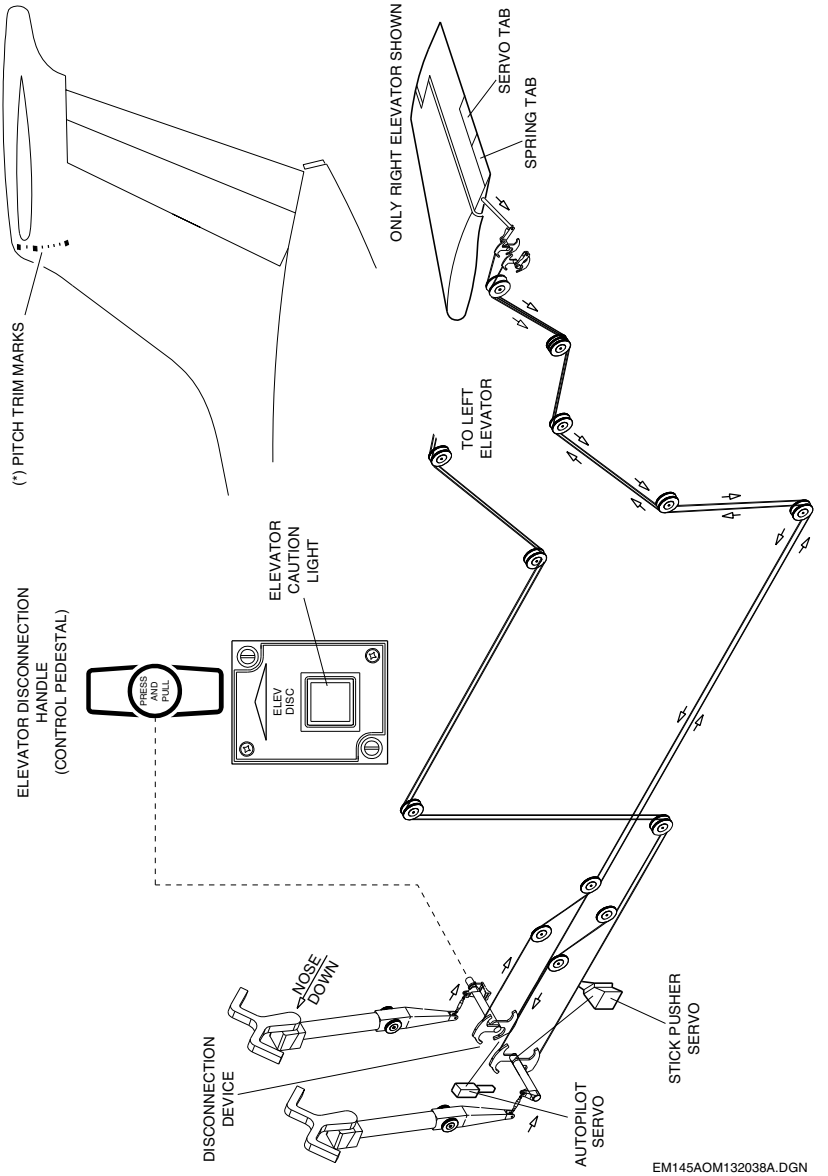

ELEVATOR SCHEMATIC

(*) The thick marks represent, respectively, 4° nose down (top of the scale), neutral, and 10° nose up (bottom of the scale) and each intermediate marks represent a 2° variation.

PITCH TRIM SYSTEM

GENERAL

Pitch trim is accomplished by an electrically-actuated movable horizontal stabilizer. The system may be either automatically or manually commanded. In both cases, the pitch trim signal is sent to the Horizontal Stabilizer Control Unit (HSCU) channels, which after processing it, command the electric motor in the Horizontal Stabilizer Actuator (HSA).

SYSTEM COMPONENTS

Horizontal Stabilizer Control Unit (HSCU)

The Horizontal Stabilizer Control Unit (HSCU) is located in the rear electronic compartment at the rear fuselage. It incorporates two identical control channels, main and backup. These channel operations are totally independent from each other. If the pitch trim main channel is inoperative, the horizontal stabilizer can still be commanded through the backup channel.

The HSCU controls the trimming rate (in degrees/second) based upon the airplane airspeed. The trimming rate reduces as the airspeed increases. The HSCU also checks the stabilizer surface position. When the Takeoff Configuration Check Button is pressed, if the surface is not within the takeoff green band limits, an aural warning message is sounded to the crew.

Horizontal Stabilizer Actuator (HSA)

The Horizontal Stabilizer Actuator (HSA) consists of an electromechanical actuator driven by two DC motors. One of the motors is driven by the main control channel of the Horizontal Stabilizer Control Unit (HSCU) and the other motor is driven by the backup channel of the HSCU. Only one motor will be driven at a time.

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SYSTEM OPERATION

Pitch trim commands may be done manually through the main switches on the control wheels or through backup switch on the control pedestal aft panel and automatically commanded through the autopilot or speed brake actuation.

When using the main control wheel trim switches or the backup trim switch, it is necessary to command both halves simultaneously because, if just one half is commanded, the control unit will not provide any command to the actuator.

In the case of activation of any stick shaker, the pitch trim up command will be inhibited.

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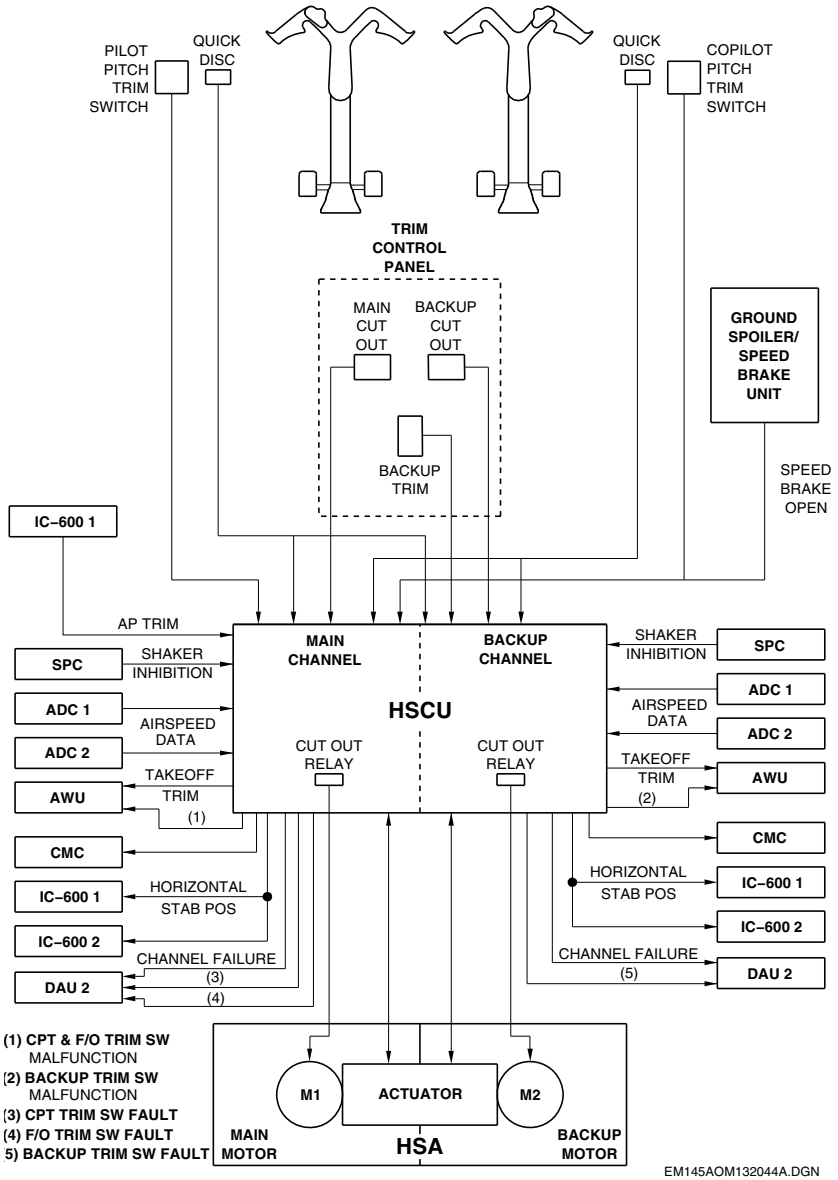

PITCH TRIM SCHEMATIC

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PITCH TRIM CHANNELS PRIORITY

Command priorities are: LH switch actuation overcomes the RH switch actuation, which, in turn, overcomes the autopilot. There is no priority with respect to the actuation of the main pitch trim switches and the backup pitch trim switches, the first being commanded taking priority. The main and backup pitch trim switches should not be commanded simultaneously. For the case of a simultaneous command of both channels, there is an specific logic inside the HSCU:

- For airplanes equipped with an HSCU P/N 362100-1009, -5009 or newer, the message PIT TRIM 1 (2) INOP will be displayed on the EICAS, associated to the second switch commanded. This message will disappear around 4 seconds after the second pitch trim switch is released.
- For airplanes equipped with an HSCU P/N 362100-1007, if the switches are commanded in different directions, the secondly commanded channel will become inoperative for the remainder of the flight and the respective message, PIT TRIM 1 (2) INOP, will be displayed on EICAS.

PITCH TRIM SYSTEM PROTECTION

Switch Protection

When only one half of the main control wheel trim switch or backup trim switch is commanded for more than 7 seconds continuously, the control unit will recognize that one half of the switch is failed stuck at the commanded position and will disregard any other command coming from that faulty switch.

NOTE: For airplanes equipped with HSCU -1009 or -5009 or newer and AWU -5 a TRIM voice message is provided to alert pilots that just one half of switch is being commanded and those equipped with HSCU -1009 or -5009 or newer and EICAS version 18 and on the messages PTRIM CPT SW FAIL, PTRIM F/O SW FAIL and PTRIM BKP SW FAIL will be displayed on the EICAS.

Runaway Protection

A quick-disconnect button on each control wheel allows disconnection from the entire pitch trim system. In case of a runaway horizontal stabilizer, the button must be kept pressed until a definite disengagement is accomplished through the cutout buttons on the control pedestal.

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Inadvertent Actuation Protection

A continuous command of any trim switch is limited to 3 seconds, even if the trim switch is pressed longer than 3 seconds. As a result, when manually actuating the trim, it is necessary to release the switch after a 3-second actuation, then actuate it again to continue the trim command. This feature intends to minimize the effects of an inadvertent trim command of the main and backup trim switches or Ground Spoiler/Speed Brake Unit. The autopilot command is not limited in time and has another logic to preclude inadvertent actuation.

NOTE: For airplanes equipped with an HSCU -5009 MOD.2 or newer and AWU -5 a TRIM voice message is provided to alert pilots that the trim switch is being pressed for more than 3 seconds.

HSA Excessive Load Protection

The crew should keep the airplane trimmed to avoid excessive loads on the Horizontal Stabilizer Actuator (HSA), especially after takeoff. High loads on horizontal stabilizer may stall the HSA, inducing a temporary loss of pitch trim command.

For airplanes equipped with an HSCU P/N 362100-1007 if the trim switches are actuated for a period of time that totalizes 8 seconds during the period when the horizontal stabilizer actuator is stalled, the control unit will switch the associated system (main or backup) off and the message PIT TRIM 1 (2) INOP will be permanently displayed on the EICAS.

For airplanes equipped with an HSCU P/N 362100-1009, -5009 or newer, if the pitch trim switches are actuated during the period when the Horizontal Stabilizer Actuator is stalled, the message PIT TRIM 1 (2) INOP will be displayed on the EICAS. The message will disappear if the trim switch is released or any horizontal stabilizer motion is detected. If the trim switches are actuated for a period of time that totalizes 16 seconds during the period when the horizontal stabilizer actuator is stalled, the control unit will switch the associated system (main or backup) off and the message PIT TRIM 1 (2) INOP will be permanently displayed on the EICAS.

NOTE: For airplanes equipped with EICAS version 18 and on, the messages PIT TRIM 1 (2) INOP have been replaced with PTRIM MAIN INOP or PTRIM BACKUP INOP.

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
WARNING	PIT TRIM 1 (2) INOP	Pitch trim system 1 (main) or system 2 (backup) is inoperative, or Quick Disconnect button is kept pressed for more than 5 seconds (airplanes equipped with EICAS 17.5 only). This message will disappear after the button is released, or Pitch trim system 1 (main) or system 2 (backup) being actuated with the HSA stalled.
	PTRIM MAIN INOP (*)	Pitch trim main system is inoperative, or Quick Disconnect button is kept pressed for more than 11 seconds. This message will disappear after the button is released, or Main trim switch(es) actuation associated with the horizontal stabilizer being commanded by the backup switch, or Main trim switch being actuated with the HSA stalled.

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EICAS MESSAGES (CONTINUED)

TYPE	MESSAGE	MEANING
WARNING	PTRIM BACKUP INOP (*)	Pitch trim backup system is inoperative, or Quick Disconnect button is kept pressed for more than 11 seconds. This message will disappear after the button is released, or Backup trim switch actuation associated with horizontal stabilizer being commanded by the main channel, or Backup trim switch being actuated with the HSA stalled.
CAUTION	PTRIM CPT SW FAIL (*)	Pilot´s pitch trim switch is inoperative.
	PTRIM F/O SW FAIL (*)	Copilot´s pitch trim switch is inoperative.
	PTRIM BKP SW FAIL (*)	Pitch trim backup switch is inoperative.

(*) APPLICABLE TO AIRPLANES EQUIPPED WITH EICAS VERSION 18 AND ON.

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CONTROLS AND INDICATORS

CONTROL STAND

1 - ELEVATOR DISCONNECTION HANDLE

- When pulled, disconnects pilot's from copilot's controls.
- To pull the handle, the safety lock button must be pressed.

2 - ELEVATOR DISCONECTION LIGHT

- Illuminates to indicate that the elevator mechanism is disconnected.

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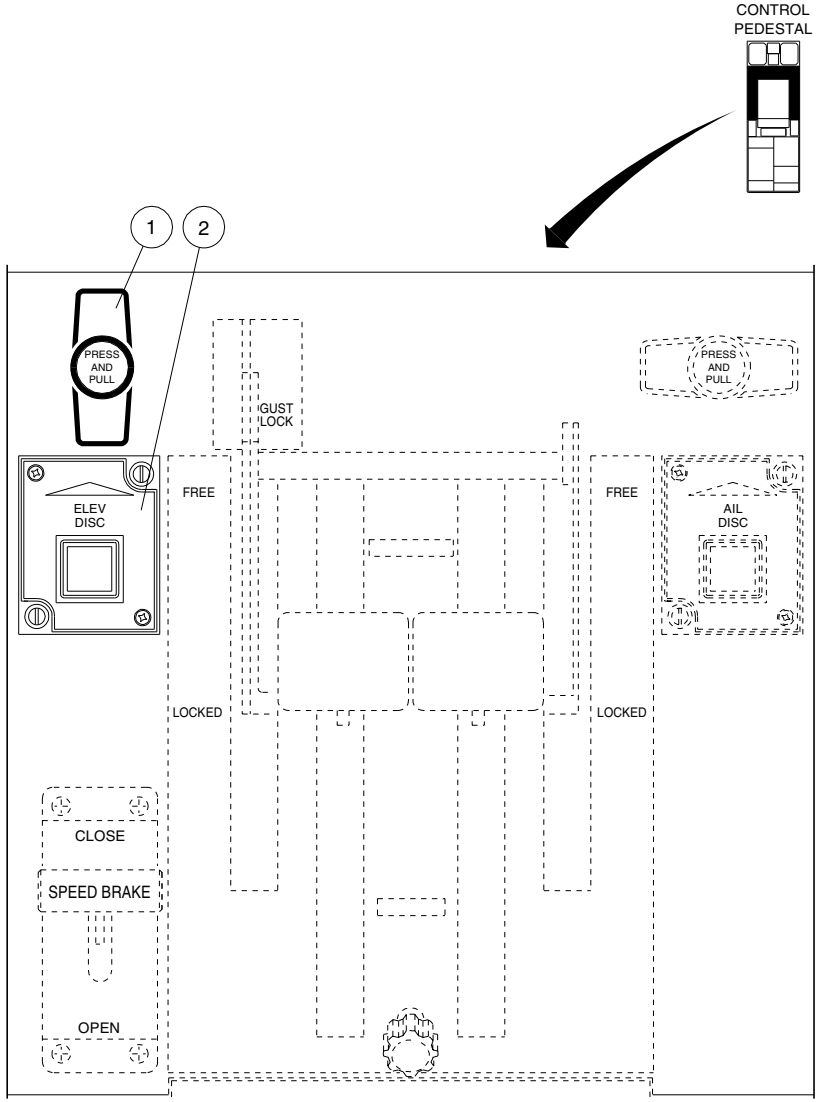

CONTROL STAND

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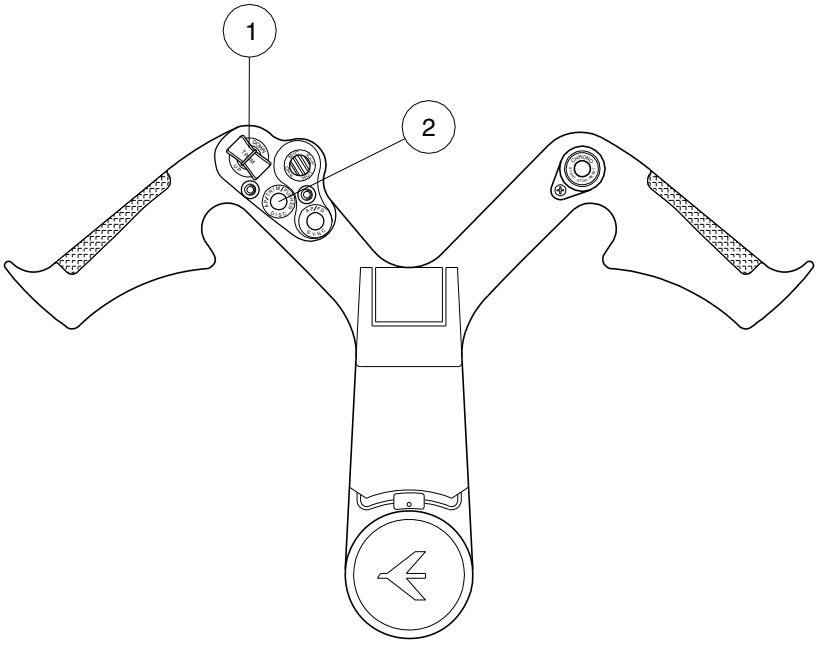
CONTROL WHEEL

1 - PITCH TRIM SWITCH (SPRING-LOADED TO NEUTRAL)

- Allows trimming the airplane when the autopilot is not engaged. The trim switch is a 3-position (UP/OFF/DN) rocker switch.
- Operating the switch while the autopilot is engaged causes the autopilot to disengage.
- It is divided into two segments, which have to be actuated together to provide command.

2 - QUICK-DISCONNECT BUTTON (MOMENTARY ACTION)

- When pressed, disconnects all trim systems.



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CONTROL PEDESTAL AFT PANEL

1 - PITCH TRIM MAIN SYSTEM CUTOUT BUTTON (SAFETY GUARDED)

- Cuts out (pushed out) or enables (pushed in) the Main Pitch Trim system.
- A striped bar illuminates inside the button to indicate that it is pushed out.
- Autopilot is not available.

2 - PITCH TRIM BACKUP SYSTEM CUTOUT BUTTON (SAFETY GUARDED)

- Cuts out (pushed out) or enables (pushed in) the Backup Pitch Trim system.
- A striped bar illuminates inside the button to indicate that it is pushed out.
- Autopilot is available.

3 - PITCH TRIM BACKUP SWITCH (SPRING-LOADED TO NEUTRAL)

- Pushed out forward or backward actuates the pitch trim through the backup channel.
- Operation of the switch while the autopilot is engaged causes the autopilot to disengage.
- It is divided into two segments, which have to be actuated together to provide command.

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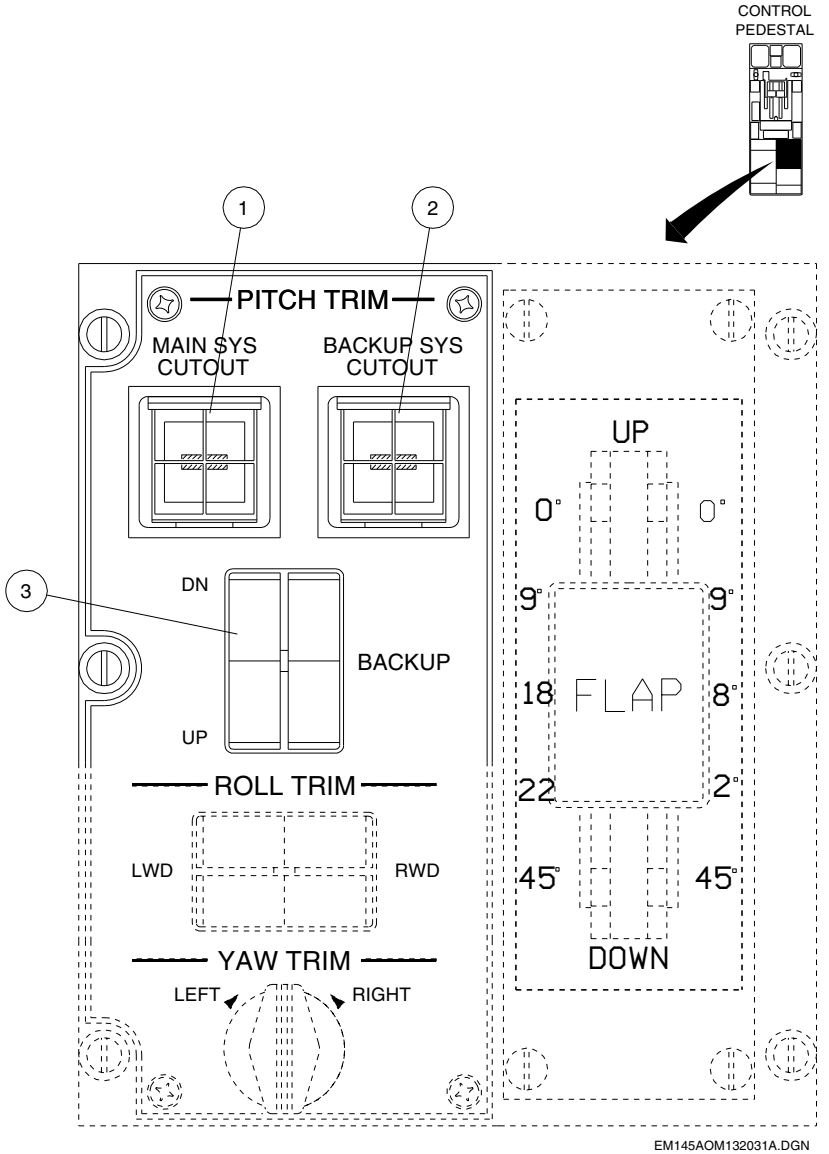

CONTROL PEDESTAL AFT PANEL

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EICAS INDICATION

1 - PITCH TRIM indication

- A green pointer moving on a white vertical scale represents the amount of pitch compensation.
- Trim position is indicated digitally in a white box.
- The letters UP or DN are presented above the box to indicate that the airplane is trimmed up or down.
- Scale ranges from 4° nose down (bottom of scale) to 10° nose up (top of scale). Every thick mark on the scale represents 3.5° of pitch.
- A green band is provided on the analog scale from 4° to 8° nose up to indicate the allowable takeoff position range for the horizontal stabilizer.

NOTE: Due to the system's resolution, it's possible to have the digits, box and pointer turning amber, in spite of the fact that the pitch trim indication is displayed at 4º or 8º. The trim setting color displayed on the EICAS depends on the horizontal stabilizer surface position. For the unit 8 displayed on the EICAS the surface position can be between 7.7° and 8.7° going upward and between 8.3° and 7.3° going downward. The color change would occur when the surface position is 8.1°. For this reason, when setting pitch trim to 8, first select 7. Then, increase slowly and stop trimming immediately when the value 8 is displayed. For the unit 4 displayed on the EICAS, the surface position can be between 3.7° and 4.7° going upward and between 4.3° and 3.3° going downward. The color change would occur when the surface position is 3.9°. For this reason, when setting pitch trim to 4, first select 5. Then, decrease slowly and stop trimming immediately when the value 4 is displayed. This procedure prevents to set the trim at the top or bottom of the green band in order to avoid the possibility of encountering takeoff config warnings.

- In the event of a pitch trim miscomparison, the pointer, digital value, and the direction indication are removed from display.
- If the pitch trim is out of the green band and the airplane is on the ground, the pointer and digital indications will turn amber.

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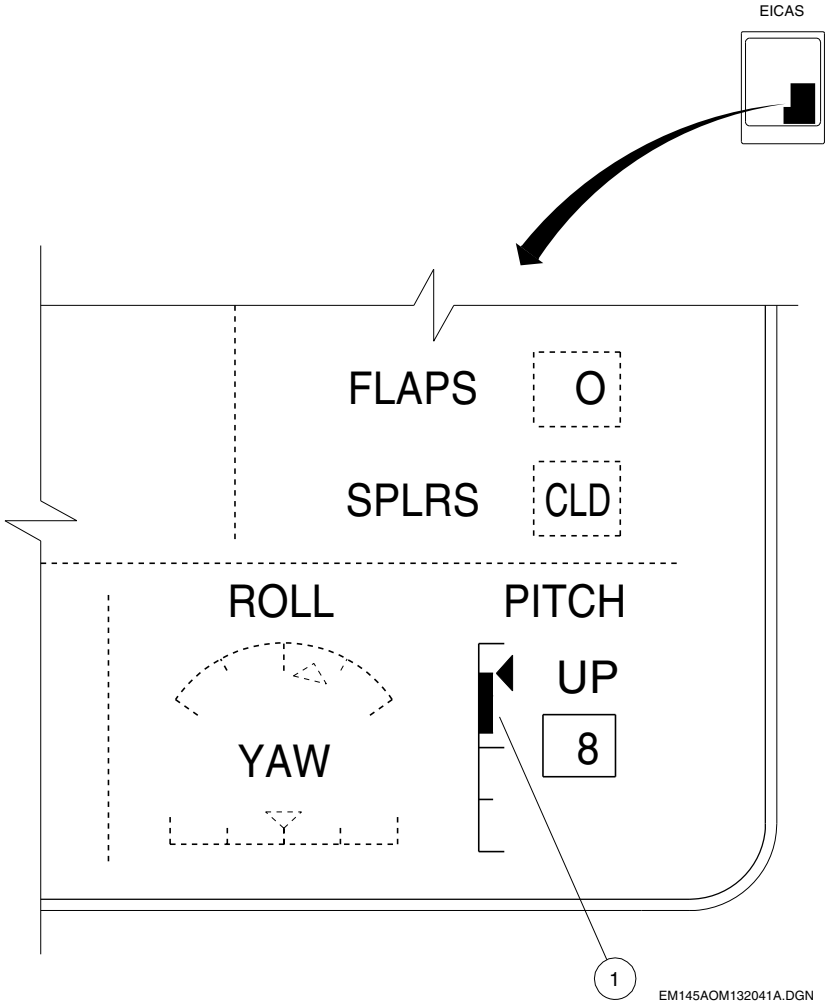
– If the airplane is on the ground, any thrust lever angle is above 60° and pitch trim is outside the green band, the digits, box, and pointer turn red, the aural warning TAKEOFF TRIM sounds and the EICAS warning message NO TAKEOFF CONFIG is displayed.



EICAS INDICATIONS

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ROLL CONTROL

Roll control is provided by hydraulically-actuated ailerons controlled by either control wheel.

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AILERON CONTROL SYSTEM

The ailerons are positioned by the pilot´s control wheels, which are linked together by a torque tube and cables to supply mechanical input to two separate hydraulic actuators.

Each aileron actuator is supplied by both hydraulic systems. Either hydraulic system is capable of providing full power control. If necessary, each hydraulic system supply can be shut off, by means of a button installed on the overhead panel. In case of loss of both hydraulic systems, rotation of the pilot´s control wheels mechanically positions the ailerons.

In case of jamming of either aileron, both panels may be disconnected through a handle located on the control pedestal. This procedure will release the free aileron from its jammed counterpart allowing the free panel to be commanded. When disconnected, an amber light illuminates on the control stand. Controls cannot be reconnected during flight, requiring maintenance action.

An autopilot servo is installed on the left side of the torque tube. The roll trim servo and the artificial feel unit are installed on the right side of the torque tube. In case of system disconnection, the artificial feel unit will actuate on the right aileron only and the autopilot must not be used. The artificial feel unit is provided to give pilots a aerodynamic load feedback imposed on the aileron surface.

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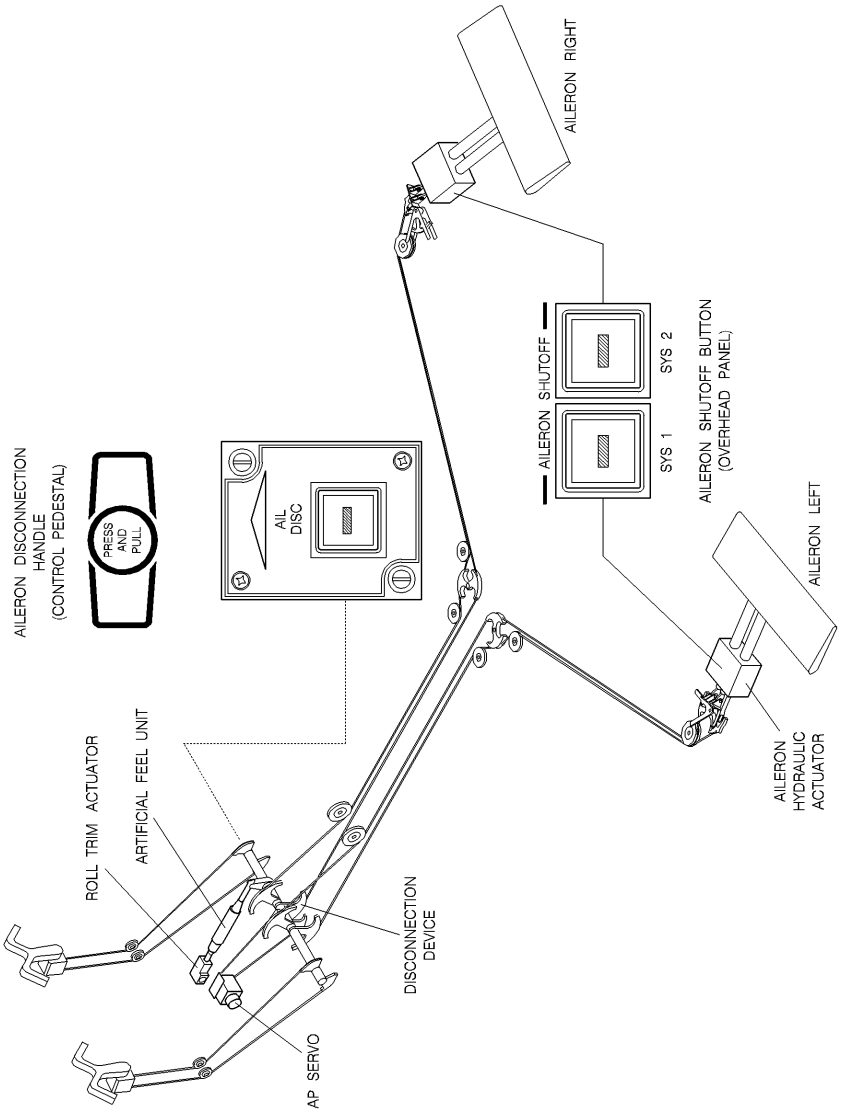

AILERON SCHEMATIC

ROLL TRIM SYSTEM

Roll trim is performed by relocating the aileron's neutral position. It is provided through an electromechanical actuator linked to the artificial feel unit and commanded through a switch on the control pedestal aft panel. If the aileron trim switches are activated with the autopilot engaged, the aileron neutral point is repositioned. When the autopilot is disengaged, the ailerons move to the repositioned aileron neutral point.

A continuous command of the roll trim switch is limited to 3 seconds, even if the trim switch is pressed longer than 3 seconds. As a result, when manually actuating the trim, it is necessary to release the switch after a 3-second actuation, then actuate it again to continue the trim command. This feature intends to minimize the effects of an inadvertent trim command failure.

When using the roll trim switch, it is necessary to command both segments simultaneously since, if just one segment is commanded, the control unit will not provide any command for the actuator.

A quick-disconnect button installed on the control wheels allows, while kept pressed, to disconnect the roll trim.

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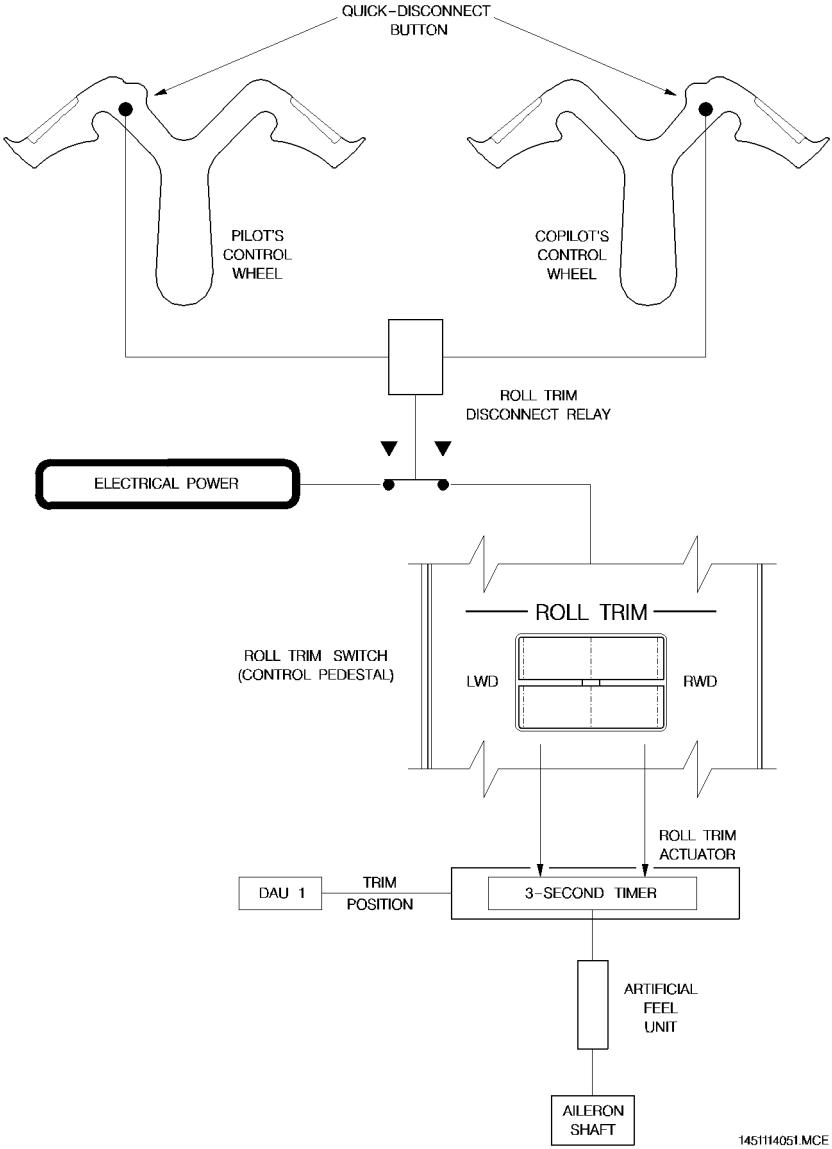


ROLL TRIM SCHEMATIC

EICAS MESSAGES

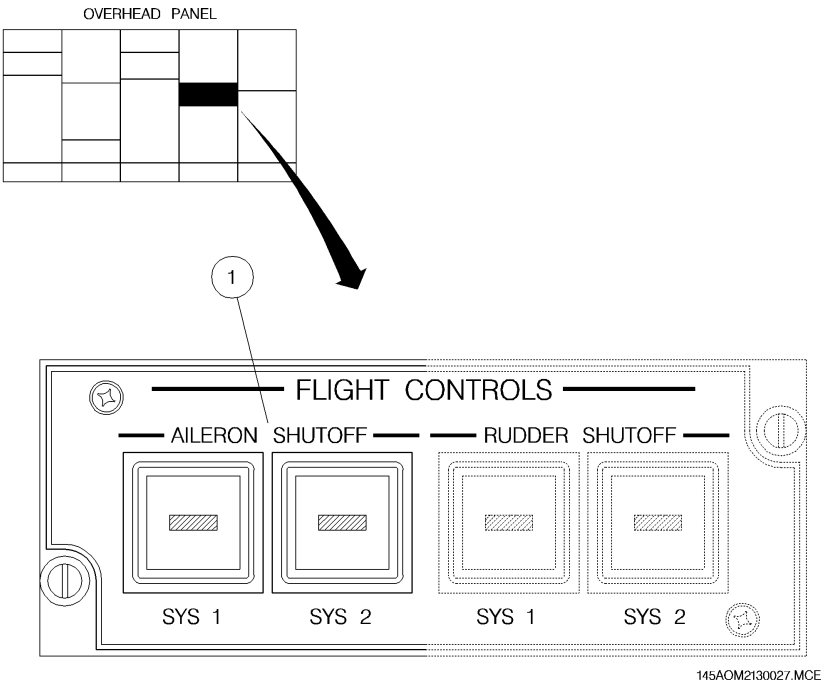
TYPE	MESSAGE	MEANING
CAUTION	AIL SYS 1 (2) INOP	Aileron actuation through hydraulic power is inoperative.

CONTROLS AND INDICATORS

FLIGHT CONTROLS PANEL

1 - AILERON SHUTOFF BUTTON

- Enables (pressed) or disables (released) the supply of hydraulic power from the associated system to the aileron units.
- A striped bar illuminates in the button to indicate that it is released.



FLIGHT CONTROLS PANEL

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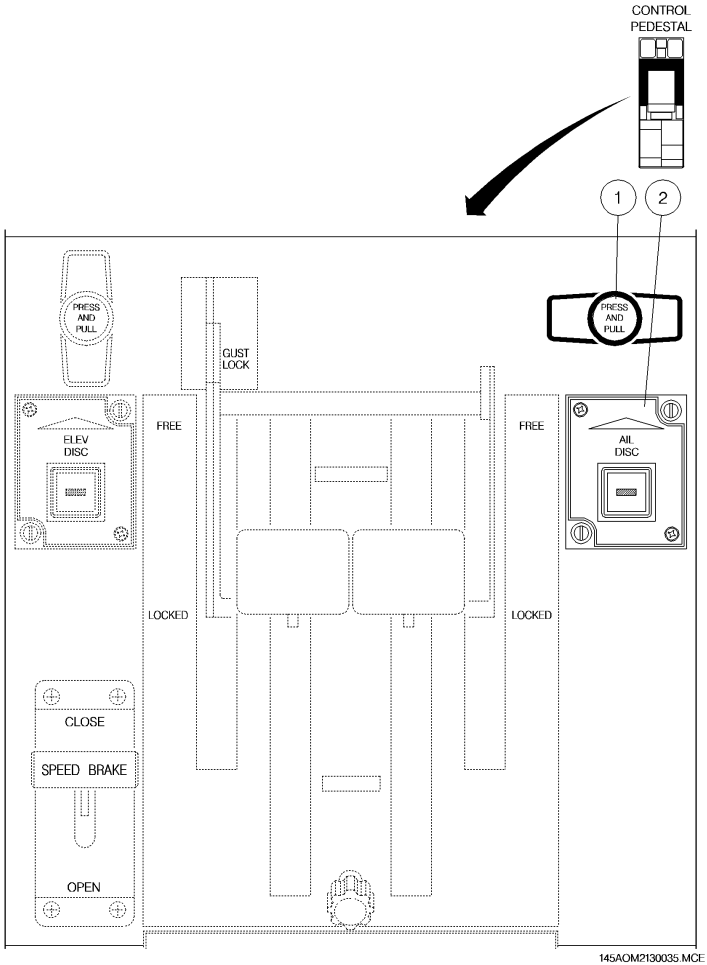
CONTROL STAND

1 - AILERON DISCONNECTION HANDLE

- When pulled, disconnects pilot's from copilot's controls.
- To pull the handle, the safety lock button must be pressed.

2 - AILERON DISCONNECTION LIGHT

- When the striped bar is illuminated, indicates that the aileron disconnection mechanism is actuated.



CONTROL STAND

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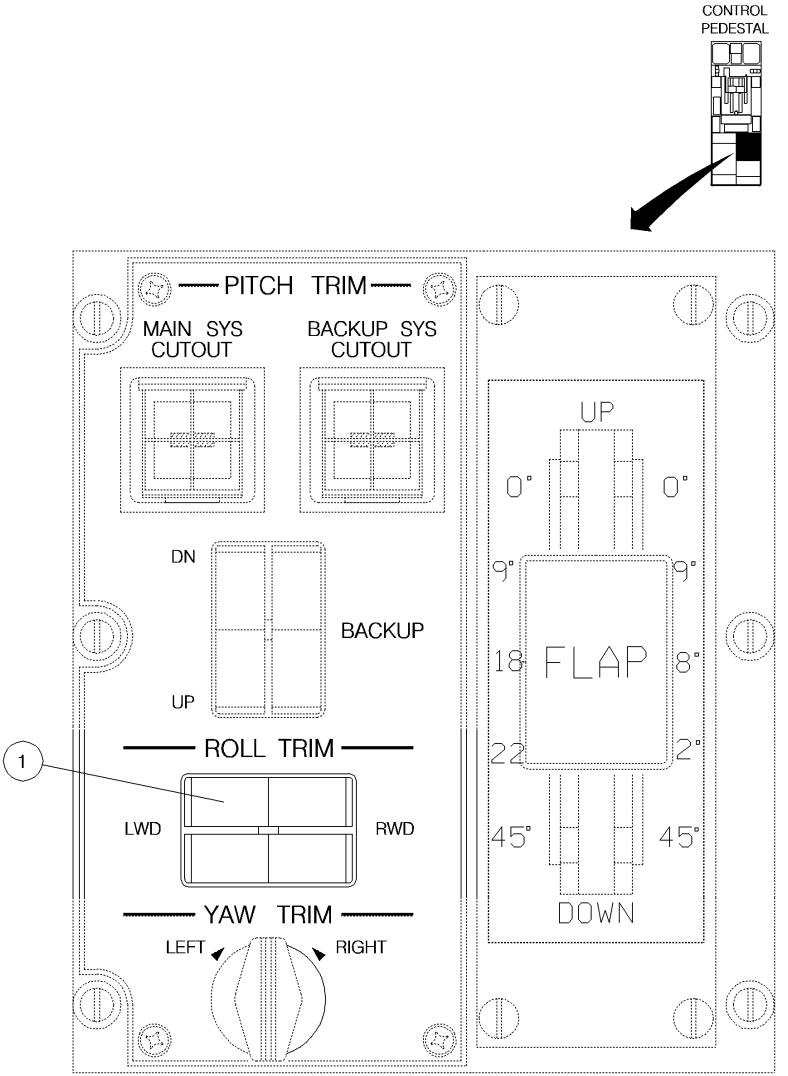
CONTROL PEDESTAL AFT PANEL

1 - ROLL TRIM SWITCH (spring-loaded to neutral)

– Pressed left or right actuates the roll trim to roll left or right.



CONTROL PEDESTAL AFT PANEL

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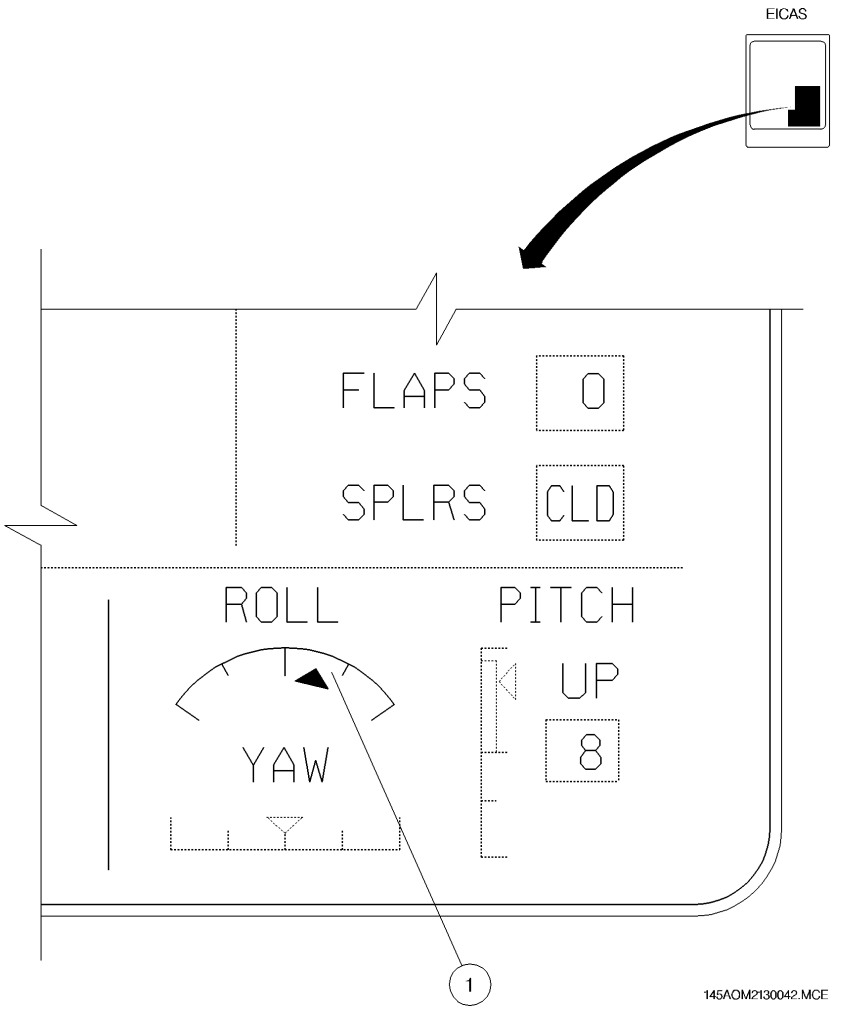
EICAS INDICATIONS

1- ROLL TRIM POSITION

- Indicated by a green pointer moving on a white semicircle scale.
- Center of the scale is zero trimming.
- Each mark represents 50% of trimming range for the associated side.



EICAS INDICATIONS

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YAW CONTROL

Yaw control is provided through hydraulically-powered rudders, which may also be mechanically commanded. A yaw trim system assists in moving and holding the rudder in the desired position.

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RUDDER CONTROL SYSTEM

Directional control about the yaw axis is provided by two in-tandem rudders. Forward rudder is driven by the control system, while the aft rudder is linked to the forward rudder and deflected as a function of forward rudder deflection. Either set of rudder pedals will position the rudder through a Power Control Unit (PCU). The mechanical control is fully duplicated, consisting of cables running from the pedals in the cockpit to the rear fuselage, where the PCU is commanded to position the forward rudder. The rudder can also be commanded through the autopilot.

The rudder PCU is a dual hydraulic unit, simultaneously powered by both hydraulic systems. Each PCU hydraulic circuit controls the hydraulic power to one respective rudder actuator. Therefore, the rudder system is divided into Rudder System 1 and Rudder System 2.

The PCU also incorporates an artificial feel device that provides the pedals with an artificial feel of the aerodynamic load imposed on the rudder.

Rudder System 1 and/or Rudder System 2 may be either manually or automatically shut off. The manual shut off operation is provided through the Rudder Shutoff Buttons, located on the Overhead Panel. The automatic shut off operation is provided through the speed switch and through the hardover protection function.

When operating under mechanical mode the aerodynamic loads on the rudder are directly transmitted to the pedals and, therefore, to the pilots. Since no rudder hydraulics control is available, artificial feel and trim functions will also not be available. Some characteristics can be observed:

– greater control forces;

– sluggish response of rudder to pedals inputs;

– backlash of rudder pedals around neutral position when changing the force application from one to the other pedal.

If either or both rudder systems are inoperative, caution messages are presented on the EICAS.

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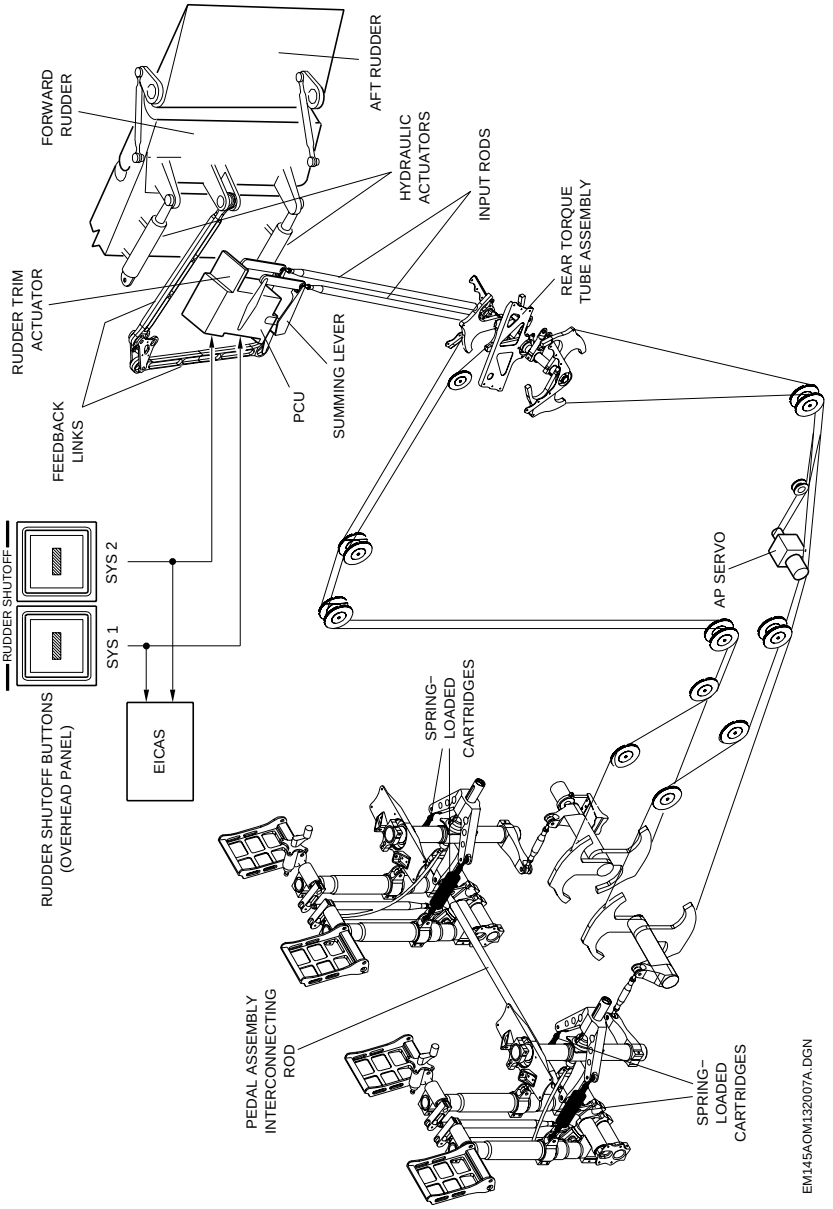

RUDDER SCHEMATIC

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AUTOMATIC SHUTOFF THROUGH THE SPEED SWITCH

During normal operation both systems are powered at speeds below 135 KIAS. Above 135 KIAS, Rudder System 1 is automatically shut off.

If the automatic shut off fails to shut off a system above 135 KIAS, a caution message is presented on the EICAS. In this case, it is necessary to manually shut off system 1 or 2, according to the checklist.

If Rudder System 2 hydraulic power supply fails, Rudder System 1 automatically takes over the rudder and an associated caution message is presented on the EICAS.

RUDDER HARDOVER PROTECTION

The rudder hardover protection function automatically selects the mechanical reversion mode as a function of pedal input force, rudder deflection, and airplane engine operation (two or single-engine operation). This feature was designed to activate in case of a runaway rudder and a caution message is presented on the EICAS.

The rudder systems are automatically shut off if all conditions below are met simultaneously:

- Rudder deflected above 5°±1°.
- Force above 59 kg (130 lb) on the pedal to counteract rudder deflection.
- Both engines running above 56% N2.

CAUTION: DO NOT RESET THE RUDDER SYSTEMS IF THE MECHANICAL REVERSION MODE WAS RESULTANT OF A RUDDER RUNAWAY FOLLOWED BY THE HARDOVER PROTECTION ACTIVATION.

If mechanical reversion mode was not resultant of a rudder runaway followed by hardover protection activation, a reset function is available on the Overhead Panel, by pressing both Rudder Shutoff Buttons off and on again.

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The following remarks are applicable to the rudder hardover protection:

– The signal from the Pedal Spring-Loaded Cartridges to shut off the rudder systems are applicable only if the pilots are applying force to one side with the rudder deflected above 5° ± 1° to the opposite side. If pilot command input and the rudder deflection are in the same direction, the system will not be shut off, regardless of how strong the pilot input.
– During single-engine operation, when the rudder system is more significantly required, the rudder hardover protection is disabled and the RUD HDOV PROTFAIL caution message may be presented on the EICAS.
– If a disagreement between FADECs from the same engine occurs, rudder hardover protection is deactivated and the RUD HDOV PROTFAIL caution message is presented on the EICAS.

RUDDER DEFLECTION

AIRPLANES UNDER ANAC AND FAA CERTIFICATION

The rudder's main control primary stops, limit rudder deflection at ± 15° on ground or in flight.

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YAW TRIM SYSTEM

Yaw trim is accomplished by an electromechanical actuator, which receives signals from the yaw trim knob.

A continuous command of the yaw trim knob is limited to 3 seconds, even if the trim knob is actuated longer than 3 seconds. As a result, when manually actuating the trim, it is necessary to release the knob after a 3-second actuation, then actuate it again to continue the trim command. This feature intends to minimize the effects of an inadvertent trim command failure.

Yaw trim position is presented on EICAS display.

A quick-disconnect button installed on the control wheels allows, while kept pressed, disconnecting the yaw trim.

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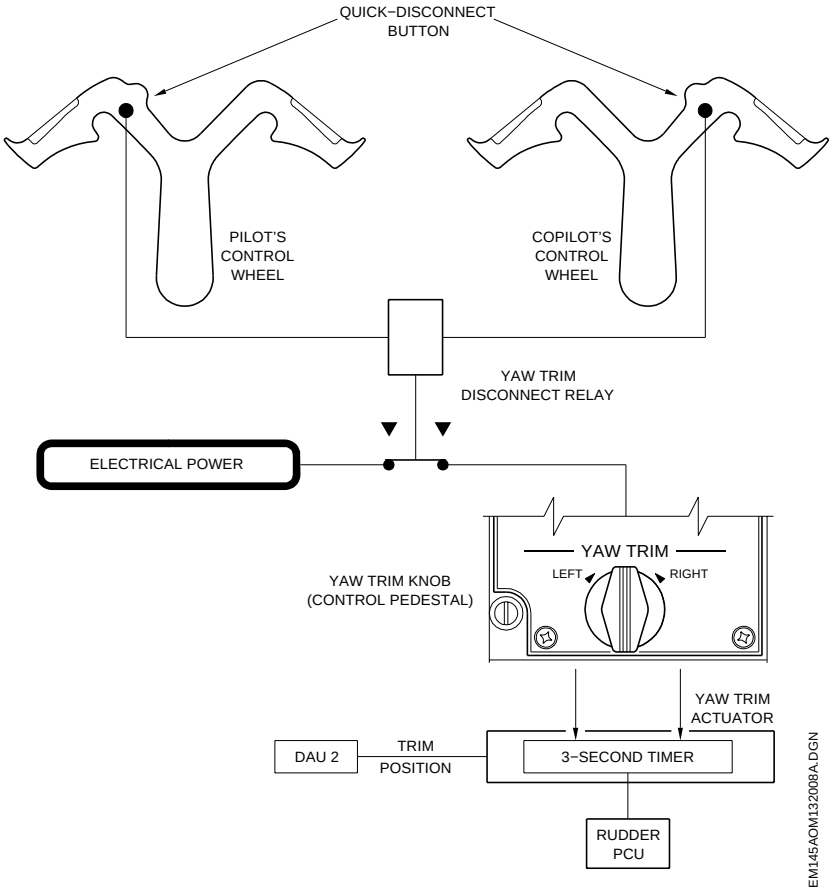

YAW TRIM SCHEMATIC

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	RUDDER SYS 1 INOP	Rudder System 1 is inoperative. Message is presented under the following conditions: –Below 135 KIAS. –Above 135 KIAS if airspeed of both ADC's is invalid.
	RUDDER SYS 2 INOP	Rudder System 2 is inoperative.
	RUDDER SYS 1–2 INOP	Both Rudder Systems are inoperative.
	RUDDER OVERBOOST	Both rudder systems hydraulic actuators are pressurized above 135 KIAS.
	RUD HDOV PROTFAIL	–Disagreement between both FADECs of a same engine. –Rudder position micro-switches indicate rudder to right and left simultaneously.

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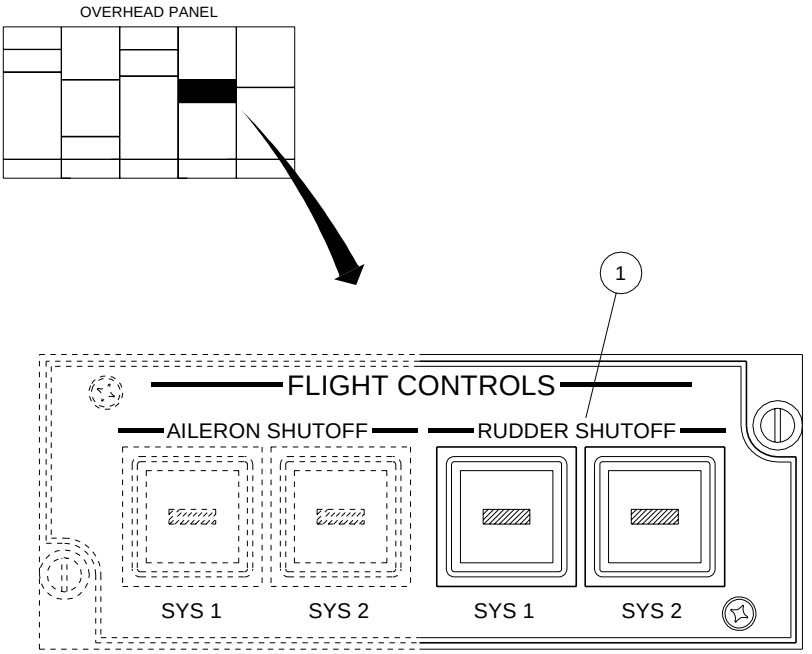
CONTROLS AND INDICATORS

FLIGHT CONTROLS PANEL

1 - RUDDER SHUTOFF BUTTON

- Enables (pressed) or disables (released) the associated rudder hydraulic actuator.
- A striped bar illuminates in the button to indicate that it is released.



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FLIGHT CONTROLS PANEL

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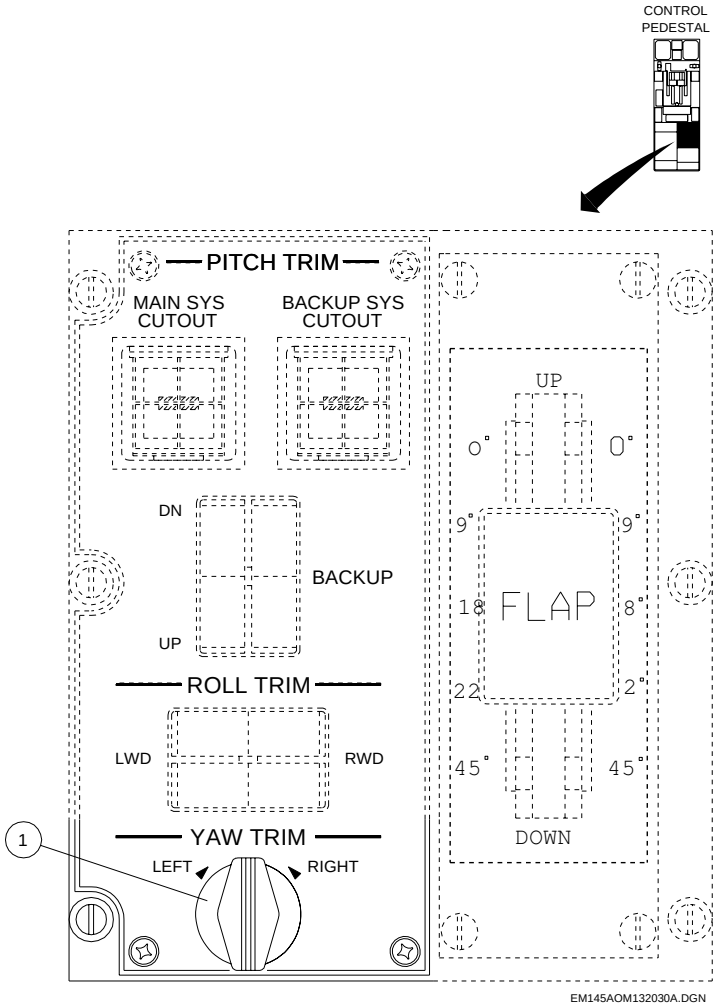
CONTROL PEDESTAL AFT PANEL

1 - YAW TRIM KNOB (spring-loaded to neutral)

– Rotated clockwise or counterclockwise actuates the yaw trim, right or left.



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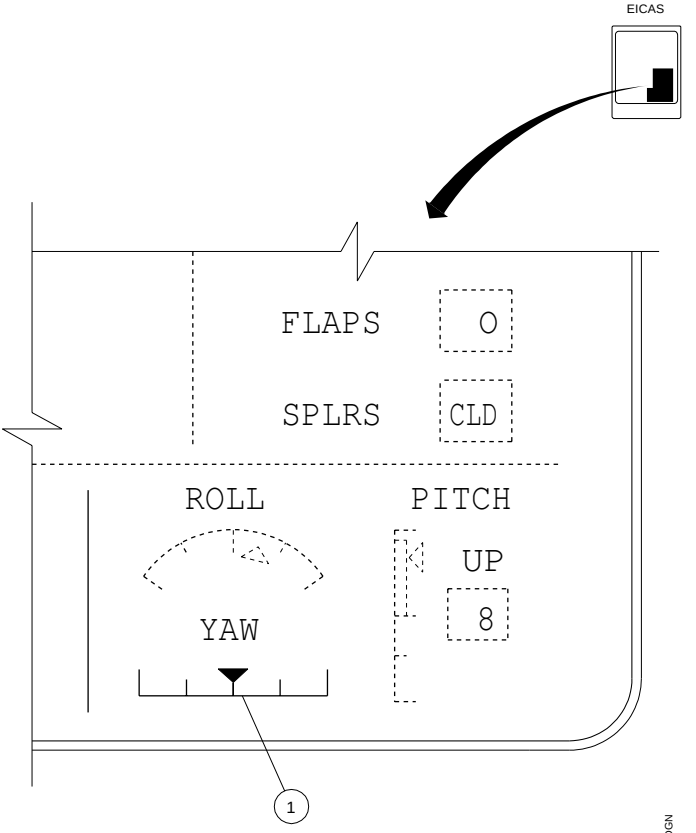
EICAS INDICATIONS

1- YAW TRIM POSITION

- Indicated by a green pointer moving on a horizontal scale.
- Center of the scale is zero trimming.
- Each mark represents 50% of trimming range for the associated side.



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GUST LOCK SYSTEM

A gust lock system is provided to lock the elevator to avoid damage to elevator components in the case the aircraft is subject to strong gusts on the ground. The aileron and rudder surfaces do not need to be mechanically locked since their actuation systems naturally damp any undesired movement.

There are two different gust lock systems:

- Mechanical Gust Lock System
- Electromechanical Gust Lock System

MECHANICAL GUST LOCK SYSTEM

The gust lock system is mechanically-actuated and can be identified by a yellow lever on the control pedestal with the inscription GUST LOCK. The mechanical gust lock actuates on the torque tube which is attached to the control column.

To lock the elevator, the control column must be pushed and held fully forward and the gust lock lever moved backwards from the FREE to LOCKED position. Aside locking the elevators, it also restricts both thrust levers to a minimum thrust above IDLE position.

To unlock the system, push the control column forward while the safety lock device is lifted and the lever is moved forward from the LOCKED to FREE position.

ELECTROMECHANICAL GUST LOCK SYSTEM

The electromechanical gust lock can be identified by a yellow and black striped safety lock device on the control pedestal with the inscription ELEC GUST LOCK, and by two indication lights on the glareshield panel.

The electromechanical gust lock acts directly on the elevator panels, preventing them from moving. Basically, the system is composed of locking pins driven by an electromechanical actuator, which is commanded by the gust lock lever. Gust lock system operation (locking and unlocking) is possible on the ground only. Once airborne, the system is deenergized to prevent gust lock lever movement and inadvertent actuation.

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The gust lock indication lights located on the glareshield panel illuminate to indicate the unlocking cycle or when a failure in the system occurs or when it is pressed for test. For airplanes Post-Mod. SB 145-27-0101 or equipped with an equivalent modification factory incorporated, when the TLA is higher than 59° and the gust lock system is still locked, the lights will illuminate indicating that an unlocking cycle has initiated.

When the gust lock lever is at locked position, the thrust levers are prevented from moving beyond the thrust setting needed for ground maneuvering. However, the gust lock lever was designed to allow extra travel for one of the thrust levers. For Airplanes Post-Mod. SB 145-27-0115 or equipped with an equivalent modification factory incorporated, depending on how the gust lock lever is installed, it allows the pilot to choose the thrust lever to have extra travel to be used during taxi.

For airplanes Post-Mod. SB 145-27-0126 or equipped with an equivalent modification factory incorporated, a movable stop member installed on the gust lock lever limits the movement for one of the thrust levers at a time, allowing pilots to operate single engine taxi.

When the movable stop member is on the RH side of the thrust levers, the pilot may perform a single engine taxi with engine 1 running, and vice-versa.

The system is fed by DC Bus 2 and has a dedicated circuit breaker, located on the overhead circuit breaker panel.

LOCKING OPERATION

To lock the elevator proceed as follows:

A. Pull the control column backwards to any position from neutral to full nose up.

B. Lift the safety lock device (1) and move the gust lock lever from the unlocked (FREE) to the locked position (2).

C. Push the control column fully forward until the control column movement is restricted. Locking is completed.

NOTE: During the locking operation, indication lights remain off.

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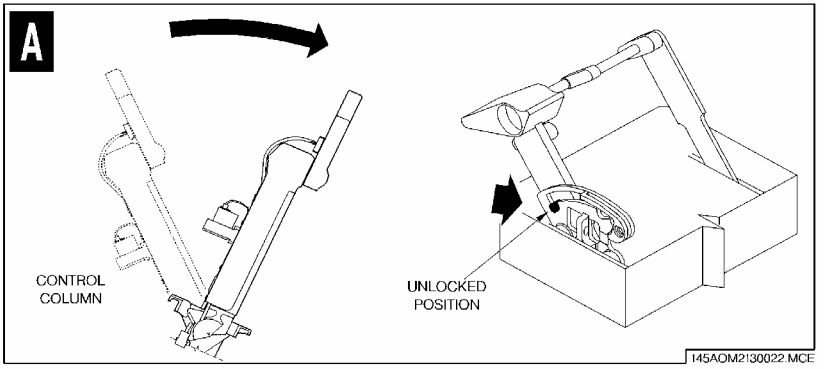
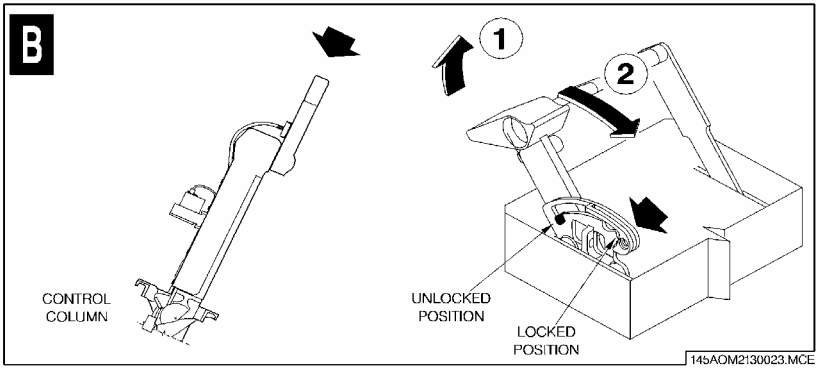
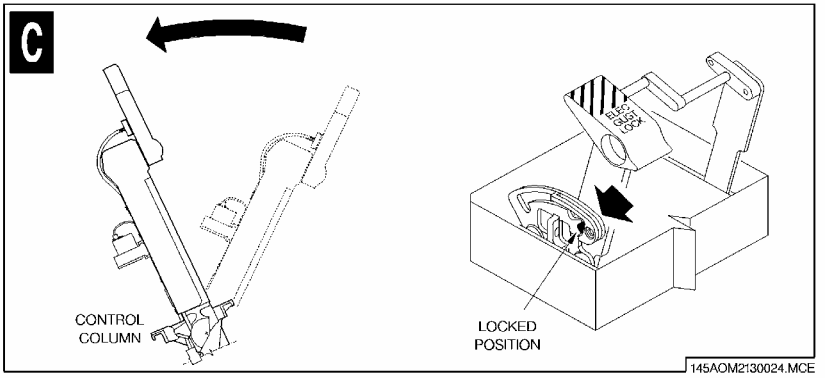
TO LOCK:







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UNLOCKING OPERATION

To unlock the elevator proceed as follows:

A. Lift the safety lock device (1) and move the gust lock lever to its intermediate detented position (2).

B. At this position, the locking pins are commanded to open and the elevators will be unlocked after approximately 10 seconds. The indication lights will illuminate during the unlocking cycle, remaining off after that.
After the indication lights go off, pull the control column backwards to any position from neutral to full nose up.

C. Lift the safety lock device (3) and pull the gust lock lever from the intermediate position to its full forward inflight resting position (4), completing the unlocking cycle.

NOTE: Gust lock lever command from the intermediate to the unlocked (FREE) position is not possible prior to pulling column rearward.

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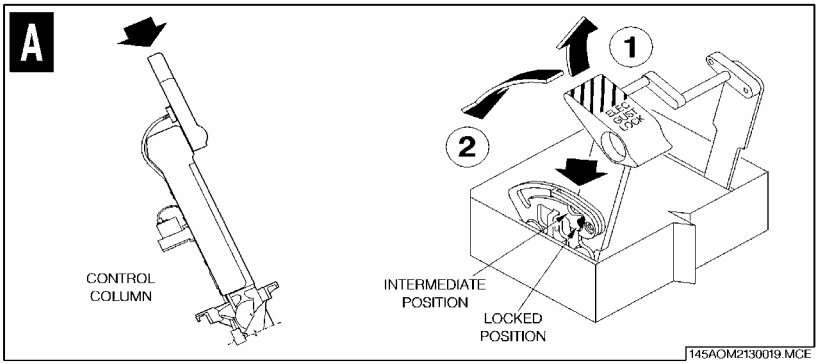
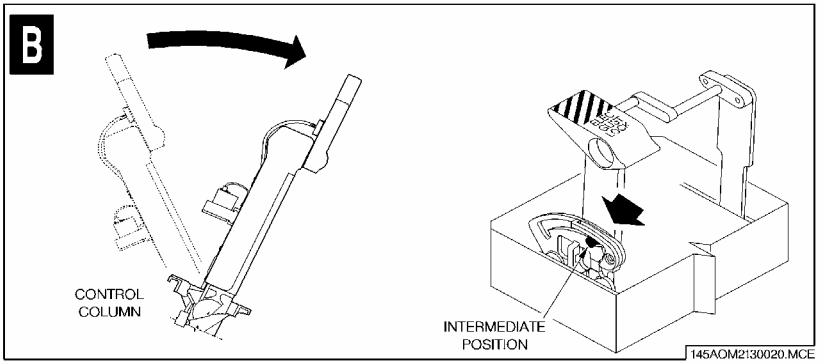
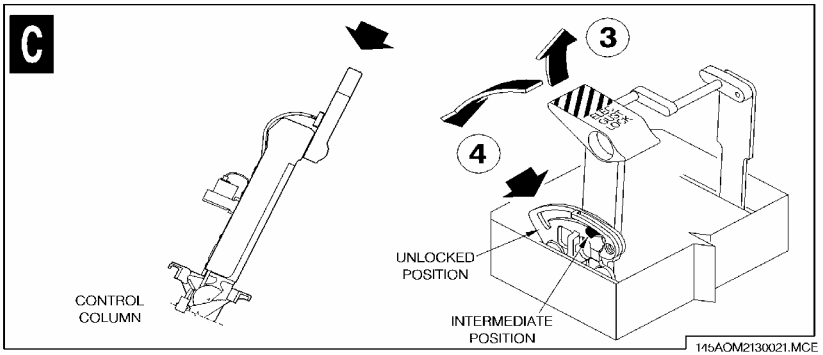
TO UNLOCK:







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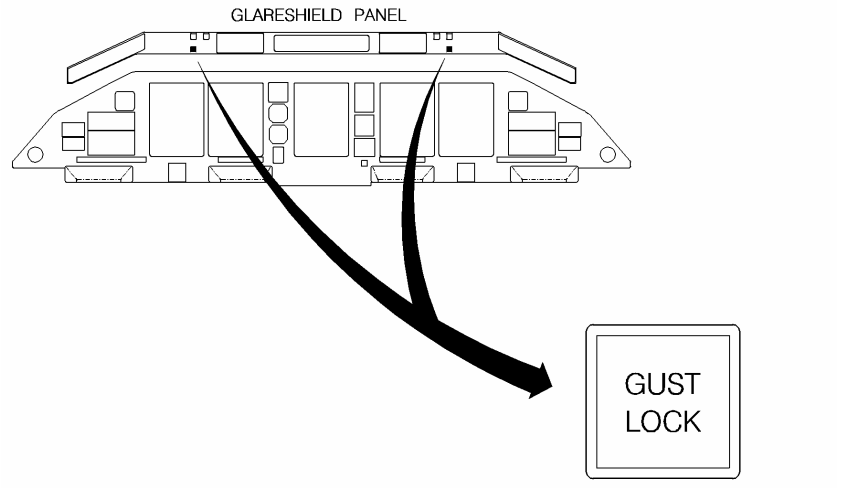
CONTROLS AND INDICATORS

GLARESHIELD PANEL

GUST LOCK INDICATION LIGHTS (*)

- Color: amber
- Illuminates during the unlocking cycle to indicate that the locking pins were commanded to unlock the elevator surfaces.
- Illuminates in case of failure.
- Illuminates when it is pressed.

NOTE: For airplanes Post-Mod. SB 145-27-0125 or with an equivalent modification factory incorporated, the Gust Lock Caution Lights remain blinking until unlocking cycle is completed. This cycle is completed with the gust lock lever at unlocked position (full forward).



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(*) Applicable only to airplanes equipped with electromechanical gust lock system.

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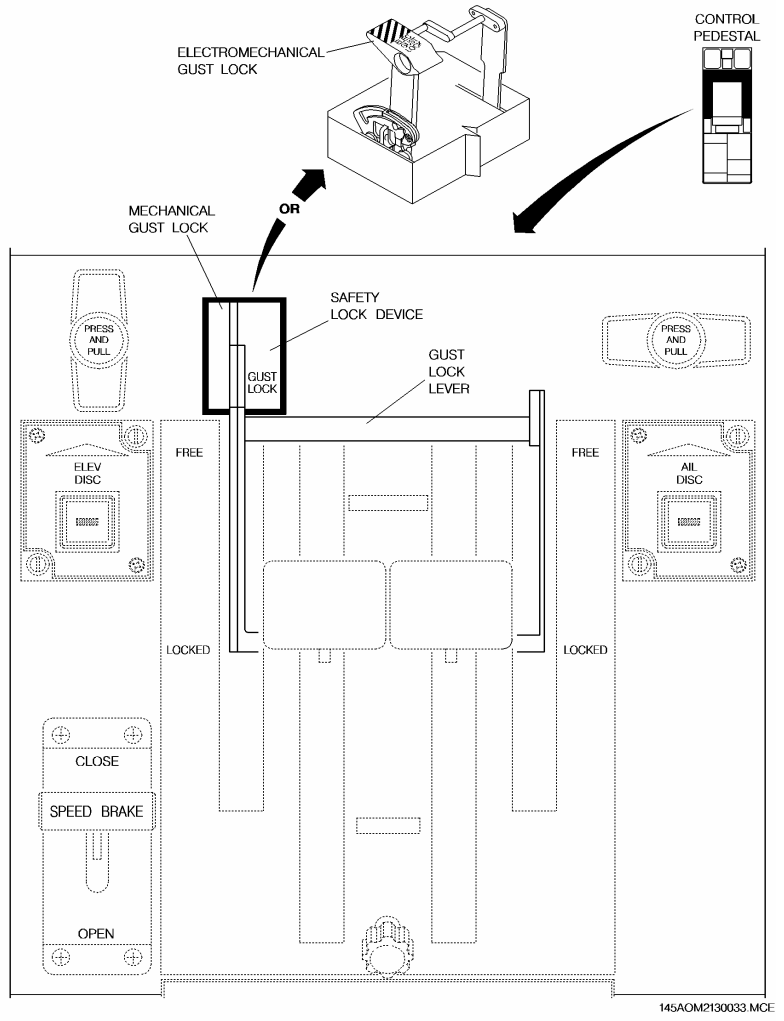
CONTROL STAND

GUST LOCK LEVER

- Actuated backward, locks both elevator and thrust control levers.
- The safety lock has to be lifted to move the lever.



CONTROL STAND

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FLAP SYSTEM

The flaps are electrically operated, consisting of two double-slotted flap panels installed to each wing.

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FLAP SYSTEM OPERATION

The Flap Selector Lever provides five detent settings at 0°, 9°, 18°, 22° and 45° positions. Intermediate positions cannot be selected. When any position is selected, the selector lever signals to the Flap Electronic Control Unit (FECU) to move the flap panels. The FECU also monitors system failures and flap position, sending signals to the EICAS and other related systems.

Flap Power and Drive Unit (FPDU) drive the flap panels. The FPDU is a gearbox with two electric motors connected to that unit. Each motor is controlled by the FECU through one independent channel. Both motors drive all the flap actuators through flexible shafts. If a motor, or its associated FECU control channel, or associated velocity sensor or transmission brake fail, the affected channel is disengaged and its associated motor actuation is interrupted. The remaining motor can drive all flap panels at half speed. An EICAS message is presented to indicate that flaps are being moved at a lower speed. If both motors or control channels fail, an EICAS message is presented to indicate that the system is inoperative.

Flap actuators are torque-limited to safeguard structure against excessive loading should flaps or actuators jam. Velocity sensors installed at the end of the flexible shafts detect panels asymmetry. In such cases, the system is disabled.

On the ground a protection circuit prevents flap movement when the airplane is energized and a disagreement is detected between flap position and flap selector lever. To override such protection, it is necessary to lift up and release the flap selector lever.

Two switches on the Flap Selector Lever send signals to the Landing Gear Warning System to alert pilots any time the airplane is in a landing configuration and the gear legs are not locked down.

Flap position is shown on the EICAS display. There are also flap marks on the wing trailing edge, indicating 9° and 22°, which becomes visible when flap moves to those positions.

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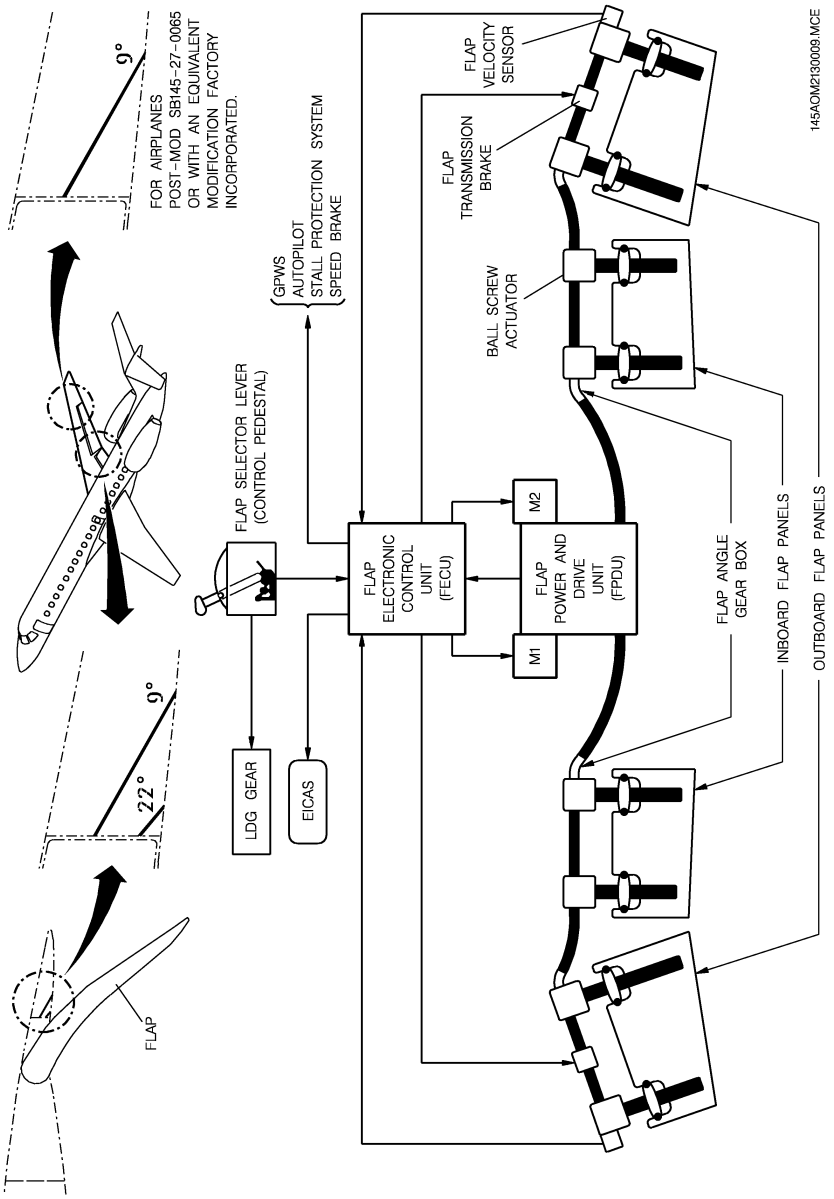

FLAP SCHEMATIC

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	FLAP FAIL	Both flap channels are inoperative.
ADVISORY	FLAP LOW SPEED	One flap channel is inoperative.

FLAP AURAL WARNING (TAKEOFF FLAPS)

If the airplane is on the ground, any thrust lever angle is above 60° and the flaps are not in the certified takeoff position, the digits, box, and pointer turn red, and the aural warning TAKEOFF FLAPS sounds. In addition, only for flaps position of 0° and 45°, the EICAS warning message NO TAKEOFF CONFIG is displayed.

CONTROLS AND INDICATORS

CONTROL PEDESTAL AFT PANEL

1 - FLAP SELECTOR LEVER

- Moved to the detent positions, selects each discrete flap position.
- To move the lever it is necessary to pull it up.
- Intermediate positions are not enabled.

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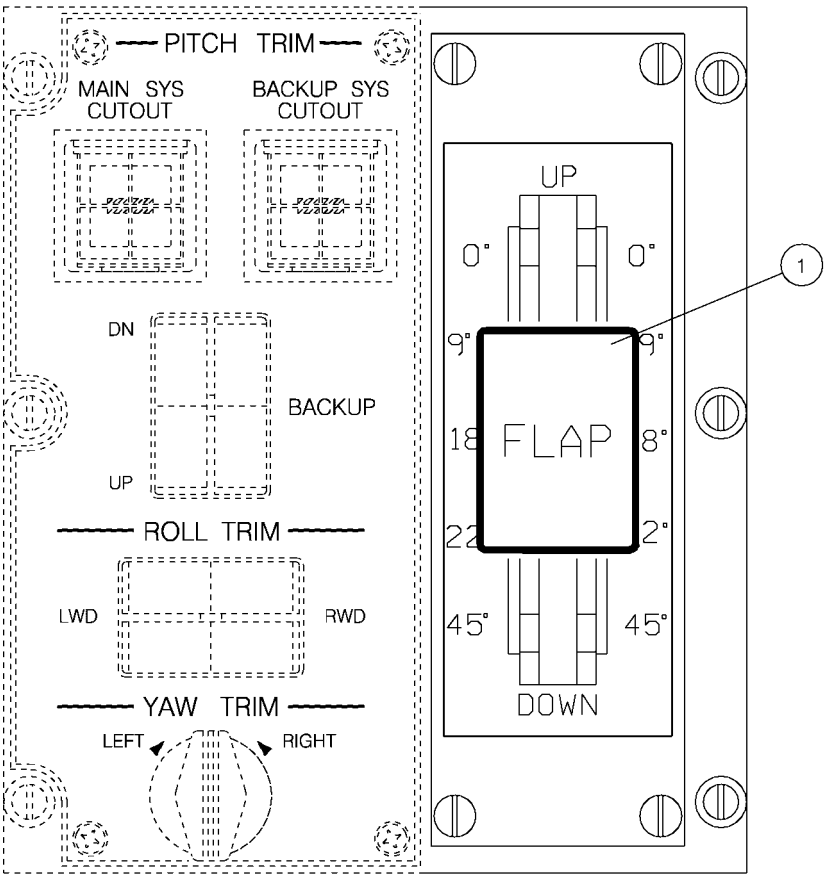

CONTROL PEDESTAL AFT PANEL

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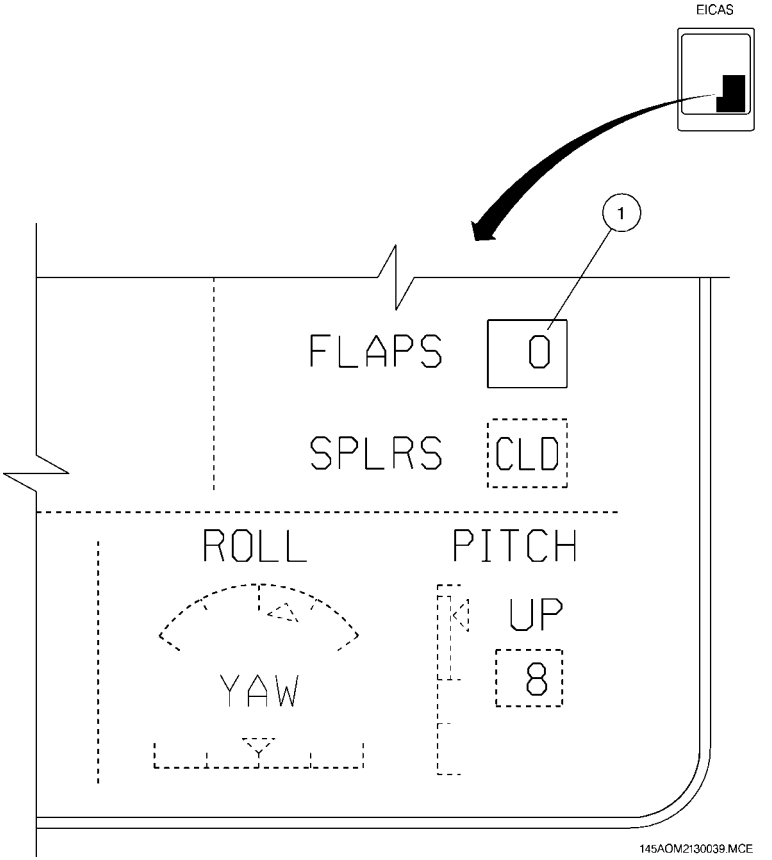
EICAS INDICATIONS

1- FLAPS POSITION

- Ranges from 0° to 45°, with discrete indication on 0°, 9°, 18°, 22° and 45°.
- Colors:
  - Box: white.
  - Digits: - green (except 0, which is white).
    - changes to a green dash when flaps are in transit.
- In-transit flap position is replaced by the actual flap position if flap fails.
- If data is invalid, digits are replaced by amber dashes and box becomes amber.



EICAS INDICATIONS

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SPOILER SYSTEM

Spoiler system consists of speed brake and ground spoiler subsystems. Speed brakes allow increased descent rate and assist in decelerating the airplane. Ground spoilers destroy lift, thus providing better braking effectiveness.

Spoilers are electrically commanded and hydraulically actuated. A Spoiler Control Unit is responsible for permitting the spoiler panels to open or not. Four spoiler panels are provided, two per wing surface. The outboard spoilers provide both speed brake and ground spoiler functions, while the inboard spoilers provide only a ground spoiler function. The actuation of either subsystem is fully independent.

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GROUND SPOILER

The Spoiler Control Unit (SCU) automatically performs ground spoiler opening, without pilots' interference. The SCU enables the ground spoilers to open whenever the following conditions are met:

– Airplane on the ground.
– Main landing gear wheels running above 25 kt.
– Both engines thrust lever angles set to below 30° or both engines N2 below 56%.

If any of those conditions is not met, the ground spoilers will not open. A status indication is presented on the EICAS to indicate that the spoilers are open or closed. If a failure is detected, a caution message is presented on the EICAS.

SPEED BRAKE

When speed brake is commanded with autopilot engaged, the auto pitch trim is provided through the autopilot; when the autopilot is not engaged the Spoiler Control Unit provides the auto pitch trim command.

The speed brakes will open when the speed brake lever is set to open and the following conditions are met:

– Thrust lever angle of both engines set to below 50°.
– Flaps at 0° or 9°.

If the speed brake lever is commanded to the OPEN position and any of the speed brake open condition is not met, the speed brake panels are kept closed and a caution message is presented on the EICAS. If the speed brake panels are open and any of the speed brake open condition is not met, the speed brake panels automatically close and an EICAS message is presented. In both cases, the speed brake lever must be moved to the CLOSE position to remove the EICAS message.

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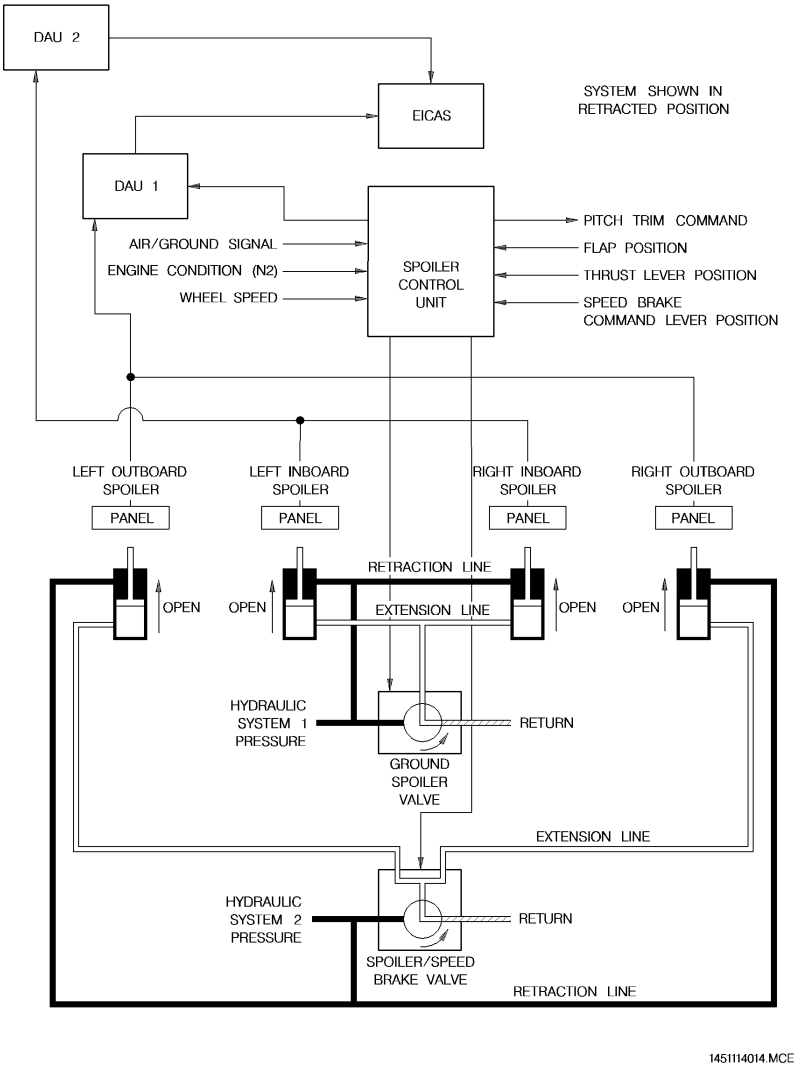

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SPOILER SYSTEM SCHEMATIC

EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	SPOILER FAIL	Any spoiler panel open inadvertently, failed to open or any failure in the input signals.
	SPBK LVR DISAGREE	Speed Brake Lever commanded to OPEN but opening logic is not satisfied.

SPOILER AURAL WARNING (TAKEOFF SPOILERS)

If the airplane is on the ground, any thrust lever angle is above 60° and any spoiler/speed brake panel is deployed, the digits, box, and pointer turn red, the aural warning TAKEOFF SPOILERS sounds and the EICAS warning message NO TAKEOFF CONFIG is displayed.

CONTROLS AND INDICATORS

CONTROL STAND

1 - SPEED BRAKE LEVER

– Actuated to the OPEN position commands outboard spoiler panels to open, provided enabling conditions are met.

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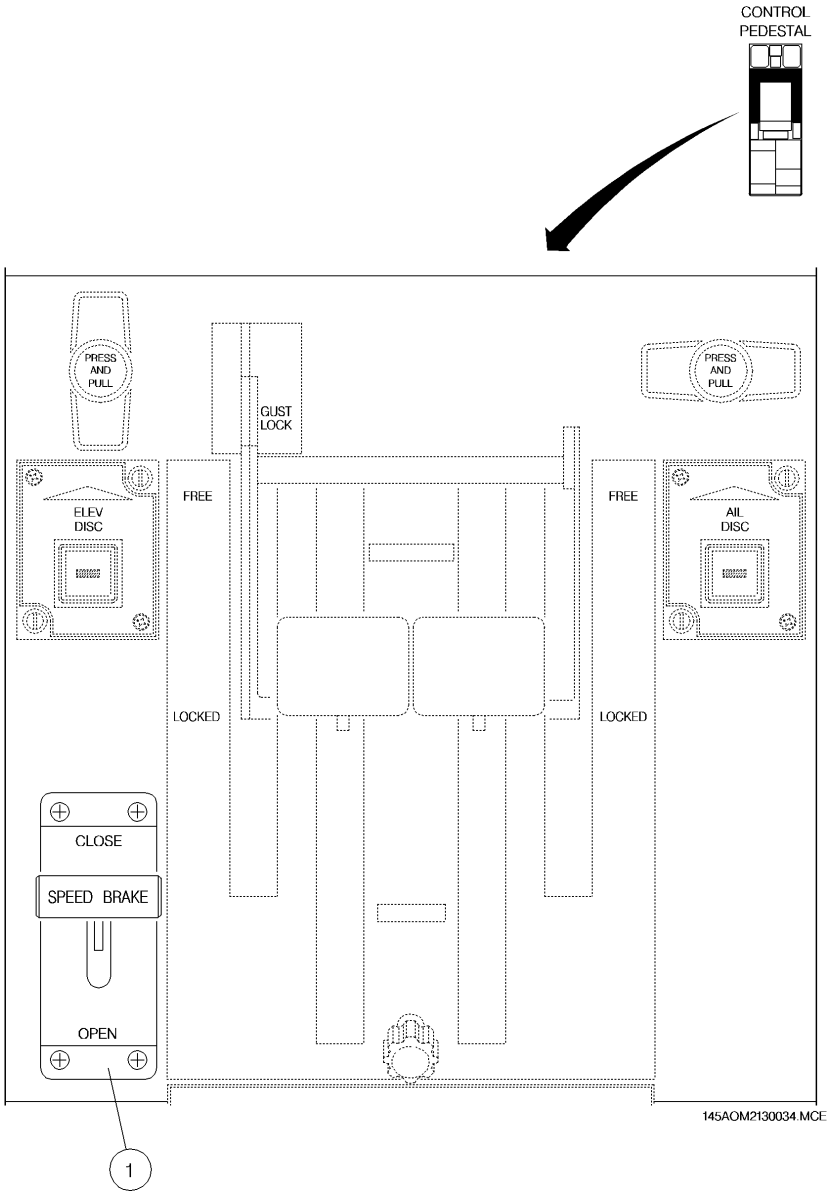

CONTROL STAND

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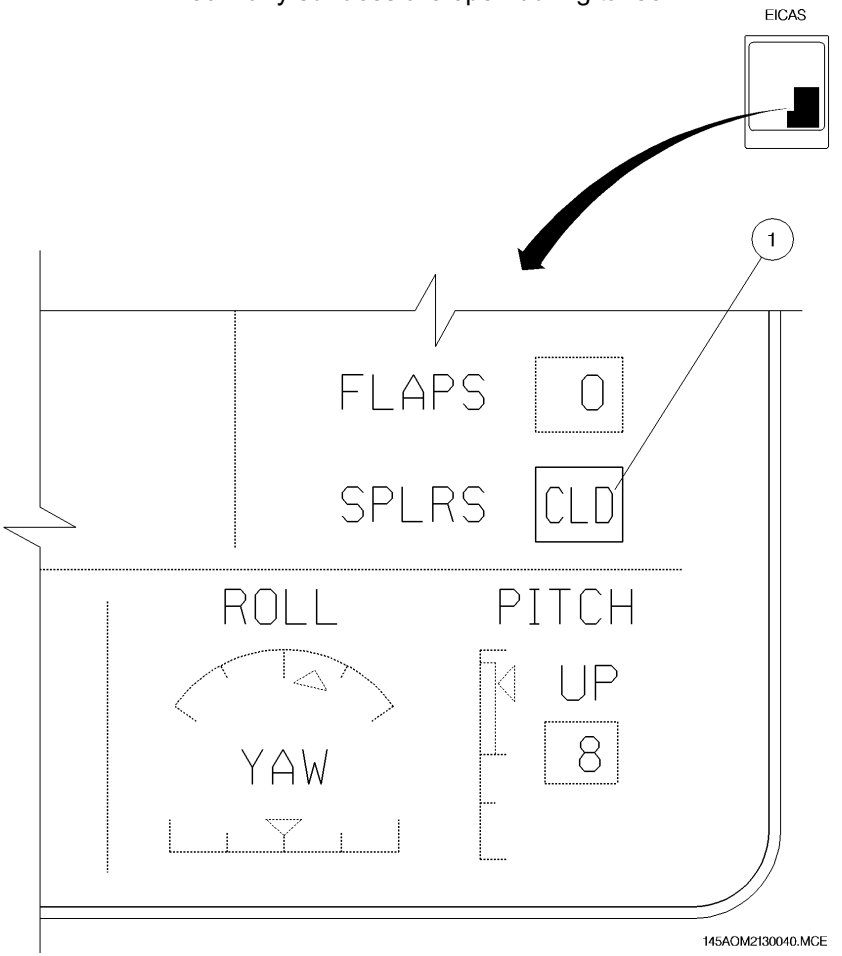
EICAS INDICATIONS

1- SPOILERS INDICATION

- Displays OPN when any of the surfaces are open, or CLD when all of the surfaces are closed.
- Colors:
  - Box: white.
  - CLD: white.
  - OPN: - green in normal condition.
    - red if any surfaces are open during takeoff.



EICAS INDICATIONS

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SECTION 2-14

PNEUMATICS, AIR CONDITIONING AND PRESSURIZATION

TABLE OF CONTENTS

Block Page

General ..... 2-14-05 ..01
Pneumatic System ..... 2-14-05 ..02
Pneumatic System Function Logic ..... 2-14-05 ..06
Cross Bleed Valve Operational Logic ..... 2-14-05 . 6A
EICAS Messages ..... 2-14-05 ..07
Air Conditioning System ..... 2-14-10 ..01
ECU Operation ..... 2-14-10 ..02
Cabin Temperature Control ..... 2-14-10 ..05
Air Conditioning Distribution ..... 2-14-10 ..06
Pack Valve Operational Logic ..... 2-14-10 ..08

EICAS Messages ..... 2-14-10 ..11
Controls and Indicators ..... 2-14-10 ..13
Environmental Control System (ECS)
and Pneumatic Page on the MFD ..... 2-14-10 ..16
Attendant´s Control Panel ..... 2-14-10 ..18
Pressurization System ..... 2-14-15 ..01
Operation in Automatic Mode ..... 2-14-15 ..02
Operation in Manual Mode ..... 2-14-15 ..07
EICAS Messages ..... 2-14-15 ..08
Controls and Indicators ..... 2-14-15 ..08
Electronic Bay Cooling System ..... 2-14-20 ..01
Forward Electronic Bay ..... 2-14-20 ..01
Rear Electronic Bay ..... 2-14-20 ..02
EICAS Messages ..... 2-14-20 ..02
Baggage Ventilation System ..... 2-14-25 ..01

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GENERAL

The pneumatic system can be supplied by the engines, APU or a ground pneumatic source.

The APU or ground pneumatic source supplies the system prior to the engine start. The engines normally supply bleed air for pneumatics after engine start.

The air conditioning system receives air from the pneumatic system and provides conditioned air to the cabin. The system is controlled by two Environmental Control Units (ECU).

The pressurization system uses bleed air from the air conditioning system to pressurize the airplane. Cabin pressure is controlled by modulating the outflow valves. The system is controlled by an automatic mode and has a manual back-up mode.

Cooling for rear and forward electronic compartments is provided by the ventilation system.

System information and messages are presented on the EICAS.

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PNEUMATIC SYSTEM

The pneumatic system receives compressed and hot air from the following sources:

– Engines compression stage
– APU
– Ground pneumatic source

The pneumatic system is used for: engine start, air conditioning, pressurization and anti-ice system.

Engine bleed air comes from the 9th (low pressure) or 14th (high pressure) engine stages depending on the system demand.

The 14th stage High Stage Valve (HSV), which is electrically commanded and pneumatically-actuated, opens automatically during low engine thrust operations, engine cross bleed start and anti-ice operation.

As thrust increases, the HSV closes and the 9th BACV (Bleed Air Check Valve) opens supplying bleed air to the system.

Bleed air for engine anti-ice system is provided through the tapping upstream of the HSV.

An Engine Bleed Valve (EBV), which is electrically commanded through the Bleed Air Button and pneumatically-actuated, is installed downstream of the pre-cooler.

Bleed air for the Air Turbine Starter (refer to Section 2-10 - Powerplant) is provided through the tapping downstream of the EBV.

Each engine supplies air to its corresponding air conditioning pack and anti-ice system when the respective EBV is open.

During take-off in specific thrust modes using engine bleed air, the operative air conditioning pack is closed by FADEC's ECS-OFF logic signal, featuring no engine bleed airflow demand when operating under no icing condition.
With no engine bleed air demand and high engine's thrust set, for airplanes Post-Mod. SB 145-36-0028 or equipped with an equivalent modification factory incorporated, EBV regulates its downstream pressure in the vicinities of its closed position and then BLD 1-2 VLV CLSD EICAS advisory message may be displayed for airplanes equipped with EICAS version 19 and on.

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In case of icing encounter during no bleed airflow demand, for airplanes Pre-Mod SB 145-36-0028 EBV remains open and for airplanes Post-Mod SB 145-36-0028 or equipped with an equivalent modification factory incorporated, EBV is opened by the pneumatic system's functional logic to allow engine bleed airflow to anti-ice system.

A Cross-Bleed Valve (CBV), which is electrically commanded through the Cross Bleed Knob and pneumatically actuated, provides the segregation or interconnection between both sides in case of APU operation or one engine pneumatic supply.

The pneumatic system’s functional logic opens or closes automatically the CBV, if the Cross Bleed Knob is on AUTO position, during engine start, depending on the available pneumatic source: APU, ground pneumatic source or opposite engine.

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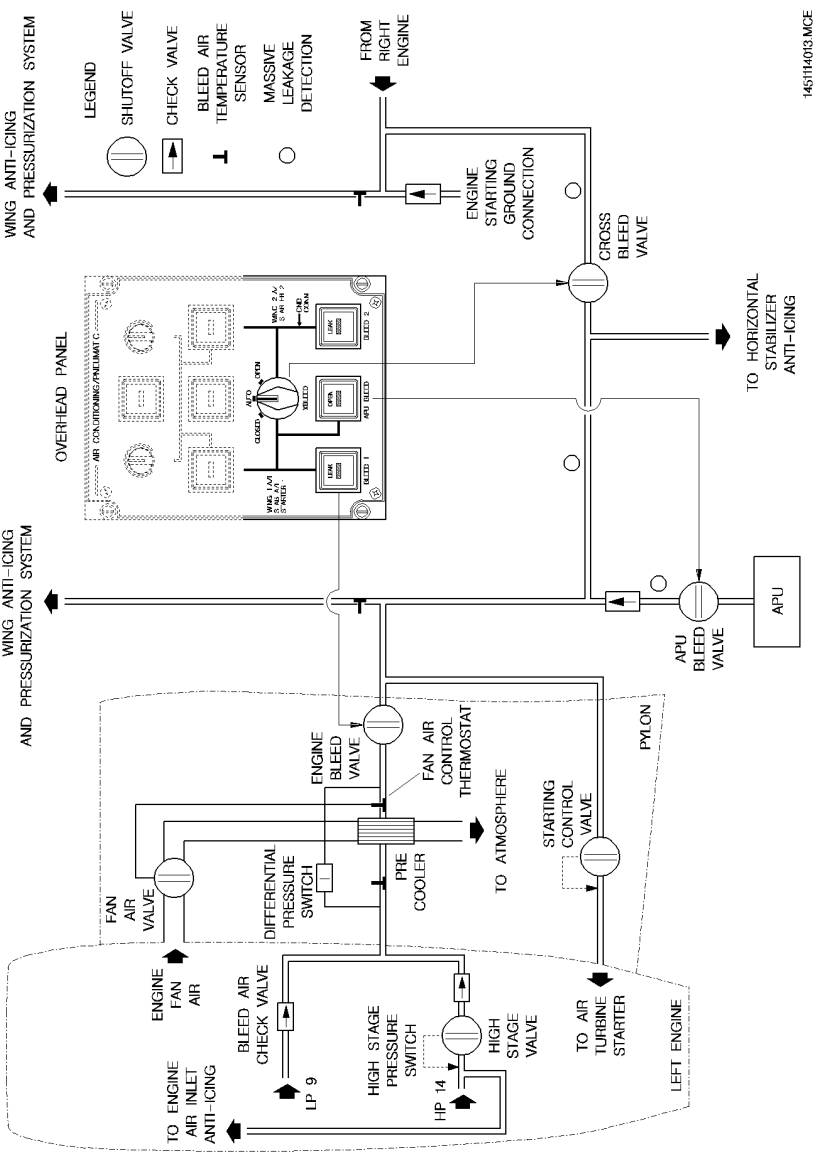

PNEUMATIC SYSTEM SCHEMATIC

The functional logic opens automatically the CBV and both HSVs and closes the left air conditioning pack below 24600 ft, whenever the anti-icing system is operating, on airplanes Pre-Mod. SB 145-36-0028.

On airplanes equipped with a pressure regulating and shutoff EBVs (Post-Mod. SB 145-36-0028), the functional logic also opens both HSVs and closes one pack below 24600 ft, but does not open the CBV if the anti-icing system is operating.

	Air Conditioning ON	Ice Protection ON
Airplanes Pre-Mod. SB 145-36-0028	Cross-bleed Closed	Cross-bleed Open
Airplanes Post-Mod. SB 145-36-0028 or equipped with an equivalent modification factory incorporated.	Cross-bleed Closed	

Bleed air from the APU, that is used primarily as an auxiliary pneumatic source, is provided in the left side of the pneumatic system to supply the air conditioning and engine starting either on ground or inflight.

An APU Bleed Valve (ABV), which is electrically controlled through the APU Bleed Button and pneumatically-actuated, provides APU bleed control.

The pneumatic system functional logic automatically closes the ABV whenever any engine is supplying bleed air to the left pneumatic side.

An APU Check Valve is installed downstream of the APU bleed valve.

A ground pneumatic source connection, including a check valve, is installed on the right side of the pneumatic system. Its main purpose is to supply pressurized air to start the engines.

Leak detectors (thermal switches) are installed along all the pneumatic lines. Should a duct leakage occur, these detectors activate a warning message in the EICAS.

Should an intense hot air leakage occur three Massive Leakage Detectors (thermal switches – formerly located at the pre-cooler and currently located in the rear electronic compartment area) will close the EBV of the affected side, as well as the CBV, ABV and HSV.

For Airplanes Post-Mod. SB 145-36-0030, all detectors, Massive Leak Detectors and Leak Detectors also can close the EBV, CBV, HSV and ABV if a duct leakage occur. All detectors activate a warning message in the EICAS in case duct leakage.

Bleed temperatures upstream and downstream of the pre-cooler are monitored through temperature sensors. Temperature downstream of the pre-cooler is presented on a vertical bar indication on the MFD.

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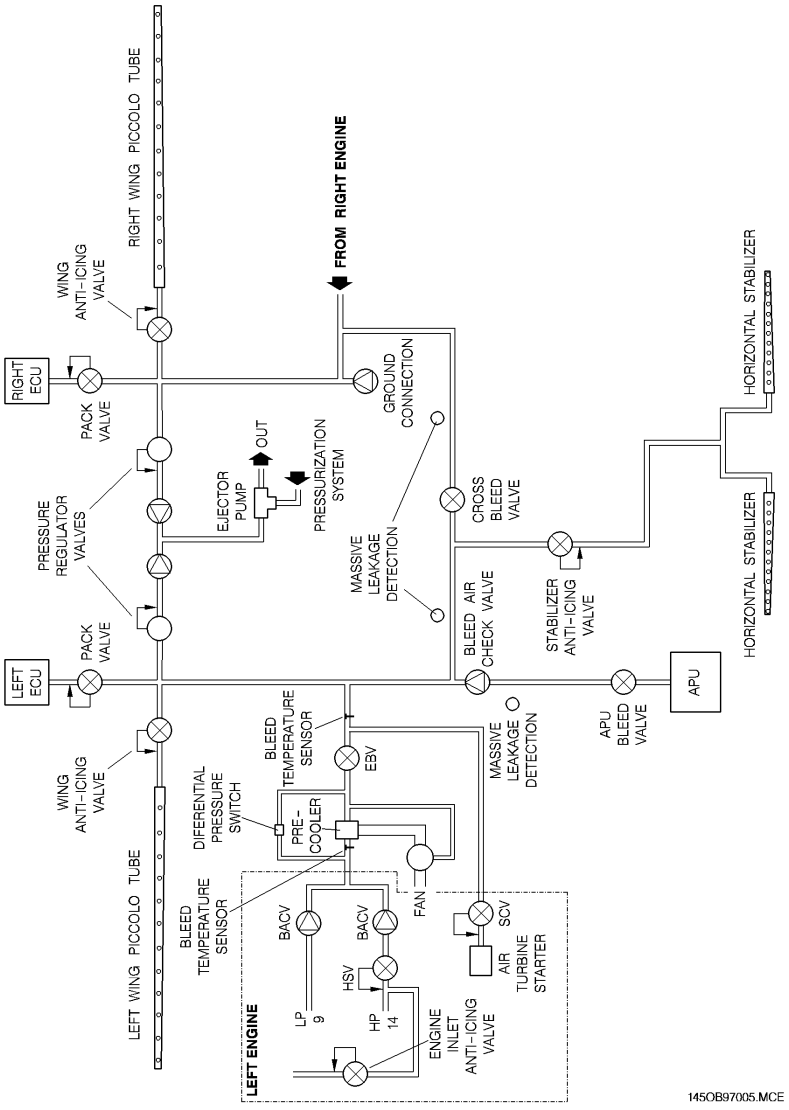

INTEGRATED PNEUMATIC SYSTEM SCHEMATIC

PNEUMATIC SYSTEM FUNCTIONAL LOGIC

The pneumatic system functional logic provides automatic control and protection for itself and the user systems, giving priority according to the airplane operation or condition.

ENGINE BLEED VALVE LOGIC

The Engine Bleed Valve (EBV) opens when the following conditions occur simultaneously:

- Bleed Air Button is pressed to open the valve;
- Respective Essential Bus is energized;
- There is no massive leakage on the respective side of the rear electronic compartment;
- There is no leakage downstream of the respective pre-cooler;
- Respective engine N2 is above 56.4%; and
- Respective engine fire extinguishing handle is not pulled.
- Bleed is requested by one of the bleed consuming systems (airplanes Post-Mod. SB 145-36-0028).

APU BLEED VALVE OPERATIONAL LOGIC

The APU Bleed Valve (ABV) receives an electrical input to open when the following conditions occur simultaneously:

- APU Bleed Button is pressed to open the valve;
- Essential DC Bus 1 is energized;
- Engine 1 bleed valve is closed (no pressure from the left side);
- Engine 2 bleed valve or cross-bleed valve is closed (no pressure from the right side);
- APU rpm above 95% after 7 seconds; and
- There is no massive leakage on the APU line.

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CROSS BLEED VALVE OPERATIONAL LOGIC

The Cross-Bleed Valve (CBV) receives an electrical input to open when the following conditions occur:

- Essential DC Bus 2 is energized;
- There is no massive bleed leakage downstream of the pre-cooler or in the Rear Electronic Compartment; and
- Cross Bleed Knob is set to OPEN; or
- Cross Bleed Knob is set to AUTO and one of the following conditions occurs:
  - Engine 2 is starting; or
  - Engine 1 is starting assisted by engine 2 or external pneumatic source (with APU Bleed Valve manually commanded to the close position); or
  - The Horizontal Stabilizer Anti-Icing System is operating (airplanes Pre-Mod. SB 145-36-0028).

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
WARNING	BLD 1 (2) LEAK BLD APU LEAK	Duct leakage in the associated bleed line. Temperature in the duct region exceeds 91°C (195°F). The switch deactivates at 79°C (175°F).
	BLD 1 (2) OVTEMP	Associated pre-cooler downstream temperature above 305°C (581°F).
CAUTION	APU BLD VLV FAIL	Disagreement between actual position and commanded position of the APU Bleed Valve.
	BLD 1 (2) LOW TEMP	Abnormal low or asymmetric bleed temperature, or pre-cooler outlet temperature sensor failure.
	BLD 1 (2) VLV FAIL	Disagreement between actual position and commanded position of the associated Engine Bleed Valve.
	CROSS BLD FAIL	Disagreement between actual position and commanded position of the Cross-Bleed Valve.
	CROSS BLD SW OFF	Cross Bleed Knob selected CLOSED with at least one engine running after brake release.
	HS VLV 1 (2) FAIL	Disagreement between actual position and commanded position of the associated High Stage Valve.
ADVISORY	BLD 1 (2) VLV CLSD	Associated Engine Bleed Valve position. This message is inhibited on ground or during associated engine start.
	CROSS BLD OPEN	Cross Bleed Valve open.

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AIR CONDITIONING SYSTEM

Airplane air conditioning is provided by two Environmental Control Units (ECU) supplied by the Pneumatic System.

Each side is provided with independent controls, protection devices, and cross-connected air distribution lines for the various modes of operation.

Cockpit and passenger cabin temperature selections are independent and may be controlled either manually or automatically. The left ECU controls the temperature in the cockpit and the right ECU controls the temperature passenger cabin.

The system is normally operated in the automatic mode. In case of automatic mode failure, a manual mode is available.

The pilots may transfer the passenger cabin temperature control to the Attendant Panel.

The air conditioning distribution is performed by the gasper system and general outlets with cross-connection between the cockpit and passenger cabin lines.

This feature, associated with the ram air inlets, allows the cockpit and passenger cabin to be supplied with fresh air, in case of failure of both ECUs.

Recirculating air, driven by two electrical fans, is mixed to fresh air in order to improve passenger and crewmembers' comfort.

A ground cart connection is available at the right-hand duct, connected to the outside through a check valve in the fuselage. The pre-conditioned air from the ground cart is delivered to the cabin directly through the distribution lines.

The air conditioning system incorporates protection features in the temperature controllers which shut off the system in case of malfunctions (duct leakage, duct overtemperature, and pack overtemperature).

The cockpit and passenger cabin temperature indications are presented on the MFD. Caution and advisory messages are presented on the EICAS.

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ECU OPERATION

Each ECU consists of a dual heat exchanger, an air cycle machine (compressor, turbine, and fan), a condenser, a water separator and related control and protective devices, installed forward of the airplane wing root, inside the wing-to-fuselage fairing.

The automatically-controlled bleed air from the pneumatic system supplies the ECU. Downstream pressure is regulated by the Pack Valve (Pressure Regulating and Shutoff Valve).

After the Pack Valve, the airflow is divided into two lines:

- One cold line that passes through to the Air Cycle Machine.
- One hot line that bypasses the Air Cycle Machine.

Both airflow lines are gathered at the expansion turbine discharge.

In the Air Cycle Machine (ACM), air is cooled in the primary heat exchanger and passes through the compressor, thus causing a pressure increase. The air then goes to the secondary heat exchanger where it is cooled again.

After leaving the secondary heat exchanger, the high-pressure cooled air passes through a condenser and a water separator for condensed water removal. Spray nozzles uses the separated water to improve the heat exchanger efficiency.

The main airstream is ducted to the turbine and expanded to provide power for the compressor and cooling fan. This energy removal produces very low turbine discharge temperatures, achieving adequate low temperatures in the process.

The cold exit air is mixed with warm air supplied by the recirculation fan and/or with the hot bypass air immediately upon leaving the turbine. A check valve is provided in the recirculation duct to prevent reverse flow if the recirculation fan is inoperative.

The ECU outlet air temperature is controlled through the dual temperature control valve. One valve adds hot bleed air to the turbine discharge while the other valve restricts the compressor inlet flow.

The ECUs are cooled in flight by external ACM fans, using the external ram air. On the ground, the ECUs are cooled by the ACM fans only.

The system has emergency ventilation, as an alternate means to allow the outside air into the cabin. The impact air passes through the same ram air inlets that are used to cool the dual heat exchangers.

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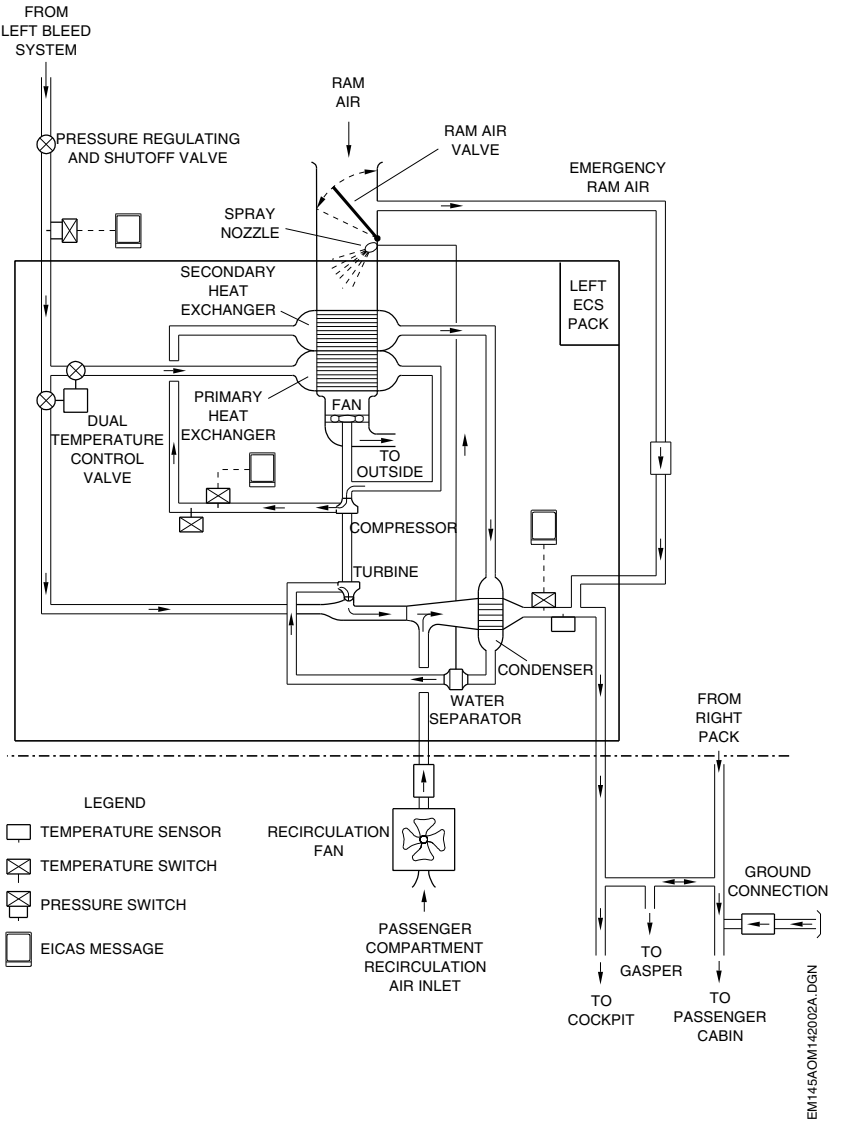

AIR CONDITIONING SYSTEM SCHEMATIC

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When the ECUs air supply is shut off in flight, the emergency ram air is activated and the ram air valves are opened automatically, allowing ram air to be routed to the distribution lines. Ram air may also be used to ventilate the airplane interior for cabin smoke evacuation and cabin ventilation purposes with the airplane depressurized and the ECUs turned off.

NOTE: For normal operations with both packs operative, the Pneumatic System automatic logic closes the left Pack Valve whenever the anti-icing system is operating below 24600 ft.

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CABIN TEMPERATURE CONTROL

AUTO MODE

In the automatic mode (temperature knobs pressed), the temperatures in the passenger cabin and in the cockpit are controlled by the digital temperature controllers that receive information from the temperature sensors (ducts, passenger cabin, or cockpit), maintaining the temperature set on the associated temperature knob.

MANUAL MODE

In manual mode (temperature knobs pulled), the temperature in the passenger cabin and in the cockpit are controlled by the temperature control module, that receives information from the temperature knobs and the duct temperature sensor.

The manual mode should be used only if a failure occurs in the automatic mode and may be noticed when the temperature is not maintained within the temperature limits of the automatic mode (between 18 and 29°C) after cabin temperature stabilization.

If switching from auto mode to manual mode is required, proceed as follows:

- Set the knob to mid range position (12 o'clock).
- Wait for system to stabilize (approximately 30 seconds).
- Switch to manual.
- Smoothly turn the knob to the required point.

Once in the manual mode, the pilot must continuously monitor the temperature and actuate on the Temperature and Mode Selector Knob.

NOTE: On airplanes Pre-Mod. SB 145-21-0011, for cruise flight times of 1:30 h or longer, it is recommended that the passenger cabin temperature be controlled by using the manual mode.

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AIR CONDITIONING DISTRIBUTION

The air conditioning distribution system provides conditioned air to the cockpit and passenger cabin.

The main source of conditioned air to the cockpit is the left pack, with a single distribution system for cooling or heating air.

The cockpit is provided with two FEET AIR handles and air outlets, allowing each pilot to individually control the airflow.

For CRT displays ventilation, a shutoff valve on each side, electrically-driven and independently controlled by a thermal switch, allows cold air to be supplied for this function only.

The main source of conditioned air to the passenger cabin is the right pack and partially by the left pack, through a cross connection duct.

The air distribution system for the passenger cabin is divided into three lines. One line is distributed to the lower ducts, installed at the foot level on both cabin sidewalls. The second line is for the upper ducts of both sidewalls. The third line is dedicated to the gasper. If the duct temperature is below 24°C (75°F), the associated temperature switches command the recirculation fans to increase airflow.

The gasper air subsystem provides air to individual air outlets (gasper), as well as for the rear electronic compartment, oxygen cylinder compartment and relay box ventilation. The air to the gasper is provided by a gasper fan and by one branch from the cross connection of the general distribution system. The gasper fan is similar to the recirculation fan, but it is operated in normal condition only. One thermal switch is installed in the branch line to close fresh air in case of heating condition (above 24°C). In this case, only air from the gasper fan is available.

The recirculation air subsystem, consists of two recirculation fans, and is usually operated to save the engine bleed. It must be kept off should there be smoke in the cabin, or on hot days while on the ground. This reduces the pull-down period and should be turned on in cold soak conditions to reduce pull-up period.

The operational logic to open the Engine Bleed, Cross-bleed, APU Bleed, and Pack Valves will be analyzed herein separately, for better system comprehension. This system also actuates on the Anti-icing System Valves. For further information, refer to Section 2-15 - Ice and Rain Protection.

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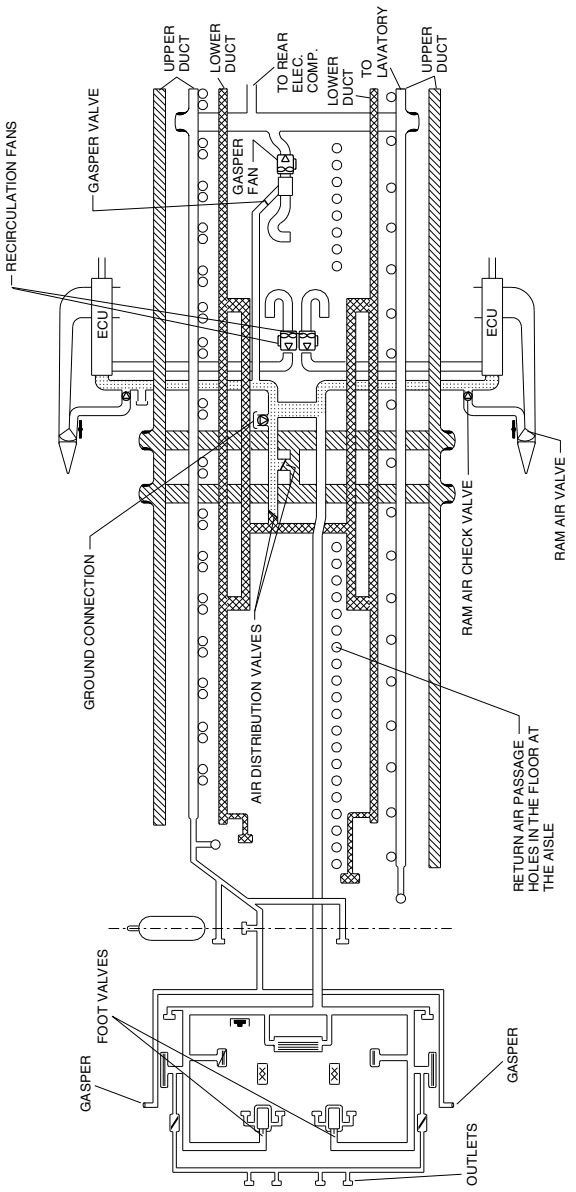

AIR CONDITIONING SYSTEM DISTRIBUTION

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PACK VALVE OPERATIONAL LOGIC

The Pack Valve receives an electrical input to open when the following conditions occur simultaneously:

- Air Conditioning Pack Button is pressed to open the valve;
- Respective DC Bus is energized;
- Respective engine is not starting;
- No engine is starting using the APU as pneumatic source;
- No failure in the related pack is detected (overpressure, overtemperature or duct leakage downstream of the Pack Valve); and
- No discrete ECS (Environmental Control System) OFF signal is sent from any related FADEC (A or B).

The FADEC`s discrete ECS OFF signals are produced according to the following conditions:

1 - During Takeoff or Go Around:

ACTIVATION CONDITIONS FOR ECS OFF SIGNALS				
			PRESSURE ALTITUDE / TAT °C	
ENGINE	FADEC	MODE	ALL ENGINES OPERATIVE (takeoff only)	ONEENGINE INOPERATIVE (4)
A or A1/1	ALL	T/O-1	Up to 1700 ft above takeoff altitude and TAT above -18°C (-0.4°F)	Lower than 9700 ft (1)
A1 or A3	ALL	T/O-1	Up to 1700 ft above takeoff altitude (2)	Lower than 9700 ft (3)
A1/3 or A1P	ALL	T/O-1,T/O or T/O RSV	Up to 1700 ft above takeoff altitude (2)	Lower than 9700 ft (3)
A1E	ALL	T/O-1, T/O, E T/O, T/O RSV or E T/O RSV	Up to 1700 ft above takeoff altitude (2)	Lower than 9700 ft (3)

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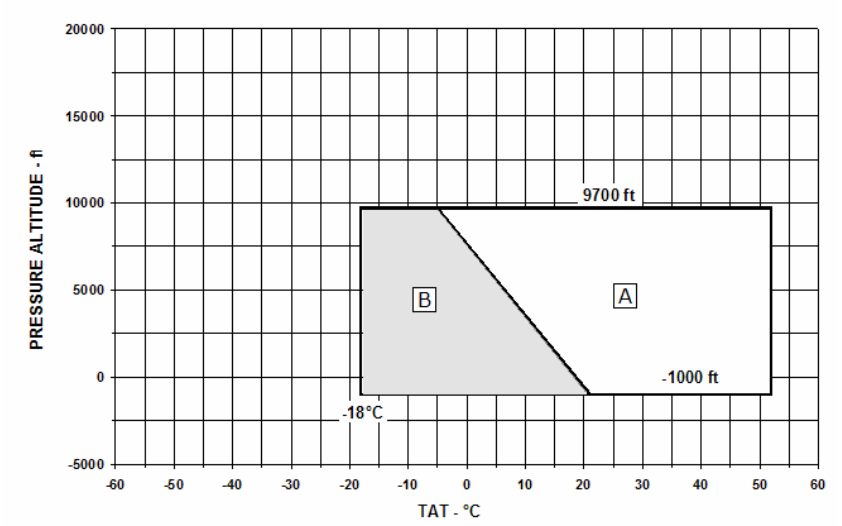
NOTE: 1) The ECS OFF signal is activated for the pack associated with the operating engine if the pressure altitude is lower than 9700 ft and TAT is above -18°C (areas A and B in the following envelope).

2) TAT above 19°C (66°F) at sea level, decreasing linearly to -5°C (23°F) at 9700 ft.

3) The ECS OFF signal is activated for the Pack associated with the operating engine if the pressure altitude is lower than 9700 ft and TAT is above 19°C at sea level, decreasing linearly to -5°C at 9700 ft (area A in the following envelope).

4) A Low N1 condition (actual N1 does not achieve requested N1) is considered one engine inoperative.



FADEC´S ECS OFF ENVELOPE

The ECS OFF logic is valid only when the packs are using engine bleed. If APU bleed is being used, the ECS OFF logic is inhibited and the pack valves will not shut down.

The FADEC's discrete ECS OFF signal is not produced when using ALT T/O-1 mode during takeoffs with all engines operative.

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On all EMB-145 XR models, packs are automatically reset when the conditions for the ECS OFF signal cease to exist. When both packs are automatically reset, pack 2 will be commanded to open 10 seconds after pack 1 opening, to avoid passenger discomfort due to packs return.

On other airplane models, if a FADEC commands its associated pack to close through the ECS OFF signal, the pilot must reset the pack when the conditions for the automatic shut down of the pack cease to exist, i.e., an automatic restart of the pack does not exist.

2 - During reverse use:

The ECS OFF signal is not activated during reverse use.

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	PACK 1 (2) OVLD	Associated ECU compressor temperature above 243°C (470°F) or ECU inlet pressure above 55 psig.
	PACK 1 (2) OVHT	Associated ECU outlet temperature above 93°C (200°F).
	PACK 1 (2) VLV FAIL RAM AIR VLV FAIL	Disagreement between associated valve actual position and commanded position.
ADVISORY	PACK 1 VLV CLSD	Left pack valve closed with no icing condition, or Left pack valve closed with airplane above 24600 ft.
	PACK 2 VLV CLSD	Right pack valve closed.

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CONTROLS AND INDICATORS

AIR CONDITIONING AND PNEUMATIC CONTROL PANEL

1 - Cockpit temperature and mode selector knob

- PRESSED - Controls the left pack in automatic mode through the Digital Temperature Controller. The cockpit temperature may be set between 18°C (65°F) and 29°C (85°F).
- PULLED - Controls the left pack in manual mode through the temperature control module. No temperature range is established.

2 - PASSENGER CABIN TEMPERATURE AND MODE SELECTOR KNOB

- PRESSED - Controls the right pack in automatic mode through the Digital Temperature Controller. The passenger cabin temperature may be set between 18°C (65°F) and 29°C (85°F).
- PULLED - Controls the right pack in manual mode through the manual mode circuit in the temperature control module. No temperature range is established.
- ATTD - The passenger cabin temperature control is transferred to the attendant's panel in automatic mode only.

3 - RECIRCULATION BUTTON

- Turns on (pressed) or turns off (released) both recirculation fans.
- A striped bar illuminates inside the button to indicate that it is released.

4 - AIR CONDITIONING PACK BUTTON

- Opens (pressed) or closes (released) the Pressure Regulating and Shutoff Valve of the associated ECU.
- A striped bar illuminates inside the button to indicate that it is released.

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5 - GASPER BUTTON

- Turns on (pressed) or turns off (released) the gasper fan inflight only.
- A striped bar illuminates inside the button to indicate that it is released.
- On ground, the gasper fan is turned on as soon as the associated DC Bus is energized.

6 - CROSS-BLEED KNOB

- CLOSED- Closes the Cross-bleed Valve.
- AUTO - Selects automatic operation mode of the Cross-bleed Valve.
- OPEN - Opens the Cross-bleed Valve.

7 - BLEED AIR BUTTON

- Opens (pressed) or closes (released) the associated Engine Bleed Valve.
- A striped bar illuminates inside the button to indicate that it is released.
- A LEAK inscription illuminates inside the button to indicate a duct leakage in the associated bleed line.

NOTE: The LEAK inscription is not available on some airplanes.

8 - APU BLEED BUTTON

- Opens (pressed) or closes (released) the APU Bleed Valve.
- A striped bar illuminates inside the button to indicate that it is pressed.
- An OPEN inscription illuminates inside the button to indicate that the APU Bleed Valve is in the open position.

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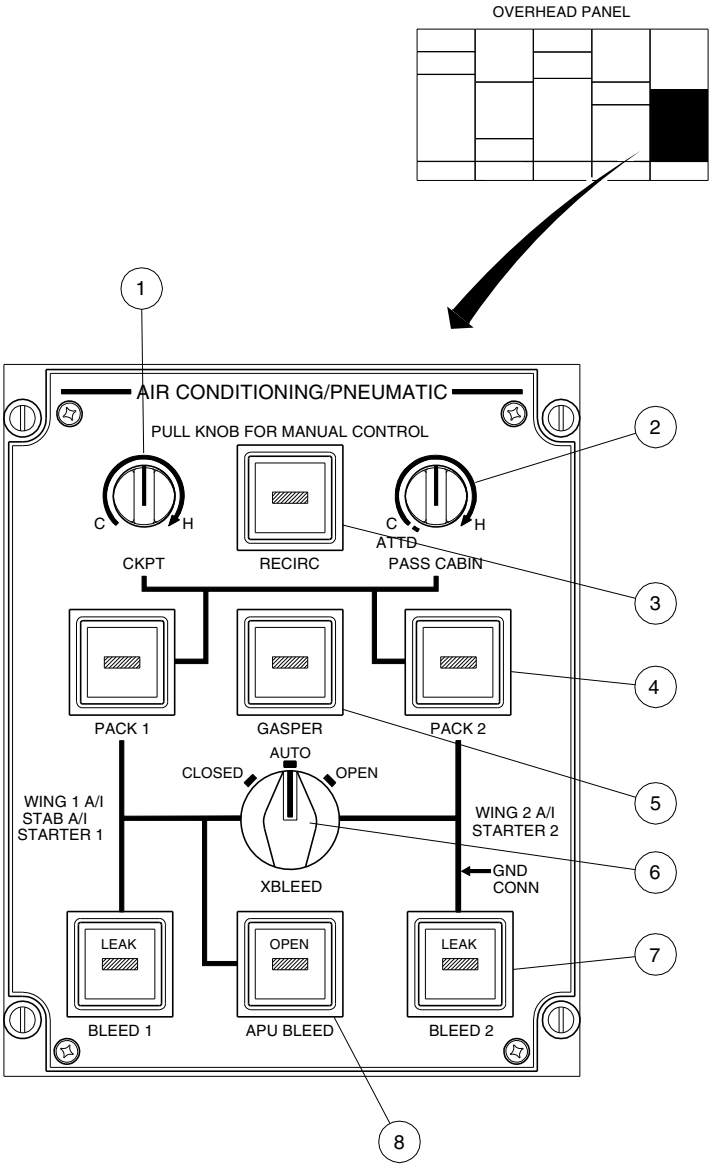

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AIR CONDITIONING AND PNEUMATIC CONTROL PANEL

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ENVIRONMENTAL CONTROL SYSTEM (ECS) AND PNEUMATIC PAGE ON THE MFD

1 - PASSENGER CABIN TEMPERATURE INDICATION

- Indicates the temperature inside the passenger cabin.
- Digits are green.
- Legends are white.
- Ranges from -10 to 50°C (14 to 122°F).

2 - Cockpit temperature indicatION

- Indicates the temperature inside the cockpit.
- Digits are green.
- Legends are white.
- Ranges from -10 to 50°C (14 to 122°F).

3 - BLEED TEMPERATURE INDICATION

- Indicates the bleed air temperature downstream of the pre-cooler on the left and right engine.
- Scale and Pointer:
  - White for the scale, below 260°C (500°F) to indicate potentially low thermal energy availability to the anti-icing system. Amber for the pointer, only if the pointer is in the white band of the scale and the message “BLD 1 (2) LOW TEMP” is shown on EICAS.

    If the pointer is in the white band of the scale and the message “BLD 1 (2) LOW TEMP” is not presented in the EICAS, the pointer will be green.
  - Green from 260 to 305°C (500 to 581°F) to indicate the acceptable range.
  - Red above 305°C (581°F) to indicate an overtemperature condition.
  - In case of an outlet temperature sensor failure, the respective pointer is removed from the vertical temperature bar.

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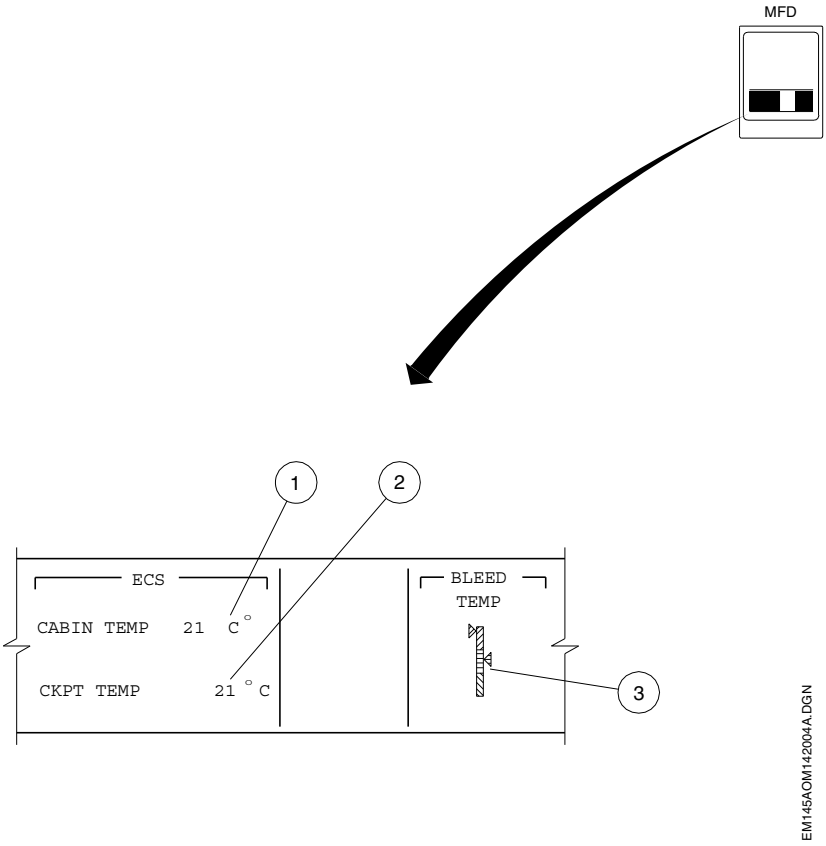

ENVIRONMENTAL CONTROL SYSTEM (ECS) AND PNEUMATIC PAGE ON MFD

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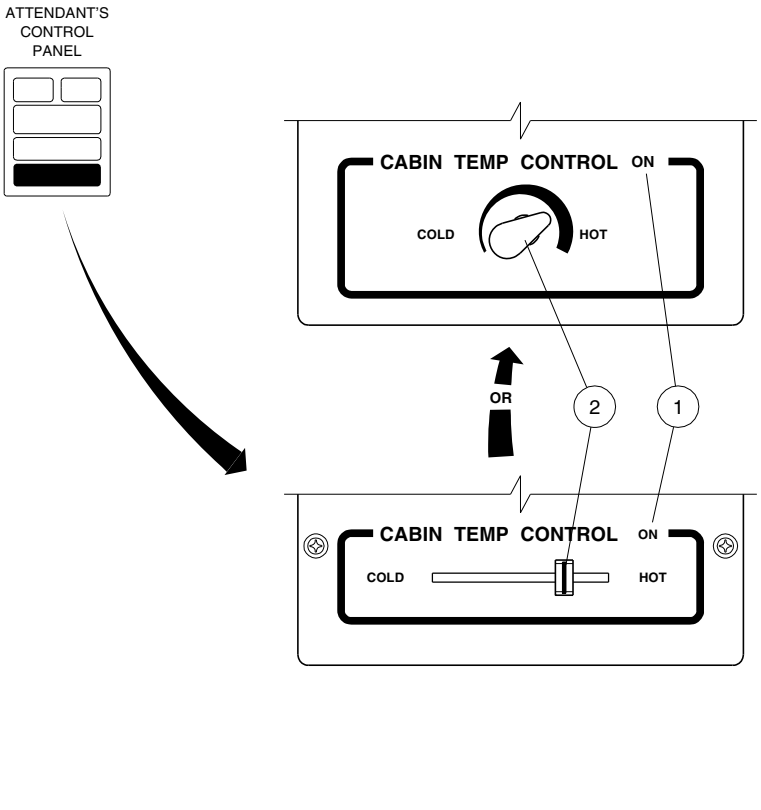
ATTENDANT'S CONTROL PANEL

1 - ON INDICATOR LIGHT (GREEN)

- Illuminates to indicate that the passenger cabin temperature control is transferred to the attendant's panel.

2 - PASSENGER CABIN TEMPERATURE CONTROL (KNOB OR SLIDING CONTROL)

- Actuates on the passenger cabin temperature controller (right ECU) in the automatic mode, provided the Passenger Cabin Temperature and Mode Selector is set to the ATTD position.
- The attendant may set the passenger cabin to between 18°C (65°F) and 29°C (85°F).



ATTENDANT'S CONTROL PANEL

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PRESSURIZATION SYSTEM

The Cabin Pressure Control System (CPCS) controls the cabin pressure by regulating the cabin air exhaust rate supplied by the ECUs.

The CPCS comprises two subsystems:

- One digital electropneumatic subsystem(automatic mode).
- One pneumatic subsystem (manual mode).

Both subsystems comprise a digital controller, a manual controller, an electropneumatic outflow valve, a pneumatic outflow valve, an air filter, two pressure regulator valves, an ejector pump, two static ports, and a Cabin Pressure Acquisition Module (CPAM).

Both outflow valves receive static pressure signals from static ports for overpressure relief and negative pressure relief functions, actuating pneumatic devices to inhibit airplane structural damage or injury in case of improper system operation. The safety devices provide the following features:

– Positive cabin differential pressure relief: 8.2 psi maximum.
– Negative cabin differential pressure relief: - 0.3 psi.
– Cabin altitude limitation (when in the auto mode): 15000 ft maximum.

The system is normally operated in the automatic mode. The manual mode is used in case of automatic mode failure.

The cabin air filter is provided to prevent nicotine and dust to enter the outflow valve chamber.

Indications of cabin altitude, cabin differential pressure, and cabin altitude rate of change are presented on the EICAS.

A caution message is presented on the EICAS in case of automatic mode failure, requiring the crew to select the manual mode.

The CPAM and CPCS have internal tolerances of ± 100 ft and ± 200 ft, respectively. Then, depending on these tolerances accumulation, the displayed cabin altitude may be increased up to 300 ft. Although displayed in the amber range for airplanes equipped with EICAS version up to 16, it may not be considered an abnormal condition if cabin altitude indication remains stabilized at or below 8300 ft.

If, however, the cabin altitude indication continuously increases and the system is out of its normal range of operation, causing a cabin depressurization, the CPAM sends a signal to the aural warning system to alert the crew when cabin altitude is above 9900 ± 100 ft.

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OPERATION IN AUTOMATIC MODE

The automatic mode maintains minimum cabin altitude according to the airplane operating altitude, imposing minimum cabin altitude rate of change.

The automatic mode is controlled by the digital controller and requires a landing altitude to be entered prior to takeoff. According to the landing altitude, the measured cabin pressure, ADC inputs (airplane altitude, altitude rate of change and barometric correction), air/ground position, and thrust lever position, the digital controller determines the adequate opening of the electropneumatic outflow valve. The pneumatic outflow valve is slaved to the electropneumatic outflow valve and both operate simultaneously, maintaining the same position while in the automatic mode

Different operation sequences are automatically initiated by the Digital Controller following the received inputs.
The Digital Controller schedules a cabin altitude that is the value that the measured cabin altitude must be equal to.
Cabin altitude rate of change varies according to the different operation sequences.

Proper operation of the pressurization system in the automatic mode requires that the following conditions be met:

- Automatic mode is selected on the Digital Controller (button not pressed and MAN inscription not illuminated). The pressurization system is in the automatic mode when electrical power is first applied.
- Landing altitude is entered in the Digital Controller prior to the takeoff. Should the landing altitude not be entered, the system will automatically consider 8000 ft as the landing altitude.
- Manual Controller is set to DN position (full counterclockwise). If the Manual Controller is out of the DN position, the pneumatic valve tends to open causing inappropriate automatic mode operation.

DETERMINATION OF THE THEORETICAL CABIN ALTITUDE

The theoretical cabin altitude is a function of the airplane operating altitude. It is calculated in such a way that the maximum cabin differential pressure (7.8 psi) is reached at the lowest possible airplane altitude considering a minimum cabin altitude rate of climb and a maximum airplane rate of climb.

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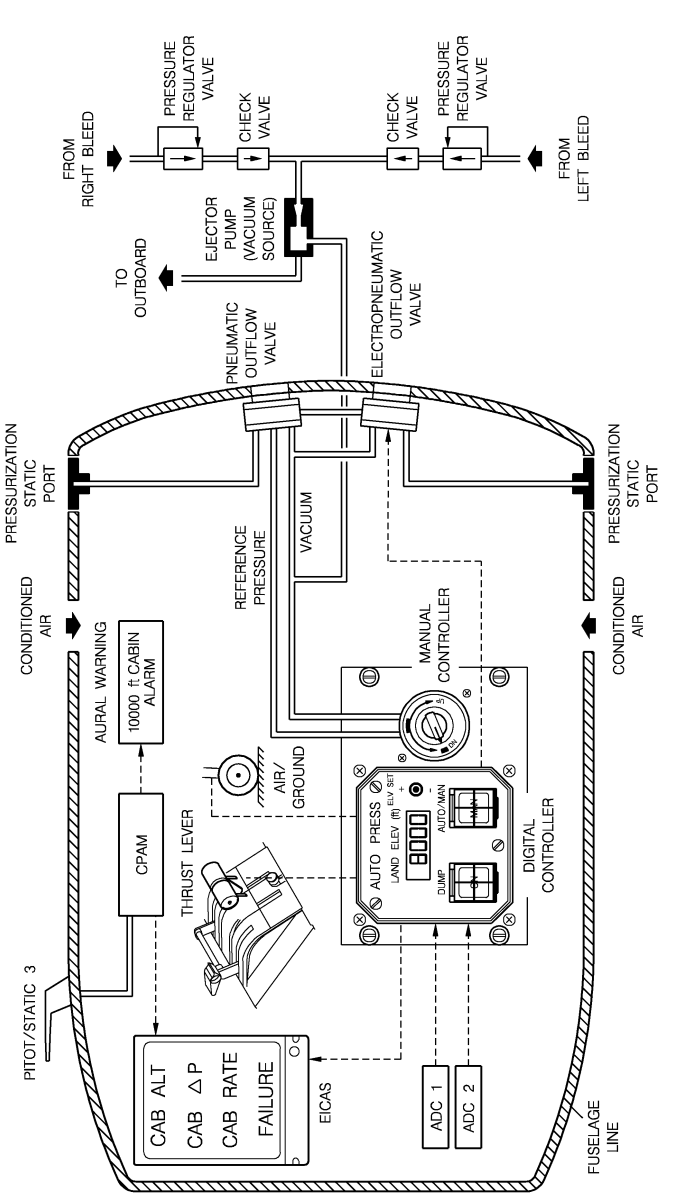

CABIN PRESSURE CONTROL SYSTEM SCHEMATIC

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AUTOMATIC PREPRESSURIZATION SEQUENCE ON GROUND

This sequence is initiated and maintained as long as the airplane is on the ground and the engine 1 thrust lever is set to THRUST SET position or above. It causes the cabin altitude to descend toward an altitude equivalent to 0.2 psi (15 mbar) below the takeoff altitude.

The purpose of the automatic prepressurization is to avoid cabin bumps due to the irregular airflow on the fuselage during rotation and takeoff and also to keep a controlled cabin altitude just after rotation, as the cabin altitude tends to follow the airplane altitude.

In the case of takeoff with air conditioning supply, the cabin altitude is controlled with an altitude rate of descent equal to –450 ft/min.

In the case of takeoff without air conditioning supply, the outflow valves are closed, also avoiding cabin bump.

TAKEOFF SEQUENCE

This sequence is initiated after the airplane leaves the ground with the purpose of avoiding reselecting the landing altitude, in case it is necessary to return to the takeoff airport.

It causes the cabin altitude to continue descending towards the altitude equivalent to 0.2 psi below the takeoff altitude. If an altitude of 0.2 psi below the takeoff altitude has already been reached during the pre-pressurization sequence, the cabin altitude does not change.

The takeoff sequence lasts until the theoretical cabin altitude becomes greater than the actual cabin altitude, or until 15 minutes have elapsed since the sequence initiation, whichever occurs first.

FLIGHT SEQUENCE

This sequence is initiated after the takeoff sequence is finished, to establish a cabin altitude and a cabin altitude rate of change during flight. The Digital Controller schedules a cabin altitude that is the greatest value between the theoretical cabin altitude and the selected landing altitude minus 11 mbar (300 ft at SL).

The cabin altitude rate of change is controlled at different values depending on the scheduled cabin altitude and the airplane vertical speed, but is limited to –450 ft/min during descent and as following while climbing:

- 500 ft/min (for airplanes Pre-Mod. SB 145-21-0006);
- 600 ft/min (for airplanes Post-Mod. SB 145-21-0006 or S/N 145.050 up to 145.362);
- 700 ft/min (for airplanes S/N 145.363 and on).

Barometric correction, when required, is automatically provided by the Air Data Computer (ADC).

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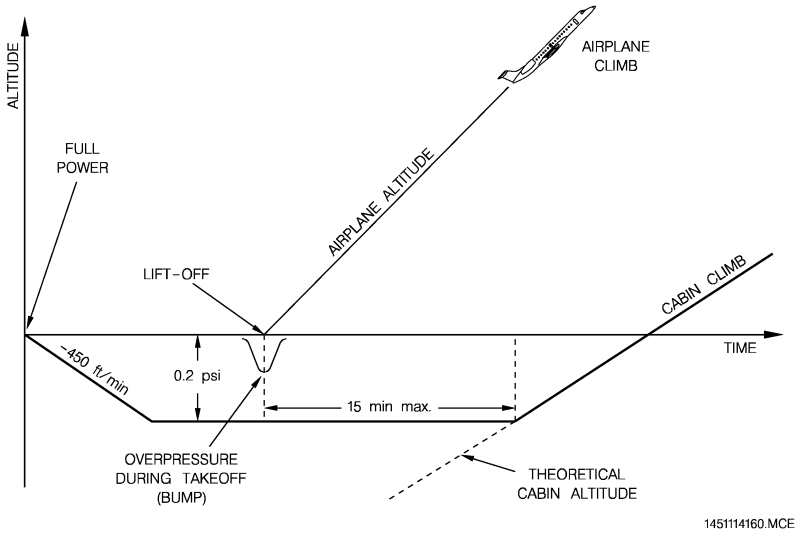
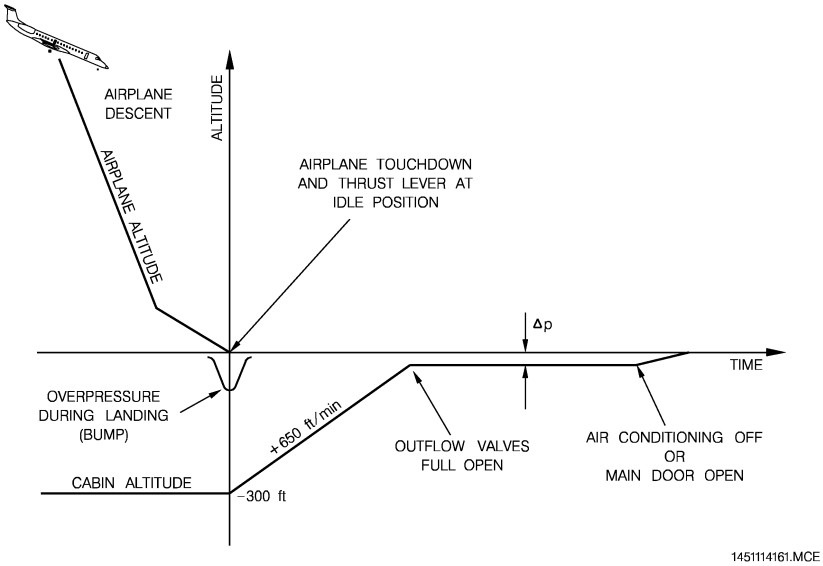


AUTOMATIC PREPRESSURIZATION AND TAKEOFF SEQUENCE



AUTOMATIC DEPRESSURIZATION SEQUENCE ON GROUND

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AUTOMATIC INCREASED RATE OF DESCENT SEQUENCE

This sequence is initiated when the airplane descent rate is greater than 200 ft/min, in order to satisfy all airplane rapid descent cases. The cabin altitude rate of change limits may be accordingly increased, depending on the remaining flight time which is calculated considering the airplane operating altitude, airplane vertical speed and the selected landing altitude.

Therefore, the cabin altitude rate of descent limit may be increased to a value between –450 ft/min and –1300 ft/min (for EMB 145 models Pre-Mod. SB 145-21-0006) or –450 ft/min and –500 ft/min (for EMB 145 Post-Mod. SB 145-21-0006 or S/N 145.050 and on, EMB-135 and ERJ-140 models).

AUTOMATIC DEPRESSURIZATION SEQUENCE ON GROUND

This sequence is initiated when the airplane is on the ground and the engine 1 thrust lever is in the IDLE position.

To avoid a cabin bump during the landing, it is necessary that the airplane land with the cabin being submitted to a small differential pressure. For that reason, the automatic mode always controls, for landing, a cabin altitude equal to the selected landing altitude minus 300 ft. This sequence cancels this differential pressure corresponding to 300 ft, as well as reduces cabin bump when the air conditioning is turned off or the main door is open.

Cabin depressurization is controlled at a rate of climb equal to 650 ft/min, up to the full opening of the outflow valves.

In automatic mode, the rapid cabin depressurization is commanded by the Dump Button.

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OPERATION IN MANUAL MODE

Manual operation is accomplished through the manual controller which actuates only the pneumatic outflow valve, while the electropneumatic outflow valve is kept closed, by selecting MAN in the Pressurization Mode Selector Button and rotating the Manual Controller until the desired cabin rate of change is reached. The crew is responsible for monitoring cabin differential pressure within acceptable values.

In manual mode, the DUMP button is not effective and a rapid cabin depressurization is commanded by turning the manual controller to the UP position (clockwise stop). In this mode, the cabin altitude limitation at 15000 ft does not exist as it does in the automatic mode.

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EICAS MESSAGE

TYPE	MESSAGE	MEANING
CAUTION	PRESN AUTO FAIL	Automatic pressurization mode failure.

CONTROLS AND INDICATORS

DIGITAL CONTROLLER

1 - LANDING ALTITUDE INDICATOR

- Displays the selected landing altitude.
- Displays a failure code if any failure is detected during power-up and continuous monitoring tests . In this case, the selection of the landing altitude is disabled.
- Successful power-up test is displayed (all light segments illuminated) until a landing altitude is selected.
- Displays blanks when Dump button or Mode Selector Button is pressed.

2 - LANDING ALTITUDE SELECTOR SWITCH

- Sets the landing altitude in the Landing Altitude Indicator.
- Altitude changes in 100-ft steps. Holding the selector for more than 5 seconds changes the altitude in a 1000 ft/sec rate.
- Landing altitude setting from –1500 ft to +14000 ft.

3 - PRESSURIZATION MODE SELECTOR BUTTON (guarded)

- Provides selection of either automatic mode (button released) or manual mode (button pressed) of operation.
- When pressed, the MAN inscription illuminates inside the button.

NOTE: In case of electrical failure that leads to the complete turning off of the automatic mode turning off, manual mode should be selected by pressing the Pressurization Mode Selector Button, but the MAN inscription will not be illuminated.

4 - PRESSURIZATION DUMP BUTTON (guarded)

- Provides rapid cabin depressurization up to 14500 ft.
- When pressed, an ON inscription illuminates inside the button.
- This button is effective in the automatic mode only.

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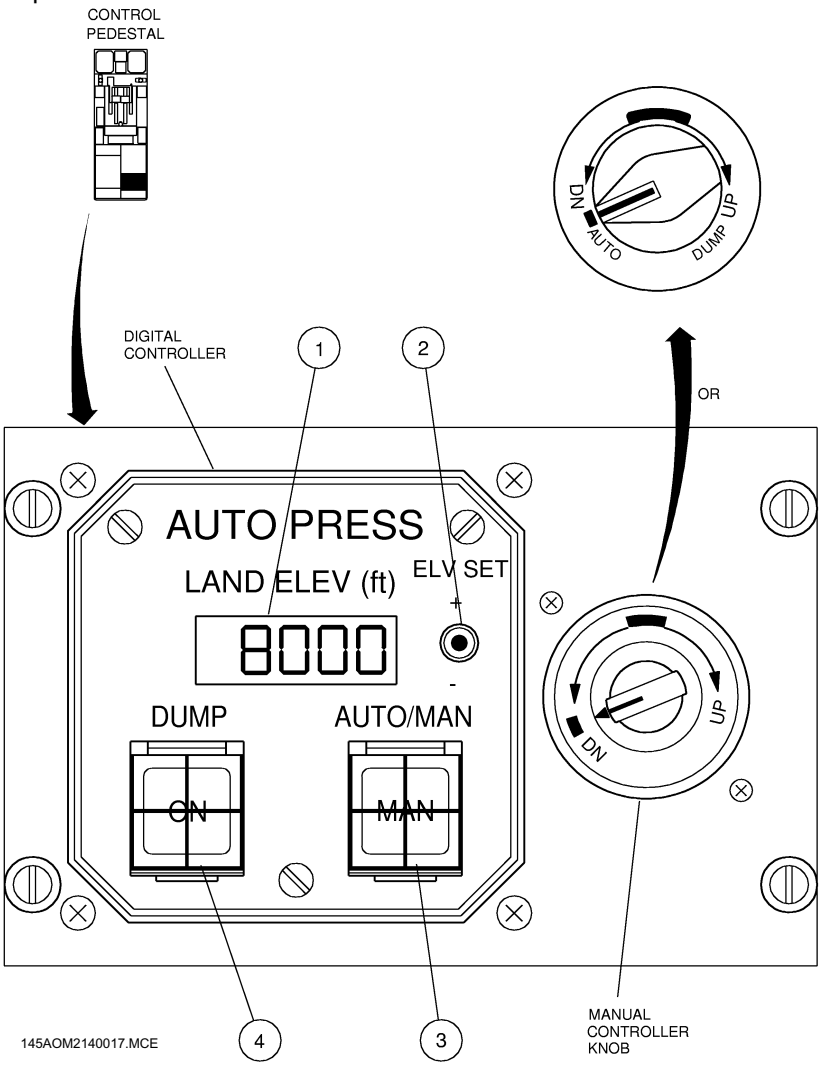
MANUAL CONTROLLER KNOB

- Selects cabin rate of change between –1500ft/min (at DN position) and approximately + 2500ft/min (at UP position), when in the manual operating mode.
- When operating in the AUTO mode, it must be set to the DN position.



PRESSURIZATION CONTROLS AND INDICATORS

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PRESSURIZATION INDICATION ON EICAS

1 - CABIN ALTITUDE INDICATION

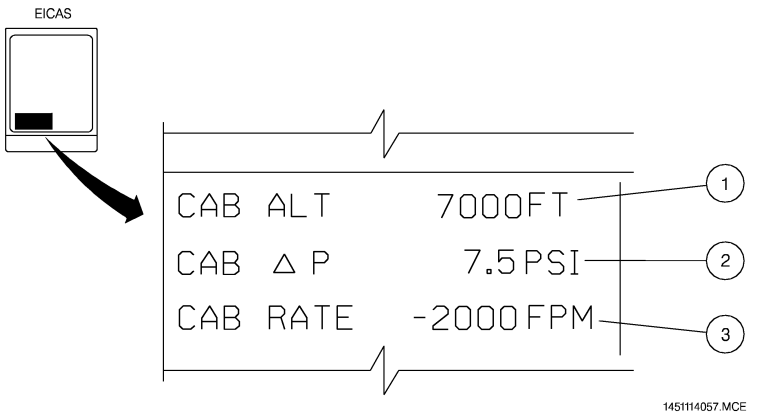
- Displays cabin altitudes, regardless of the operating mode.
- Ranges from – 1500 to 37000 ft, with a resolution of 100 ft.
- Green: from – 1500 to 8000 ft (for EICAS versions up to 13).
  from – 1500 to 8100 ft (for EICAS version 14 up to16).
  from – 1500 to 8300 ft (for EICAS version 16.5 and above).
- Amber: from 8100 to 9900 ft (for EICAS versions up to 13).
  from 8200 to 9900 ft (for EICAS version 14 up to 16).
  from 8400 to 9900 ft (for EICAS version 16.5 and above).
- Red: from 10000 to 37000 ft.

2 - DIFFERENTIAL PRESSURE INDICATION

- Displays the differential pressure between the cabin interior and the outside, regardless of the operating mode.
- Ranges from – 0.5 to 10.0 psi, with a resolution of 0.1 psi.
- Green: from 0.0 to 7.9 psi.
- Amber: from – 0.3 to – 0.1 psi and from 8.0 to 8.3 psi.
- Red: from – 0.5 to – 0.4 psi and from 8.4 to 10.0 psi.

3 - CABIN RATE OF CHANGE INDICATION

- Displays the cabin rate of change, regardless of the operating mode.
- Ranges from –2000 to 2000 ft/min, with a resolution of 50 ft/min.
- Green full range.
- For rates out of range the indication is replaced by amber dashes.



PRESSURIZATION INDICATION ON EICAS

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PRESSURIZATION SYSTEM

The information presented herein is only applicable to airplanes properly equipped for takeoff and landing operation above 8000 ft.
Airplanes properly equipped accomplished any of the following Service Bulletins or have an equivalent modification factory incorporated:
- SB 145-00-0031
- SB 145-00-0033
- SB 145-21-0050

The Cabin Pressure Control System (CPCS) controls the cabin pressure by regulating the cabin air exhaust rate supplied by the ECUs.

The CPCS comprises two subsystems:

- One digital electropneumatic subsystem (automatic mode).

- One pneumatic subsystem (manual mode).

Both subsystems comprise a digital controller, a manual controller, an electropneumatic outflow valve, a pneumatic outflow valve, an air filter, two pressure regulator valves, an ejector pump, two static ports, and a Cabin Pressure Acquisition Module (CPAM).

Both outflow valves receive static pressure signals from static ports for overpressure relief and negative pressure relief functions, actuating pneumatic devices to inhibit airplane structural damage or injury in case of improper system operation. The safety devices provide the following features:

– Positive cabin differential pressure relief: 8.2 psi maximum.
– Negative cabin differential pressure relief: - 0.3 psi.
– Cabin altitude limitation (when in the auto mode): 15000 ft maximum.
The system is normally operated in the automatic mode. The manual mode is used in case of automatic mode failure.

The cabin air filter is provided to prevent nicotine and dust to enter the outflow valve chamber.

Indications of cabin altitude, cabin differential pressure, and cabin altitude rate of change are presented on the EICAS.

A caution message is presented on the EICAS in case of automatic mode failure, requiring the crew to select the manual mode.

The CPAM and CPCS have internal tolerances of ± 100 ft and ± 200 ft, respectively. Then, depending on these tolerances accumulation, the displayed cabin altitude may be increased up to 300 ft.

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If, however, the cabin altitude indication continuously increases and the system is out of its normal range of operation, causing a cabin depressurization, the CPAM sends a signal to the aural warning system to alert the crew when cabin altitude is above 9900 ± 100 ft.

Some airplanes are equipped and certified with HIGH ALT mode. HIGH ALT is a designation for High Altitude Takeoff and Landing Operation mode which allows operations above 8000 ft up to 13500 ft. The pilot activates the HIGH ALT mode manually by pressing a Bezel Button on the MFD Display. When HIGH ALT mode is selected an indication on MFD Display becomes boxed and the message “HI ALT LDG-T/O” will appear on EICAS. This message will advise the flight crewmembers the shift of aural warning from 9900 ± 100 ft to 14500 ± 500 ft; the shift of cabin altitude color range indication on EICAS, and the inhibition of Cabin Pressure Control System (CPCS) takeoff-abort mode.

Also, for these airplanes equipped and certified with HIGH ALT mode the passengers oxygen masks switches are set to deploy masks at 14500 ± 500 ft cabin altitude pressure.

When HIGH ALT mode is not active the airplane is in NORMAL mode operation. In NORMAL mode operation the airplane functions are exactly the same as in airplanes not equipped with HIGH ALT system. Some following information with NORMAL mode inscription in this chapter refers to either cases.

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OPERATION IN AUTOMATIC MODE

The automatic mode maintains minimum cabin altitude according to the airplane operating altitude, imposing minimum cabin altitude rate of change.

The automatic mode is controlled by the digital controller and requires a landing altitude to be entered prior to takeoff. According to the landing altitude, the measured cabin pressure, ADC inputs (airplane altitude, altitude rate of change and barometric correction), air/ground position, and thrust lever position, the digital controller determines the adequate opening of the electropneumatic outflow valve. The pneumatic outflow valve is slaved to the electropneumatic outflow valve and both operate simultaneously, maintaining the same position while in the automatic mode.

Different operation sequences are automatically initiated by the Digital Controller following the received inputs.

The Digital Controller schedules a cabin altitude that is the value that the measured cabin altitude must be equal to.

Cabin altitude rate of change varies according to the different operation sequences.

Proper operation of the pressurization system in the automatic mode requires that the following conditions be met:

– Automatic mode is selected on the Digital Controller (button not pressed and MAN inscription not illuminated). The pressurization system is in the automatic mode when electrical power is first applied.
– Landing altitude is entered in the Digital Controller prior to the takeoff. Should the landing altitude not be entered, the system will automatically consider 8000 ft as the landing altitude.
– Manual Controller is set to DN position (full counterclockwise). If the Manual Controller is out of the DN position, the pneumatic valve tends to open causing inappropriate automatic mode operation.

DETERMINATION OF THE THEORETICAL CABIN ALTITUDE

The theoretical cabin altitude is a function of the airplane operating altitude. It is calculated in such a way that the maximum cabin differential pressure (7.8 psi) is reached at the lowest possible airplane altitude considering a minimum cabin altitude rate of climb and a maximum airplane rate of climb.

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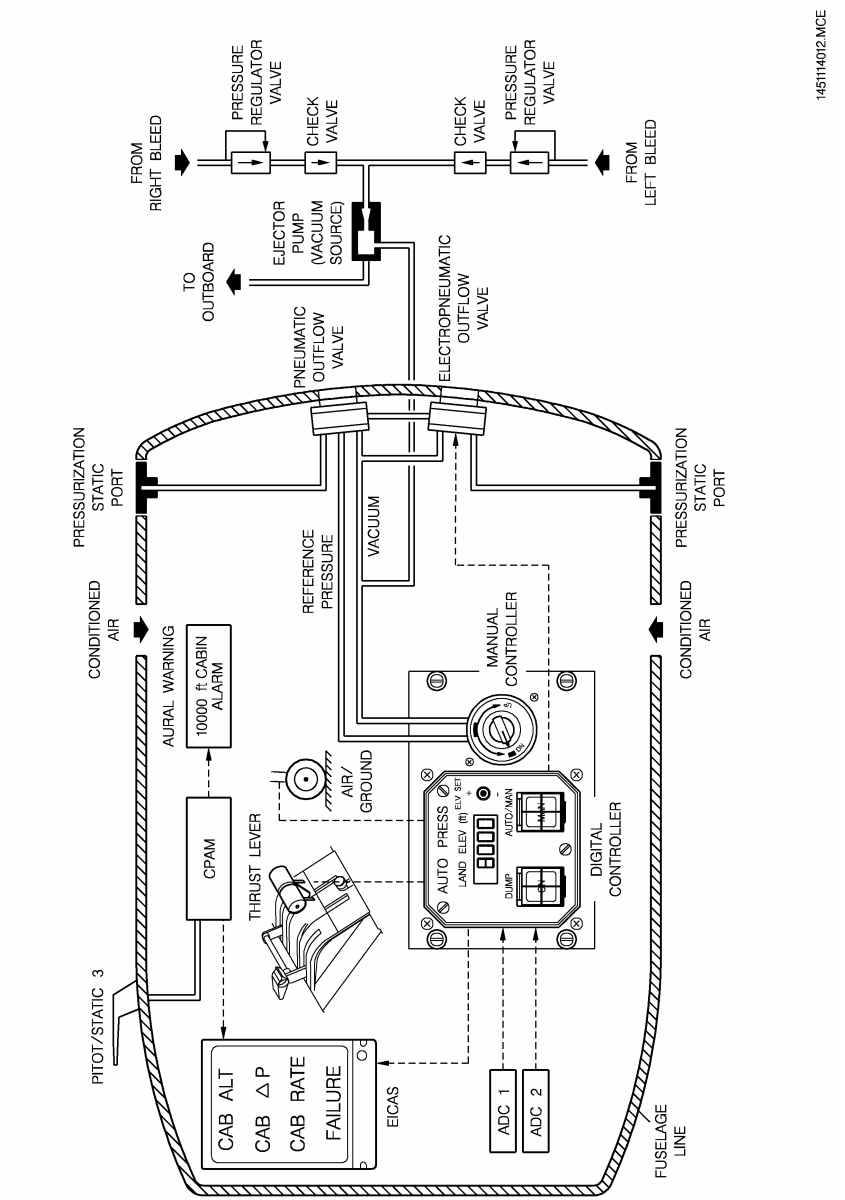

CABIN PRESSURE CONTROL SYSTEM SCHEMATIC

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AUTOMATIC PREPRESSURIZATION SEQUENCE ON GROUND (NORMAL MODE OPERATION)

This sequence is initiated and maintained as long as the airplane is on the ground and the engine 1 thrust lever is set to THRUST SET position or above. It causes the cabin altitude to descend toward an altitude equivalent to 0.2 psi (15 mbar) below the takeoff altitude.

The purpose of the automatic prepressurization is to avoid cabin bumps due to the irregular airflow on the fuselage during rotation and takeoff and also to keep a controlled cabin altitude just after rotation, as the cabin altitude tends to follow the airplane altitude.

In the case of takeoff with air conditioning supply, the cabin altitude is controlled with an altitude rate of descent equal to –450 ft/min.

In the case of takeoff without air conditioning supply, the outflow valves are closed, also avoiding cabin bump.

TAKEOFF SEQUENCE

(NORMAL MODE OPERATION)

This sequence is initiated after the airplane leaves the ground with the purpose of avoiding reselecting the landing altitude, in case it is necessary to return to the takeoff airport.

It causes the cabin altitude to continue descending towards the altitude equivalent to 0.2 psi below the takeoff altitude. If an altitude of 0.2 psi below the takeoff altitude has already been reached during the prepressurization sequence, the cabin altitude does not change.

The takeoff sequence lasts until the theoretical cabin altitude becomes greater than the actual cabin altitude, or until 15 minutes have elapsed since the sequence initiation, whichever occurs first.

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FLIGHT SEQUENCE

(NORMAL MODE OPERATION)

This sequence is initiated after the takeoff sequence is finished, to establish a cabin altitude and a cabin altitude rate of change during flight. The Digital Controller schedules a cabin altitude that is the greatest value between the theoretical cabin altitude and the selected landing altitude minus 11 mbar (300 ft at SL).

The cabin altitude rate of change is controlled at different values depending on the scheduled cabin altitude and the airplane vertical speed, but is limited to –450 ft/min during descent and as following while climbing:

- 500 ft/min (for airplanes Pre-Mod. SB 145-21-0006);
- 600 ft/min (for airplanes Post-Mod. SB 145-21-0006 or S/N 145.050 up to 145.362);
- 700 ft/min (for airplanes S/N 145.363 and on).

Barometric correction, when required, is automatically provided by the Air Data Computer (ADC).

FLIGHT SEQUENCE

(HIGH ALT MODE OPERATION)

During HIGH ALT mode operation the cabin altitude will automatically descend (at 500 ft/min) to 8000 ft altitude level immediately after takeoff, avoiding exposing the passengers to 15 minutes of high cabin altitude.

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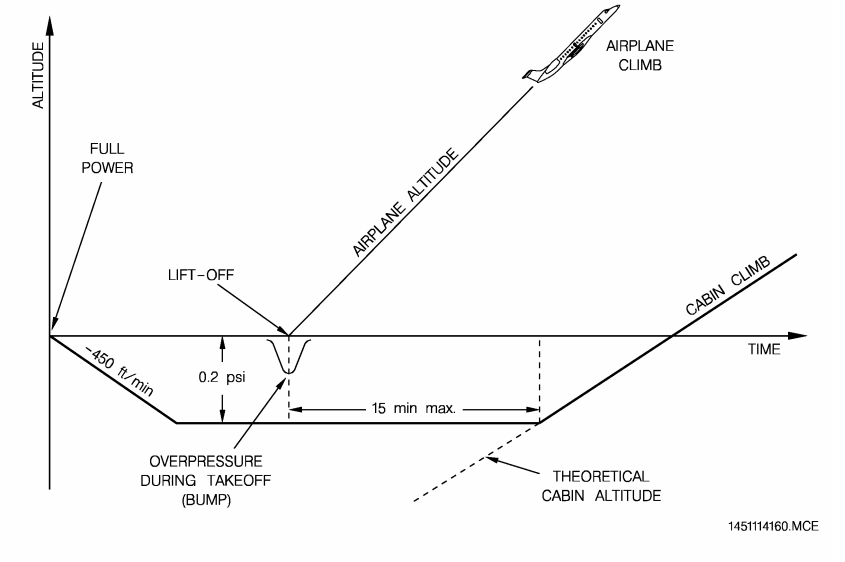
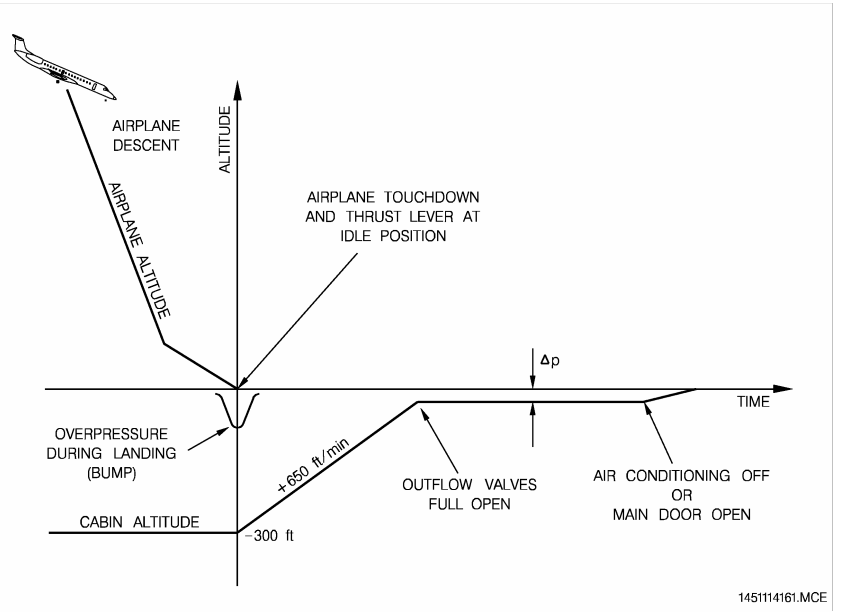


AUTOMATIC PREPRESSURIZATION AND TAKEOFF SEQUENCE



AUTOMATIC DEPRESSURIZATION SEQUENCE ON GROUND

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AUTOMATIC INCREASED RATE OF DESCENT SEQUENCE

This sequence is initiated when the airplane descent rate is greater than 200 ft/min for at least 10 seconds, in order to satisfy all airplane rapid descent cases. The cabin altitude rate of change limits may be accordingly increased, depending on the remaining flight time which is calculated considering the airplane operating altitude, airplane vertical speed and the selected landing altitude.

Therefore, the cabin altitude rate of descent limit may be increased to a value between –450 ft/min and –1300 ft/min (for EMB-145 models Pre-Mod. SB 145-21-0006) or –450 ft/min and –500 ft/min (for EMB-145 Post-Mod. SB 145-21-0006 or S/N 145.050 and on and EMB-135 models).

AUTOMATIC DEPRESSURIZATION SEQUENCE ON GROUND

This sequence is initiated when the airplane is on the ground and the engine 1 thrust lever is in the IDLE position.

To avoid a cabin bump during the landing, it is necessary that the airplane land with the cabin being submitted to a small differential pressure. For that reason, the automatic mode always controls, for landing, a cabin altitude equal to the selected landing altitude minus 300 ft. This sequence cancels this differential pressure corresponding to 300 ft, as well as reduces cabin bump when the air conditioning is turned off or the main door is open.

Cabin depressurization is controlled at a rate of climb equal to 650 ft/min, up to the full opening of the outflow valves.

In automatic mode, the rapid cabin depressurization is commanded by the Dump Button.

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OPERATION IN MANUAL MODE

Manual operation is accomplished through the manual controller which actuates only the pneumatic outflow valve, while the electropneumatic outflow valve is kept closed, by selecting MAN in the Pressurization Mode Selector Button and rotating the Manual Controller until the desired cabin rate of change is reached. The crew is responsible for monitoring cabin differential pressure within acceptable values.

In manual mode, the DUMP button is not effective and a rapid cabin depressurization is commanded by turning the manual controller to the UP position (clockwise stop). In this mode, the cabin altitude limitation at 15000 ft does not exist as it does in the automatic mode.

EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	PRESN AUTO FAIL	Automatic pressurization mode failure.
ADVISORY	HI ALT LDG-T/O	High Altitude Takeoff and Landing mode activate.

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CONTROLS AND INDICATORS

DIGITAL CONTROLLER

1 - LANDING ALTITUDE INDICATOR

- Displays the selected landing altitude.
- Displays a failure code if any failure is detected during power-up and continuous monitoring tests. In this case, the selection of the landing altitude is disabled.
- Successful power-up test is displayed (all light segments illuminated) until a landing altitude is selected.
- Displays blanks when Dump button or Mode Selector Button is pressed.

2 - LANDING ALTITUDE SELECTOR SWITCH

- Sets the landing altitude in the Landing Altitude Indicator.
- Altitude changes in 100-ft steps. Holding the selector for more than 5 seconds changes the altitude in a 1000 ft/sec rate.
- Landing altitude setting from –1500 ft to +14000 ft.

3 - PRESSURIZATION MODE SELECTOR BUTTON (guarded)

- Provides selection of either automatic mode (button released) or manual mode (button pressed) of operation.
- When pressed, the MAN inscription illuminates inside the button.

NOTE: In case of electrical failure that leads to the complete turning off of the automatic mode turning off, manual mode should be selected by pressing the Pressurization Mode Selector Button, but the MAN inscription will not be illuminated.

4 - PRESSURIZATION DUMP BUTTON (guarded)

- Provides rapid cabin depressurization up to 14500 ft.
- When pressed, an ON inscription illuminates inside the button.
- This button is effective in the automatic mode only.

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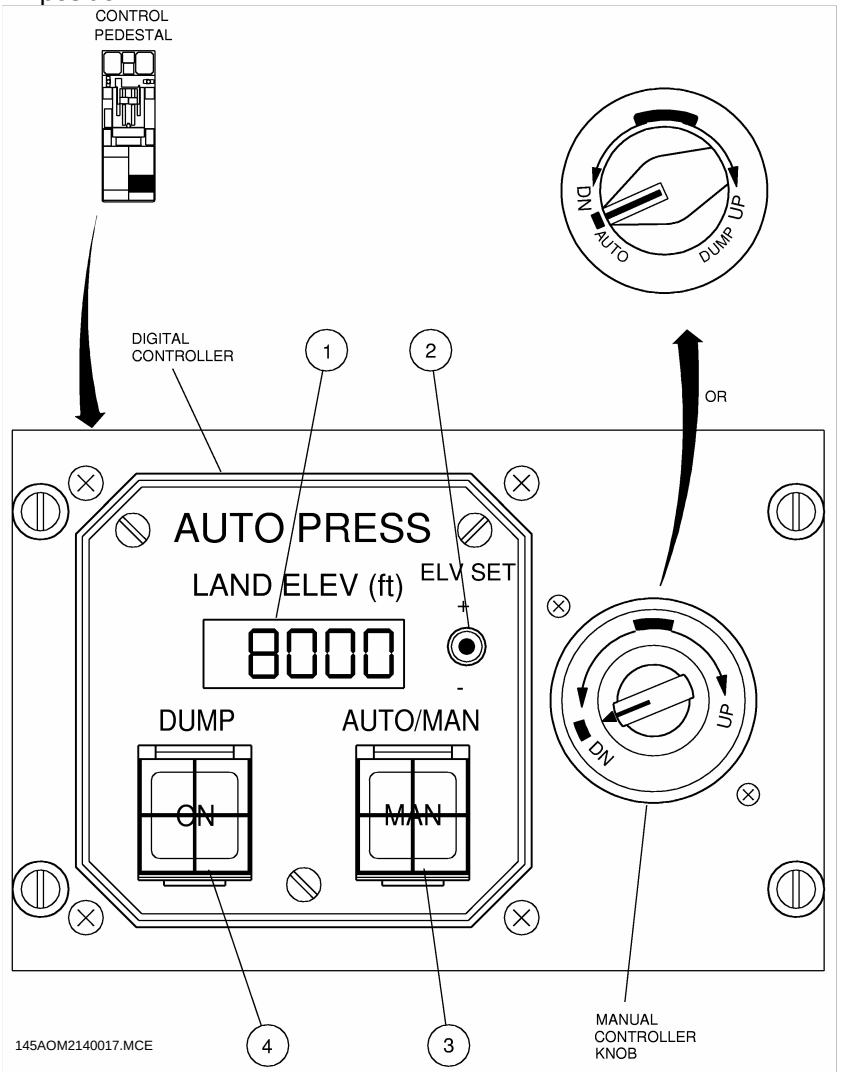
MANUAL CONTROLLER KNOB

- Selects cabin rate of change between –1500 ft/min (at DN position) and approximately + 2500 ft/min (at UP position), when in the manual operating mode.
- When operating in the AUTO mode, it must be set to the DN position.



PRESSURIZATION CONTROLS AND INDICATORS

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MFD

1 - HIGH ALT STATUS INDICATION

- Displays HIGH ALT activation status.
- Boxed: HIGH ALT mode activated.
- Unboxed: HIGH ALT mode deactivated.

2 - HIGH ALT BEZEL BUTTON

- Provides HIGH ALT activation when pressed.

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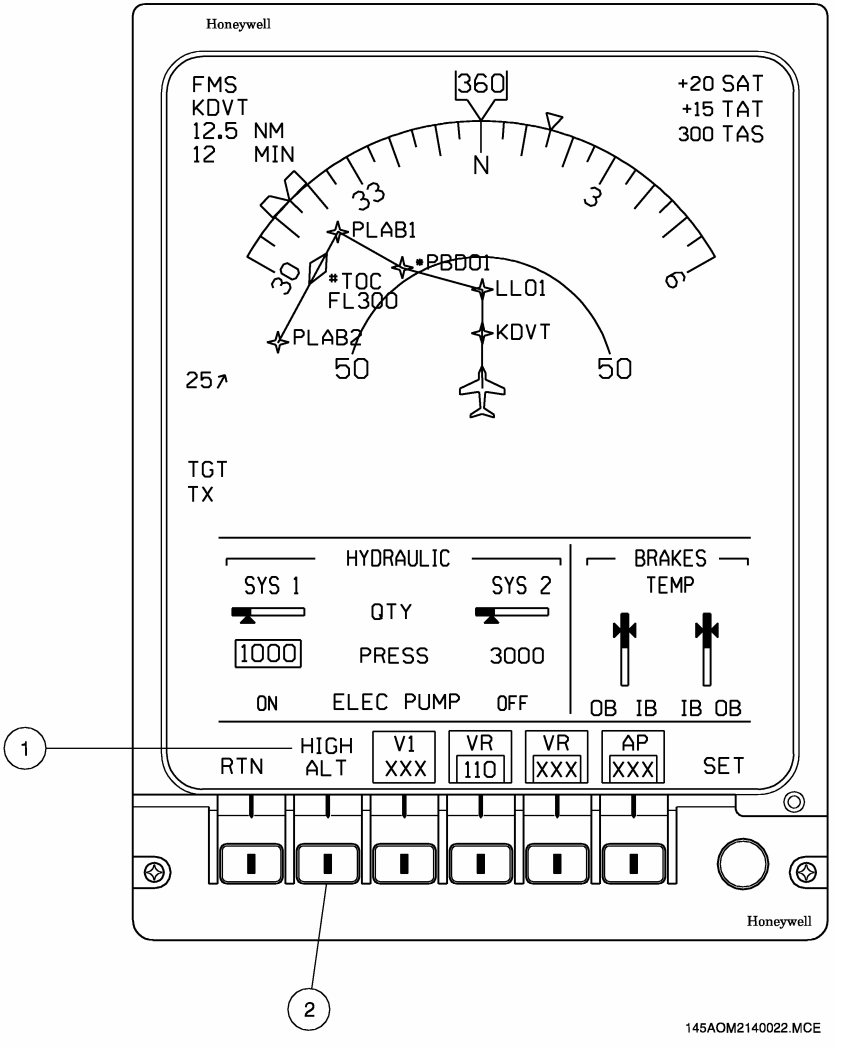

MFD HIGH ALT MODE ACTIVATION

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PRESSURIZATION INDICATION ON EICAS

1 - CABIN ALTITUDE INDICATION

- Displays cabin altitudes, regardless of the operating mode.
- Ranges from – 1500 to 37000 ft, with a resolution of 100 ft.

Cabin altitude indication color	Cabin altitude range (ft)	
	Normal mode operation	High altitude takeoff and landing mode operation (HIGH ALT mode) *
Green	-1500 to 8300	-1500 to 8300
Amber	8400 to 9900	8400 to 14400
Red	10000 to 37000	14500 to 37000

2 - DIFFERENTIAL PRESSURE INDICATION

- Displays the differential pressure between the cabin interior and the outside, regardless of the operating mode.
- Ranges from – 0.5 to 10.0 psi, with a resolution of 0.1 psi.
- Green: from 0.0 to 7.9 psi.
- Amber: from – 0.3 to – 0.1 psi and from 8.0 to 8.3 psi.
- Red: from – 0.5 to – 0.4 psi and from 8.4 to 10.0 psi.

3 - CABIN RATE OF CHANGE INDICATION

- Displays the cabin rate of change, regardless of the operating mode.
- Ranges from –2000 to 2000 ft/min, with a resolution of 50 ft/min (for EICAS versions up to 18.5).
- Ranges from –4000 to 4000 ft/min, with a resolution of 50 ft/min (for EICAS versions 19 and on).
- Green full range.
- For rates out of range the indication is replaced by amber dashes.

NOTE: (*) Only for airplanes equipped with HIGH ALT mode.

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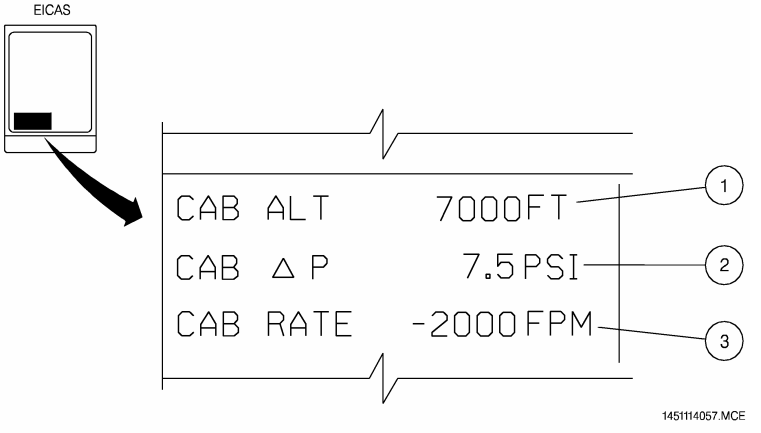

PRESSURIZATION INDICATION ON EICAS

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ELECTRONIC BAY COOLING SYSTEM

FORWARD ELECTRONIC BAY

An automatic cooling system is provided in the nose electronic bay, where most of the electronic equipment is installed. This system maintains the temperature inside the bay within the avionics operational limits.
The system comprises two NACA air inlets, two shutoff valves, two recirculation fans, two exhaust fans, two check valves, four control thermostats, and two overtemperature thermostats.

The NACA air inlets are provided with water separators and drains to deter water ingestion by the air inlets into the compartment.

All the fans are powered by four dedicated Inverter Modules.
When the airplane is energized, the inverter modules are turned on, supplying power to the recirculation fans.
The electrical power supply to the recirculation fan 2, exhaust fan 1 and shutoff valve 1 is completely segregated from the remaining components, to prevent a total loss of the system in case of an electrical system single failure. Each recirculation fan operates continuously when its associated bar is energized.

A check valve is installed on each exhaust duct (left and right) to avoid water ingestion through the exhaust fans.

If the forward electronic bay internal temperature exceeds 24°C (75°F) the control thermostats open the shutoff valves and turn the exhaust fans on. When the temperature drops below 19°C (66°F), the shutoff valves are closed and the exhaust fans are turned off.

In the event that the temperature limit is reached, two overtemperature thermostats are actuated and a caution message is presented on the EICAS.

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REAR ELECTRONIC BAY

In flight or during operation with the doors closed, rear electronic bay cooling is performed by conditioned air discharged from the cabin. When this air flows from the underfloor area to the outflow valves, installed on the rear pressure bulkhead, it passes through this compartment, cooling it.

During ground operation, with the airplane unpressurized, an air outlet blows air from the gasper fan line towards the rear electronic bay.

EICAS MESSAGE

TYPE	MESSAGE	MEANING
CAUTION	ELEKBAY OVTEMP	Temperature inside the forward bay exceeds 71ºC (160°F) maximum.

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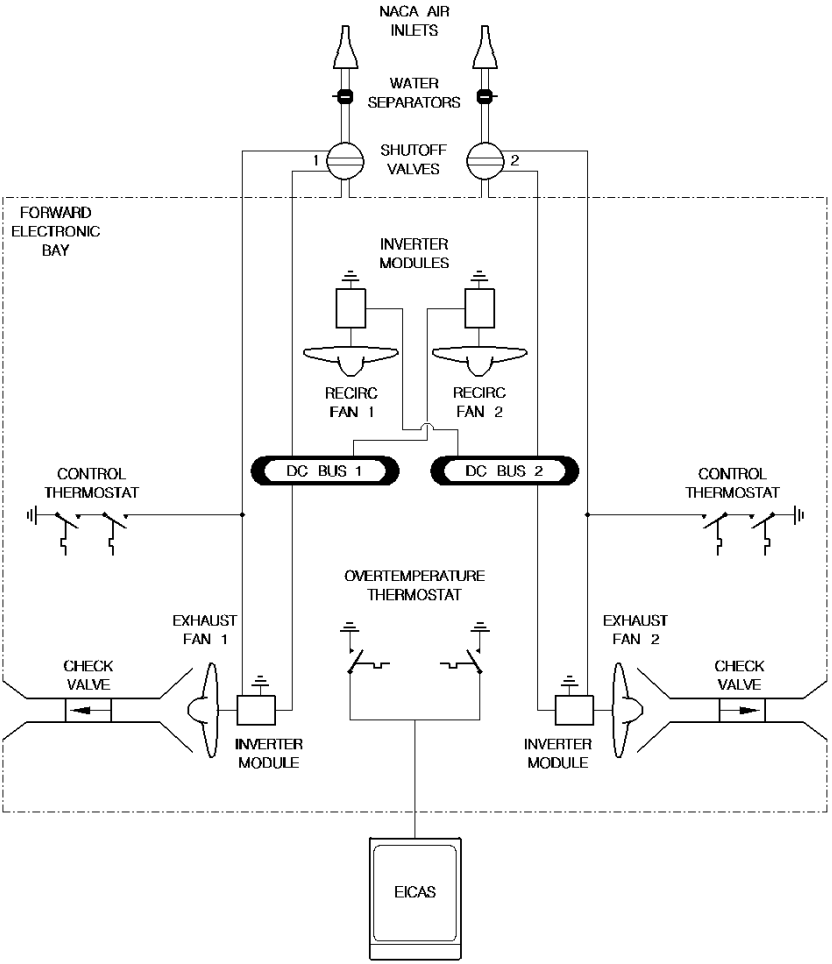

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FORWARD ELECTRONIC BAY COOLING SCHEMATIC

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BAGGAGE VENTILATION SYSTEM

Airplanes equipped with “class-C” baggage compartment have a Baggage Ventilation System installed. Although no dedicated temperature control is available (the “class-C” baggage compartment is heated by the passenger cabin air flowing into it), the Baggage Ventilation System provides an adequate environment for carrying live animals in the compartment.

The Baggage Ventilation System is composed of two ambient check valves and a baggage compartment fan.

Whenever the recirculation fan is off, the forward check valve prevents reverse flow into the passenger cabin and the two check valves prevent smoke or fire extinguishing agent penetration into the passenger cabin or into the rear electronic compartment, (refer to Section 2-7 - Fire Protection).

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SECTION 2-15
ICE AND RAIN PROTECTION

TABLE OF CONTENTS

Block Page

General ..... 2-15-05 .. 01
Bleed Air Thermal Anti-Icing System ..... 2-15-10 .. 01
Wing, Stabilizer and Engine Anti-icing Valves Operational Logic ..... 2-15-10 .. 03
EICAS Messages ..... 2-15-10 .. 08
Windshield Heating System ..... 2-15-10 .. 09
EICAS Messages ..... 2-15-10 .. 10
Windshield Differentiation ..... 2-15-10 .. 11
Sensor Heating System ..... 2-15-10 .. 13
EICAS Messages ..... 2-15-10 .. 14
Lavatory Water Drain and Nipple Heating System ..... 2-15-10 .. 15
Ice Protection Controls and Indicators ..... 2-15-10 .. 15
Ice Protection Control Panel ..... 2-15-10 .. 15
Ice Detection System ..... 2-15-15 .. 01
EICAS Messages ..... 2-15-15 .. 01
Windshield Wiper System (if applicable) ..... 2-15-15 .. 02
Windshield Wiper Control Panel (if applicable) ..... 2-15-15 .. 02

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GENERAL

Airplane ice protection system is provided by heating critical ice build up areas through the use of either hot air or electrical power. The system is fully automatic and under icing conditions, activates the entire protection system (the only exception is the windshield heating system).

The hot air-heated areas are:
– Wing and horizontal stabilizer leading edges.
– Engine air inlet lips.

The electrically heated areas are:
– Windshields.
– Pitot tubes, Pitot-static tube, AOA sensors, TAT probes, ADCs and pressurization static ports.
– Lavatory water drain and water service nipples.

Two fully independent wiper systems remove rain from the windshields.

NOTE: For airplanes Pre-Mod. SB 145-30-0055 and Post-Mod. SB 145-30-0054 (or with an equivalent modification factory incorporated), the Rain Repellent Coating replace the Windshield Wipers. Approved Rain Repellent Coatings are listed in AMM chapter 30-41-04.

All ice protection systems provide signals to the EICAS for malfunctioning system display.

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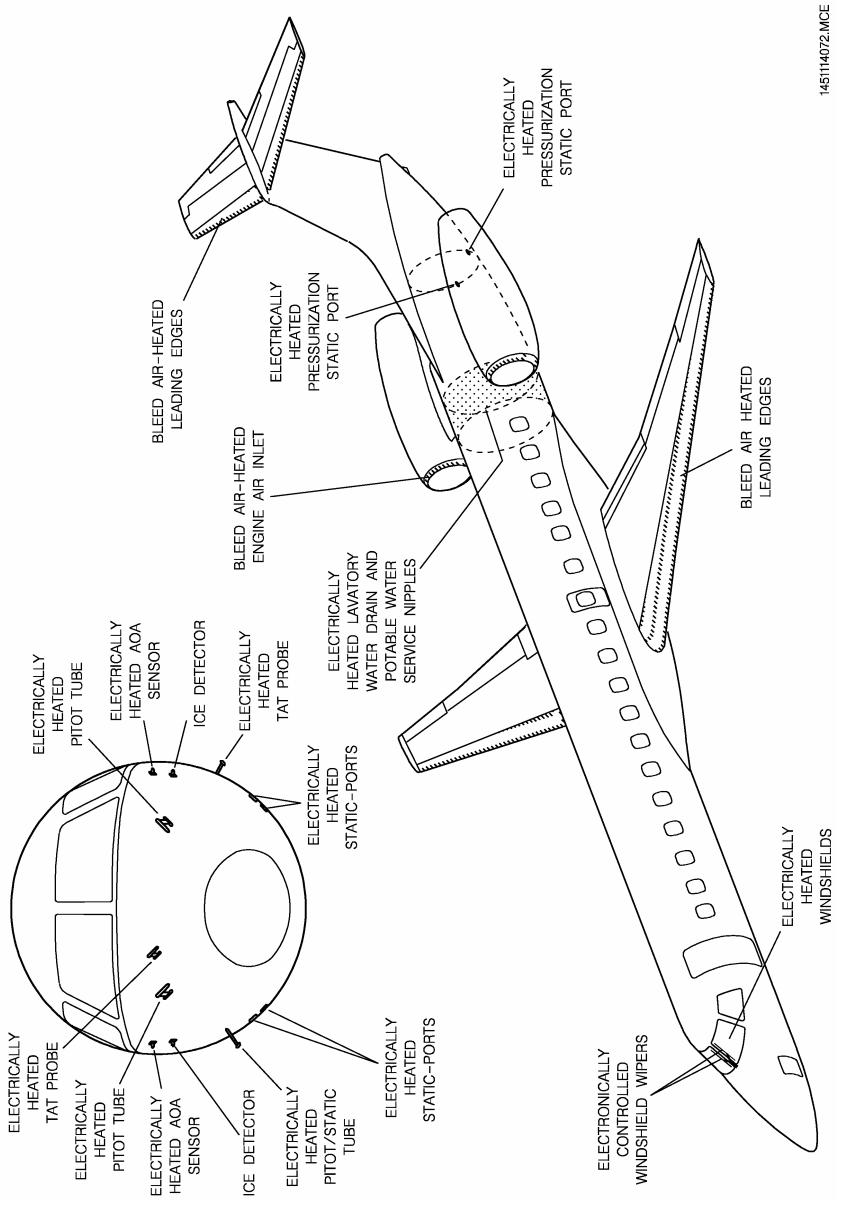

ICE AND RAIN PROTECTION SYSTEM

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BLEED AIR THERMAL ANTI-ICING SYSTEM

The bleed air thermal anti-icing system is supplied with hot air tapped from the engines. In the automatic mode, the system is turned on through activation of either ice detector. Manually, setting the OVERRIDE Knob to the ALL position activates the system.

Adequate ice protection for the wing and horizontal stabilizer leading edges and engine air inlet lips is ensured by heating these surfaces. Hot air supplied by the Pneumatic System is ducted through perforated tubes, known as Piccolo tubes. Each Piccolo tube is routed along the surface, so that hot air jets flowing through the perforations heats the surface. Dedicated slots are provided for hot air exhaustion after the surface has been heated.

During night flights, inspection lights, installed on the wing-to-fuselage fairing, illuminate the wing leading edges, allowing the crew to check for ice accumulation.

Each subsystem comprises an anti-icing valve (pressure regulating/shutoff valve). A restrictor limits the airflow rate supplied by the Pneumatic System. It is monitored by pressure sensors, that indicate abnormal low and high air pressure conditions. The pressure sensors protect the respective subsystem against either insufficient or excessive airflow rate.

The wing and stabilizer low pressure protection mode has a redundant detection by means of a second low pressure sensor on the stabilizer system and a differential pressure switch ($\pm$ 2 psi) that compares root pressure on the left and right half-wing Piccolo tubes.

Air leakage is detected by thermostats installed close to each duct connection. Low pressure switches provide an additional protection against unacceptable leakage level.

The Piccolo tubes integrity is monitored as follows:

Horizontal stabilizer: By one differential pressure switch comparing the left and right Piccolo tubes pressure.

Half-wing: It depends on the airplane model. By one differential pressure switch in each Piccolo tube comparing the root and tip pressures or, by manometric switches measuring the tip pressure only.

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Engine ice protection is provided by heating the engine air inlet lip, through the use of non-temperature-controlled hot air tapped directly upstream of each high stage valve. As the engine air inlet has enough airflow surrounding the lip when the engine is running, the engine air inlet lip anti-icing system can be operated on the ground normally and with no limitations. Each engine has its own protection system independent of the airplane's pneumatic system.

The left hand Pneumatic System supplies the horizontal stabilizer anti-icing subsystem. Each half-wing anti-icing subsystem is supplied by its respective side of the Pneumatic System.

The bleed air thermal anti-icing system may be deactivated by buttons, located on the overhead panel.

On the ground, the FADEC incorporates an automatic logic to reduce the maximum available thrust to avoid a sudden engine thrust loss during lift-off, even with the thrust lever set at MAX position.

In flight, the FADEC allows the engines to deliver the maximum rated thrust to compensate for the effect of the high bleed air consumption by the wing and horizontal stabilizer thermal anti-icing subsystems. Moreover, the FADEC provides an automatic logic to ensure a minimum available thrust during icing conditions, even during low thrust setting conditions. This logic is automatically inhibited when the landing gear is extended, in order to improve the airplane's rate of descent and glide slope path adjusting capability.

The APU bleed air is not hot enough to perform anti-icing functions. Therefore it must not be used for such applications.

A caution message is presented on the EICAS if the thermal anti-icing system is turned on during non-icing conditions.

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WING, STABILIZER AND ENGINE ANTI-ICING VALVES OPERATIONAL LOGIC

Since the Bleed Thermal Anti-icing System is supplied by the Pneumatic System, it is integrated to the functional logic that provides automatic control and protection for the system.

The Wing and Stabilizer Anti-icing Valves receive an electrical input to open when the following conditions occur:

- The Ice Detection Test Knob is set to 1 or 2, or
- The airplane is in-flight or attained a ground speed above 25 kt, and
- The Ice Detection Override Knob is set to ALL, or
- The Ice Detection Override Knob is set to AUTO or ENG and any ice detector is activated.

NOTE: - The Wing and Stabilizer Anti-icing Valves are inhibited from opening on the ground and at a ground speed below 25 kt to prevent structural damage caused by surface heating, except during ice detection testing. The ice detection test should not be activated for more than 15 seconds.

- An ICE COND-A/I INOP message may be displayed on ground in icing conditions at a ground speed below 25 kt. For the logic of this message, refer to Section 1-00-30 (EICAS Versions) of AOM. If the message is displayed, the associated procedure must be accomplished.

- The Engine Anti-icing Valves receive an electrical input to open when the following conditions occur:
- The Ice Detection Override Knob is set to ALL or ENG, or
- The Ice Detection Override Knob is set to AUTO position and any ice detector is activated, or
- The Ice Detection Test Knob is set to 1 or 2.

The engine anti-ice system logic has a narrow range between normal operating pressures and a low pressure value that, if reached, would trigger an E1(2) A/ICE FAIL message on the EICAS. This message may be presented in flight whenever the engines are set at low thrust settings. This message may be cleared increasing the engine anti-ice system pressure by advancing the thrust levers with Ice Detection Override Knob in AUTO. If the message does clear and the related Engine Air Inlet OPEN inscription remains illuminated, the system is operating normally and the flight may be continued.

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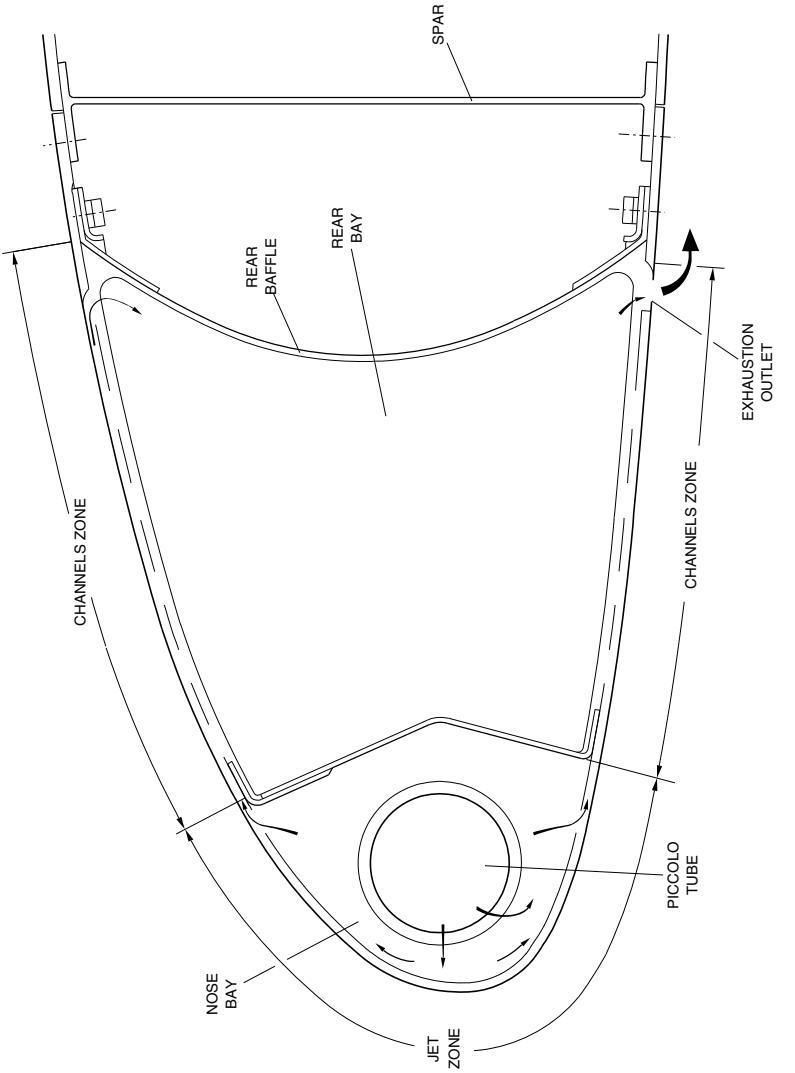

WING ANTI-ICING SYSTEM SCHEMATIC

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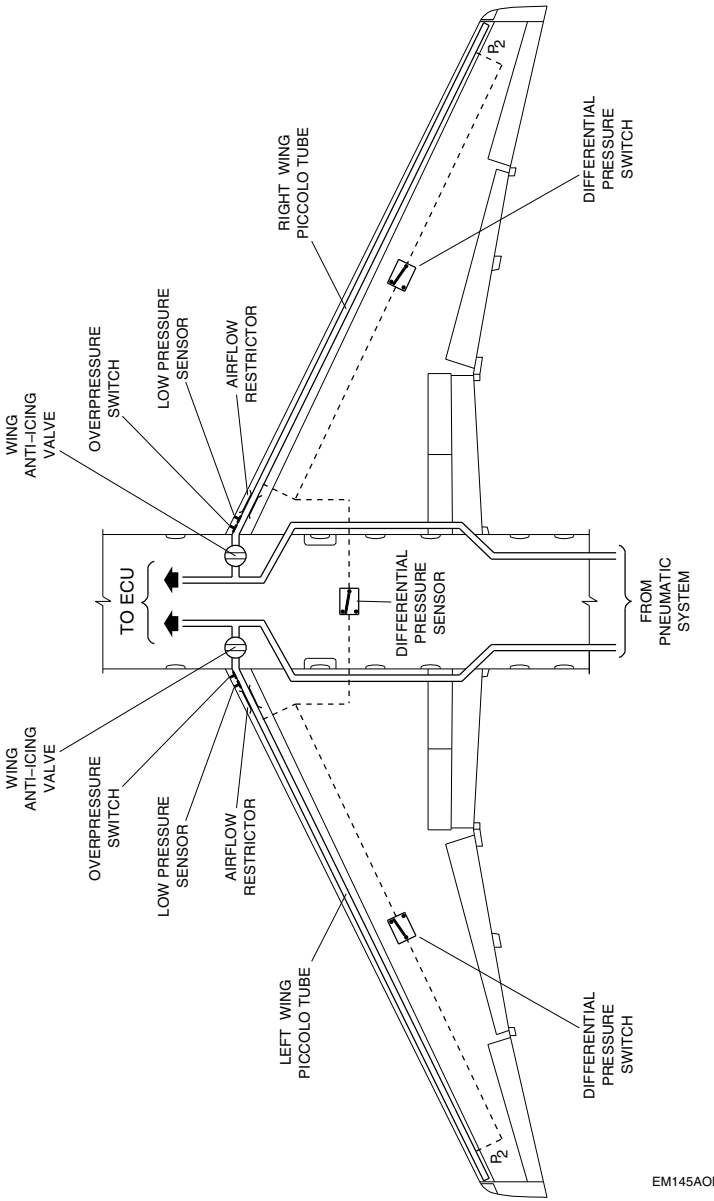

AIRPLANES PRE-MOD. SB 145-30-0019

WING ANTI-ICING SYSTEM SCHEMATIC

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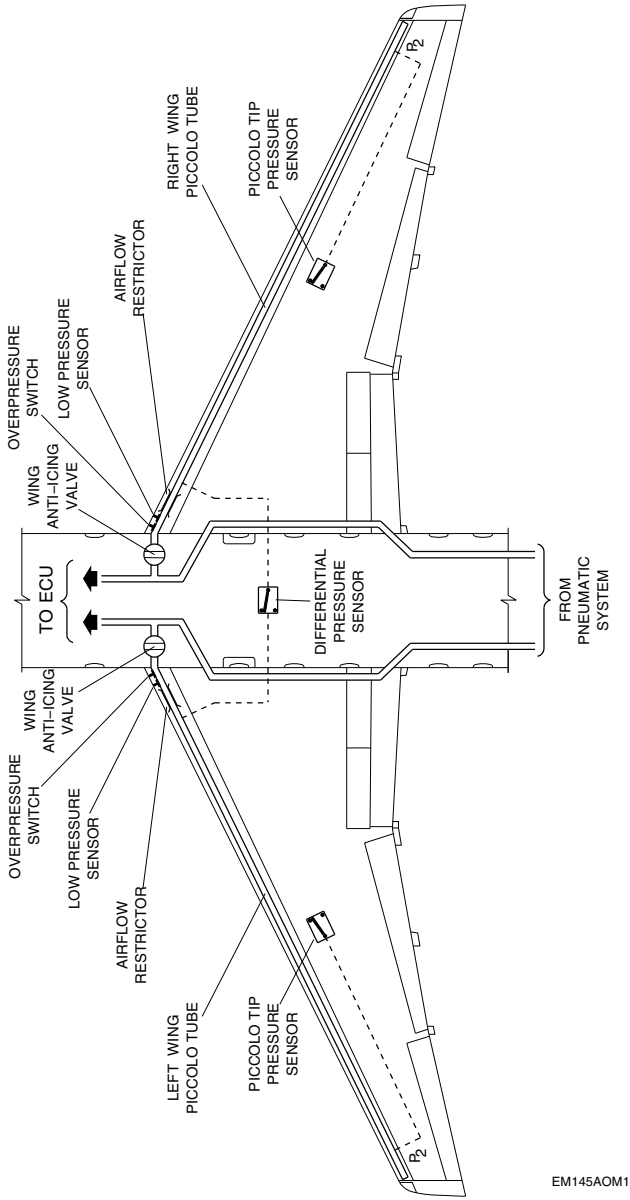

AIRPLANES POST-MOD. SB 145-30-0019

WING ANTI-ICING SYSTEM SCHEMATIC

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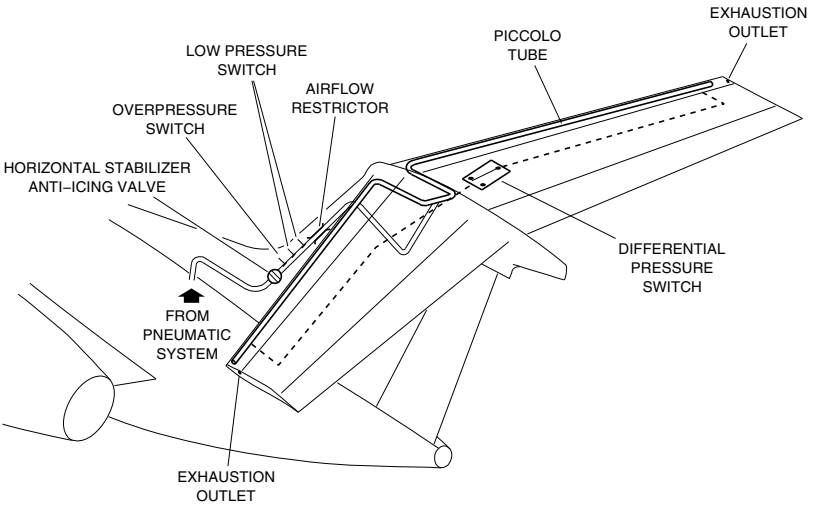

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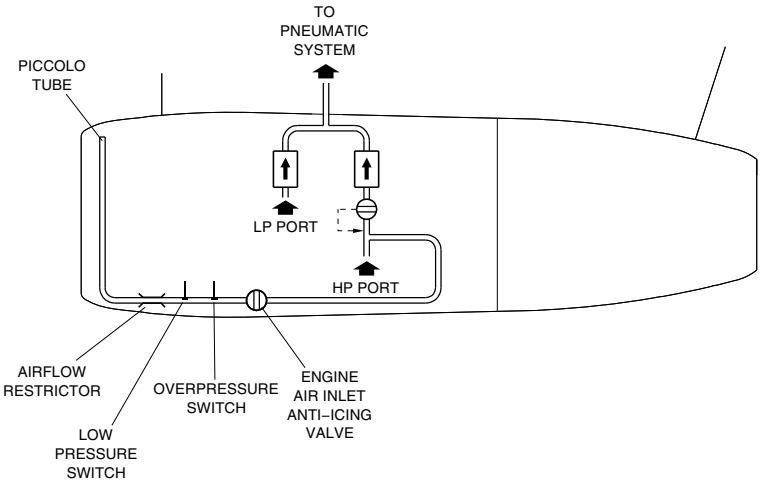
HORIZONTAL STABILIZER ANTI-ICING SYSTEM SCHEMATIC



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ENGINE AIR INLET ANTI-ICING SYSTEM SCHEMATIC

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
WARNING	ICE COND-A/I INOP	Any Bleed Air Thermal anti-icing subsystem not functioning properly under icing conditions.
CAUTION	A/ICE LOW CAPACITY	Low pressure condition downstream of any wing or stabilizer anti-ice valve or wing pressure asymmetry.
	A/ICE SWITCH OFF	Any Bleed Air Thermal anti-icing button turned off.
	E1 (2) A/ICE FAIL	– Low pressure condition. – Valve failure. – Any switch failure. – Overpressure condition. – Any system failure.
	NO ICE-A/ICE ON	Any anti-icing valve opened in flight out of icing conditions.
	STAB A/ICE FAIL	– Low pressure condition. – Valve failure. – Any switch failure. – Duct leakage. – Any system activation device failure.
	WG A/ICE FAIL	– Low pressure condition, or – Disagreement between valve position and system command, or – Piccolo tube failure.
ADVISORY	ENG A/ICE OVERPRES	Inflight overpressure condition detected.

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WINDSHIELD HEATING SYSTEM

The windshields are electrically heated to prevent ice and fog formation or for deicing and defogging purposes. Due to a higher thermal inertia to bring heat to windshield inner layer, when Descent phase is initiated the system must be turned ON to prevent fogging. During all the others flight phases, the system must be kept OFF except when icing conditions are anticipated or if situation requires. For airplanes equipped with PPG windshield, the windshield heating system may be selected ON during all flight phases.

The outer glass layer has no structural significance but provides a rigid, hard and protected surface.

Windshield heating is accomplished through an electric conductive grid embedded in its interlayer, which functions as an electric resistor.

Individual buttons located on the overhead panel control left and right windshield heating. Separate power supplies are provided for each windshield heating element and its control circuit.

Each windshield element is provided with three temperature sensors. One sensor is used for temperature control and a second sensor is used for overheat protection. A third sensor is provided as a spare for use by maintenance personnel, should a failure occur in any of the two sensors.

For airplanes Pre-Mod. SB 145-30-0033, each windshield element has a dedicated temperature controller that receives a signal from the associated temperature sensors and controls the windshield temperature. When the temperature reaches the upper limit (45°C), power supply to the heater is interrupted. When the temperature is below the lower limit (40°C), power supply is automatically restored. A caution message W/S HEAT FAIL is presented on the EICAS when a system failure is detected or the windshield temperature exceeds 55°C.

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For airplanes Post-Mod. SB 145-30-0033 or with an equivalent modification factory-incorporated, the temperature controller has two modes of operation, defog heat and anti-ice heat mode. When the windshield heating push button is set to ON, the controller continuously monitors the windshield temperature; as temperature drops below 26°C (defog mode), it modulates power input to the electric conductive grid and maintains this temperature. If ice detectors sense ice formation, the controller automatically increase power input to maintain the temperature at 43°C (anti-ice mode). If both ice detectors are inoperative, the Override knob on the Overhead Panel set to ALL position provides manual means to put both systems into anti-ice mode automatically increasing power input to maintain the temperature at 43°C. A caution message W/S HEAT FAIL is presented on the EICAS when a system failure is detected or the windshield temperature exceeds 65°C.

EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	W/S 1 (2) HEAT FAIL	For airplanes Pre-Mod. SB 145-30-0033, associated windshield heating system failure (< 38°C) or associated overheat condition (> 55°C). For airplanes Post-Mod. SB 145-30-0033, associated windshield heating system failure or associated overheat condition (> 65°C).

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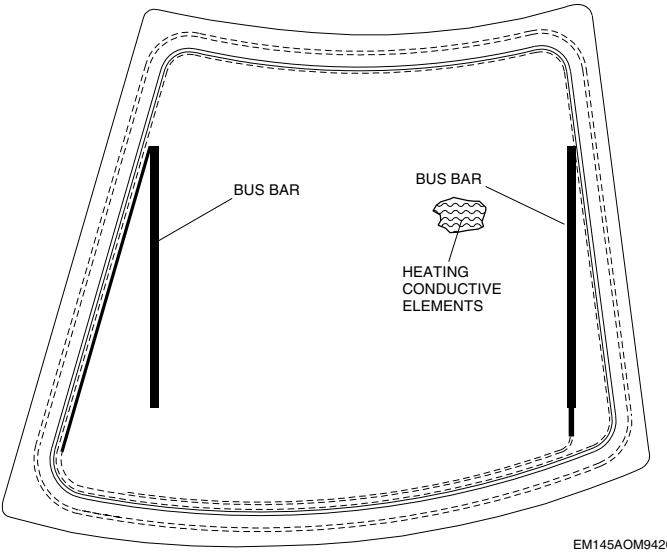
WINDSHIELD DIFFERENTIATION

SIERRACIN WINDSHIELD

Sierracin windshields can be easily identified by their green colored tint and by the positions of the bus bars to which the heater filaments are attached, in the vertical direction, as shown below:



SIERRACIN WINDSHIELD SCHEMATIC

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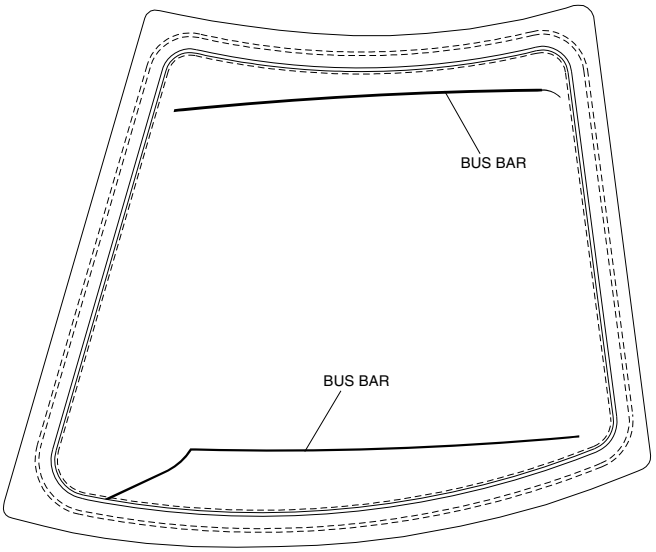
PPG WINDSHIELD

PPG windshields can be easily identified by the positions of the bus bars to which the heater filaments are attached, in the horizontal direction, as shown below:



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PPG WINDSHIELD BUS BARS POSITIONS

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SENSOR HEATING SYSTEM

The Sensor Heating System provides automatic operation for the heater elements of Pitot tubes 1 and 2, Pitot/Static 3, Pressurization System and ADS Static Ports, TAT sensors 1 and 2, and AOA vanes 1 and 2, thus providing constant temperature and ice-free operation during all flight phases.

All the sensors are electrically heated and controlled by three buttons, located on the overhead panel.

In the automatic mode, the sensor heating system operates according to three functional logics:

- Pitot 1 and 2 and Pitot/Static 3, AOA 1 and 2, ADS Static Ports 1, 2, 3 and 4, and Pressurization Static Ports 1 and 2 are heated whenever at least one engine is running (N2 above 54.6%).
- A separate logic assures Pitot/Static 3 and Pressurization System Static Port 2 heating in any flight condition.
- For airplanes Pre-Mod SB 145-30-0028, TAT 1 and 2 are heated provided either Engine 1 or 2 anti-icing subsystem is functioning or airplane is in flight (the TAT sensor normal range of operation is from - 99ºC to + 99ºC).
- For airplanes Post-Mod. SB 145-30-0028 and on, TAT heating is on when Thrust Levers are set above 65º position or when the airplane is airbone.

NOTE: For airplanes Pre-Mod. SB 145-30-0028, when operating in icing conditions on the ground with the Engine Anti-Ice turned ON, if a TAT invalid indication is displayed on the MFD due to temperature values beyond the sensor normal range (TAT digits replaced by three amber dashes) with the consequent AHRS reversion to the Basic Mode, disregard the information and continue the takeoff normally. The TAT invalid indication and AHRS reversion will remain until the airplane reaches a sufficient speed to bring the TAT sensors into the normal range of operation. This may occur on the ground or when airplane is airborne and the airplane will return to the normal condition (AHRS Full Performance) and no pilot's or maintenance personnel's action is required.

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Heater deactivation is accomplished either when the above conditions are not met or when the associated control button is manually pressed.

Caution messages are presented on the EICAS to indicate that the sensor heating is inoperative. These messages are inhibited during the takeoff and approach phases.

EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	PITOT 1 (2, 3) INOP	– Associated sensor heating inoperative with any engine running (N2 above 60%). – Both engines N2 below 50%.
	AOA 1 (2) HEAT INOP	– Associated sensor heating inoperative with any engine running (N2 above 60%) and airplane airborne. – Both engines N2 below 50%.
	TAT 1 (2) HEAT INOP	Associated sensor heating inoperative in icing conditions and airplane airborne.

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LAVATORY WATER DRAIN AND NIPPLE HEATING SYSTEM

The lavatory waste water drain and water service nipples (overflow and fill) are heated by electric resistors to prevent clogging by water freezing under any atmospheric conditions on the ground and in flight.

The heating is automatically turned on when the DC BUS 1 is powered.

Refer to Section 2-2 – Equipment and Furnishings.

ICE PROTECTION CONTROLS AND INDICATORS

ICE PROTECTION CONTROL PANEL

1 - ENGINE AIR INLET ANTI-ICING BUTTONS

- Turns off (released) or permits (pressed) the automatic activation of the associated engine air inlet anti-icing subsystem.
- A striped bar illuminates inside the button to indicate that it is released.
- An OPEN inscription illuminates inside the button to indicate that the associated engine air inlet anti-icing valve is open.

2 - WING ANTI-ICING BUTTON

- Turns off (released) or selects the automatic mode (pressed) of the half-wing anti-icing subsystems.
- A striped bar illuminates inside the button to indicate that it is released.
- An OPEN inscription illuminates inside the button to indicate the following conditions:
  - Both valves are open with the system commanded to open.
  - At least one valve is open with the system not commanded to open.

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3 - HORIZONTAL STABILIZER ANTI-ICING BUTTON

- Turns off (released) or permits (pressed) the automatic activation of the horizontal stabilizer anti-icing subsystem.
- A striped bar illuminates inside the button to indicate that it is released.
- An OPEN inscription illuminates inside the button to indicate that the horizontal stabilizer anti-icing valve is open.

4 - SENSOR HEATING BUTTONS

- The left button controls Pitot tube 1, AOA 1 vane, TAT 1 probe, ADC Static Ports 1 and 3, and pressurization static port 1.
- The central button controls Pitot/Static tube 3 and pressurization static port 2.
- The right button controls the Pitot tube 2, AOA 2 vane, TAT 2 probe and ADC static ports 2 and 4.
- When pressed, the associated sensor heating system operates in the automatic mode according to its functional logic. When released, the associated sensor heating system is turned off.
- A striped bar illuminates inside the button to indicate that it is released.

5 - ICE DETECTION TEST KNOB

Permits the half-wing, horizontal stabilizer and engine air inlet anti-icing subsystems to operate for test purposes, by simulating an icing condition on ice detectors 1 and 2. The adequate system operation is confirmed by the illumination of the OPEN inscriptions in the anti-icing buttons, which indicate the current valve position.

NOTE: The ICE CONDITION, ICE DET 1 (2) FAIL and BLD 1 (2) LOW TEMP messages are displayed during test. The CROSS BLD OPEN message is also presented for airplanes Pre-Mod. SB 145-36-0028.

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6 - ICE DETECTION OVERRIDE KNOB

ENG - Turns on the engine air inlet anti-icing subsystems for ground speeds below 25 kt. Above 25 kt the wing and horizontal stabilizer anti-icing subsystems are also turned on if icing condition is detected.

AUTO - Allows the automatic operation of the bleed air anti-icing system.

NOTE: If ground speed is equal or above 25 kt and an icing condition is detected, wing and horizontal stabilizer anti-icing subsystems are turned on. The engine anti-icing subsystem is turned on as soon as an icing condition is detected.

ALL - Turns on the complete bleed air anti-icing system provided airplane is on ground at speed equal or above 25 knots or in flight.

NOTE: On ground, below 25 kt, only engine anti-icing is turned on.

7 - WINDSHIELD HEATING BUTTON

– Turns on (pressed) or turns off (released) the windshield heating system.
– A striped bar illuminates inside the button to indicate that it is released.

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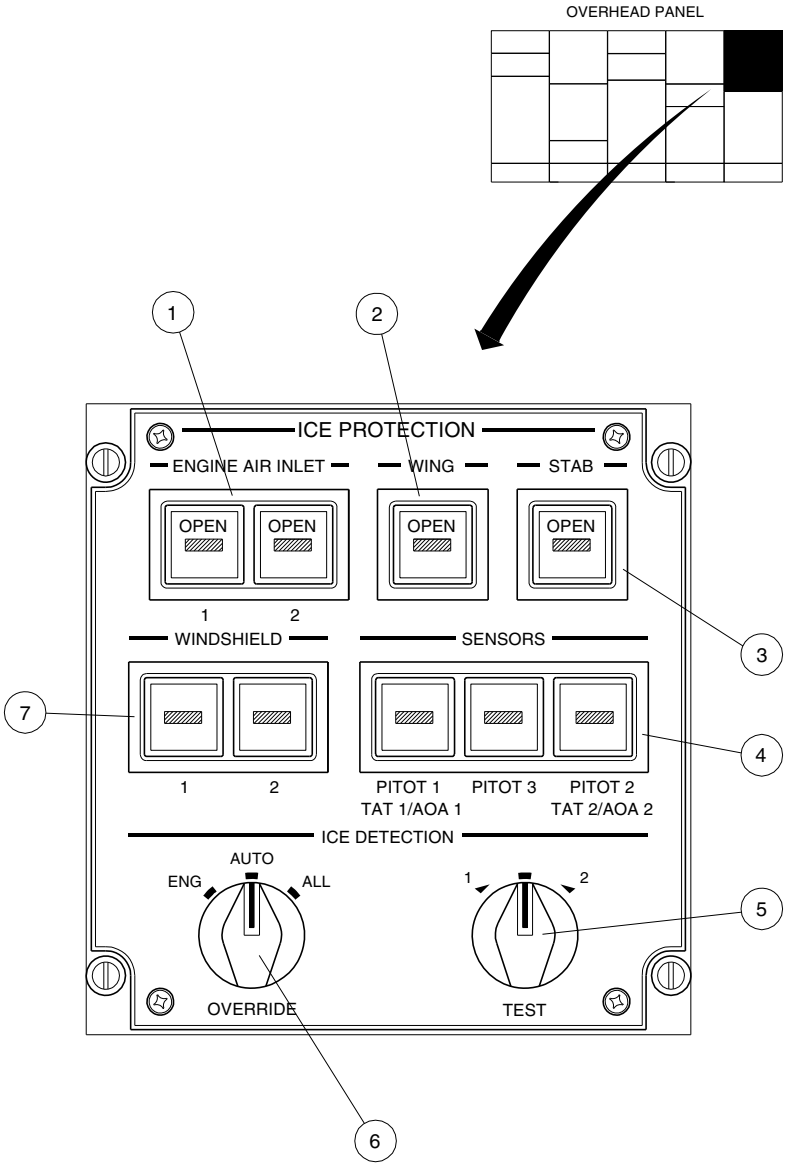

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ICE PROTECTION CONTROL PANEL

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ICE DETECTION SYSTEM

Ice detectors 1 and 2 are respectively installed at the airplane's left and right nose section, to provide icing condition detection.

The ice detector was designed to pick up ice quickly. Therefore, in the most cases, ice will be detected before it can be noticed by the crew.

NOTE: Notwithstanding ice detector monitoring, the crew remains responsible for monitoring icing conditions and for manual activation of the ice protection system if icing conditions are present and the ice detection system is not activating the ice protection system.

A 0.5 mm (0.020 inch) ice thickness, on any probe, causes bleed air anti-icing system automatic mode activation, a SPS angle of attack set values reduction (refer to Stall Protection System on Section 2-4 – Crew Awareness), and an advisory message to be presented on the EICAS.

During ice encounters, the icing signal remains active during 60 seconds. Simultaneously, an internal ice detector heater is activated to de-ice the unit and probe. When the probe's natural frequency is recovered, heating is de-energized. Once deiced, the sensing probe cools within a few seconds and is ready to once more monitor ice build-up. Then a new detection cycle begins and remains as long as the ice condition persists.

In case of failure of any or both ice detectors, a caution message is presented on the EICAS and the bleed air thermal anti-icing system may be activated through the OVERRIDE knob on the Ice Detection panel.

The system's normal operation may be checked through the TEST knob on the Ice Protection panel.

EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	ICE DETECTORS FAIL	Both ice detectors have failed.
	ICE DET 1 (2) FAIL	Associated ice detector has failed.
ADVISORY	ICE CONDITION	At least one of the probes has detected ice.

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WINDSHIELD WIPER SYSTEM (IF APPLICABLE)

NOTE: For airplanes Pre-Mod. SB 145-30-0055 and Post-Mod. SB 145-30-0054 (or with an equivalent modification factory incorporated), the Rain Repellent Coating replace the Windshield Wipers. Approved Rain Repellent Coatings are listed in AMM chapter 30-41-04.

A two-speed windshield wiper is provided for the left and right windshields. Each system comprises a motor-converter, a wiper arm, and blades. A control box provides speed control, synchronization, and off-screen park functions for both systems through independent channels.

Each system has its own independent power supply and a four-position knob on the overhead panel.

WINDSHIELD WIPER CONTROL PANEL (IF APPLICABLE)

1 - WINDSHIELD WIPER SELECTOR KNOB

TIMER - Provides intermittent operation of the associated windshield wiper in single cycles (two strokes) with an 8 second time interval between two cycles, in high speed.

OFF - Associated wiper blades travel to the windshield inboard position, parking out of pilots vision.

LOW - Associated wiper operates at approximately 80 ± 10 strokes per minute.

HIGH - Associated wiper operates at approximately 140 ± 14 strokes per minute.

NOTE: Dry windshield operation leads the motor-converter to a stall condition, due to the high friction level. The controller senses the motor-converter current surge and drives the arm directly to the parked position. The system remains inoperative until the Windshield Wiper Selector Knob is set to OFF position and a new operation mode is selected.

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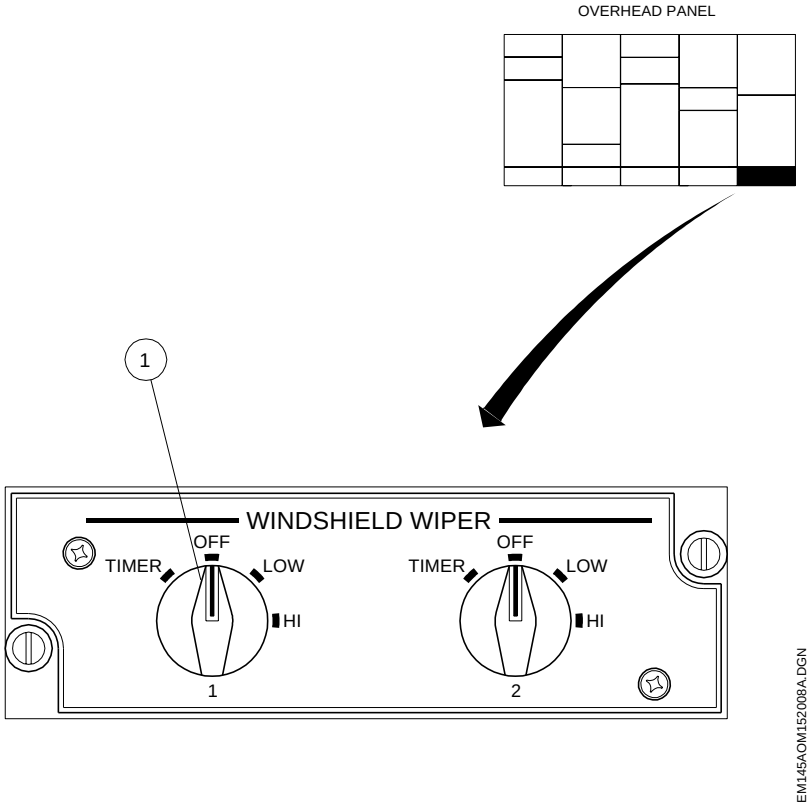

WINDSHIELD WIPER CONTROL PANEL

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SECTION 2-16

OXYGEN

TABLE OF CONTENTS

	Block	Page
General	2-16-05	01
Flight Crew Oxygen	2-16-10	01
EICAS Message	2-16-10	05
ECS Page on MFD	2-16-10	05
Crew Mask Stowage Boxes	2-16-10	06
Crew Mask	2-16-10	07
Controls and Indicators (EROS Mask)	2-16-10	08
Controls and Indicators (PURITAN Mask)	2-16-10	10
Smoke Goggles	2-16-10	12
Passenger Oxygen	2-16-15	01
Controls and Indicators	2-16-15	05
Portable Oxygen Cylinder	2-16-20	01
Protective Breathing Equipment	2-16-25	01
EROS (Air Liquide) PBE Unit	2-16-25	02
PURITAN Bennet PBE Unit	2-16-25	04
Minimum Oxygen Pressure for Dispatch	2-16-30	01
Flight Crew Oxygen System	2-16-30	01
Portable Oxygen Cylinder	2-16-30	01
Oxygen Pressure Correction Chart	2-16-30	02
Oxygen Consumption Chart	2-16-30	04

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GENERAL

The oxygen system is divided into two different and separate systems: a gaseous-type for crewmembers (pilot, copilot and observer) and a chemical generation-type one for passengers and flight attendants.

The crewmembers oxygen is a conventional, high pressure gaseous-type system, in which the oxygen is stored in a cylinder at high pressure and distributed at low pressure to the masks.

The passengers oxygen system is supplied through chemical oxygen generators, which is distributed through dispensing units in several different locations in the cabin.

For airplanes Post-Mod. SB 145-35-0008 or equipped with an equivalent modification factory incorporated, gaseous oxygen supply is provided in the lavatories.

In addition to the flight crew and passenger oxygen systems, equipment for smoke protection and fire fighting is provided both in the cockpit and in the passenger cabin.

The system is monitored so that all the necessary parameters are informed to the flight crew and flight attendants.

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FLIGHT CREW OXYGEN

The flight crew is provided with oxygen through a conventional high-pressure gaseous system. The system employs a 50-cu.ft cylinder in which the oxygen is stored at high pressure (1850 psi), installed on the right side of the cockpit/passenger cabin partition, to feed the cockpit crew masks.

The system is protected from overpressurization by a safety disc located on the lower right side of the aircraft's nose. Discharge through the safety disc may be visually verified when the discharge indicator (green disc) has been blown out. If the cylinder pressure drops below 400 psi, a caution message is presented on EICAS.

The cylinder is provided with an integrated shutoff/regulator valve, that controls oxygen outlet pressure. The regulator valve at the ON position supplies the crew distribution lines at low pressure rate (70 psi). A relief valve opens if the pressure exceed 90 psi.

The cockpit is provided with a quick-donning diluter/demand-type mask, available inside mask stowage boxes adjacent to each crew station, and a smoke protection kit. The smoke protection kit consists of two smoke goggles to be used with the diluter/demand masks by the pilot and copilot, and one Protective Breathing Equipment (PBE) unit for fire fighting.

Two additional PBE units are also available in the passenger cabin to protect crewmembers or flight attendants from smoke during fire fighting operation.

An oxygen service panel, located on right side of the front fuselage, allows access to the oxygen cylinder and monitoring of oxygen quantity through a pressure gauge. Some airplanes may have a factory incorporated removable panel located behind the copilot's seat that provides access to the oxygen cylinder and its replacement. The cylinder pressure is also indicated on the MFD (ECS page).

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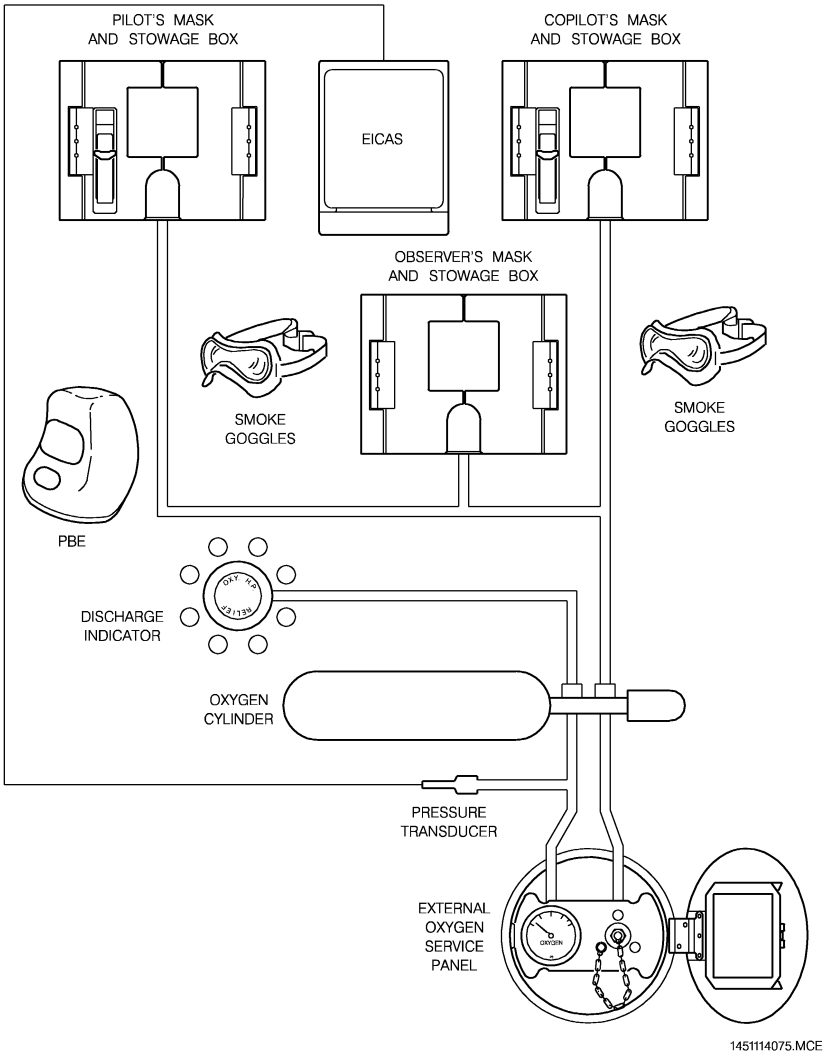

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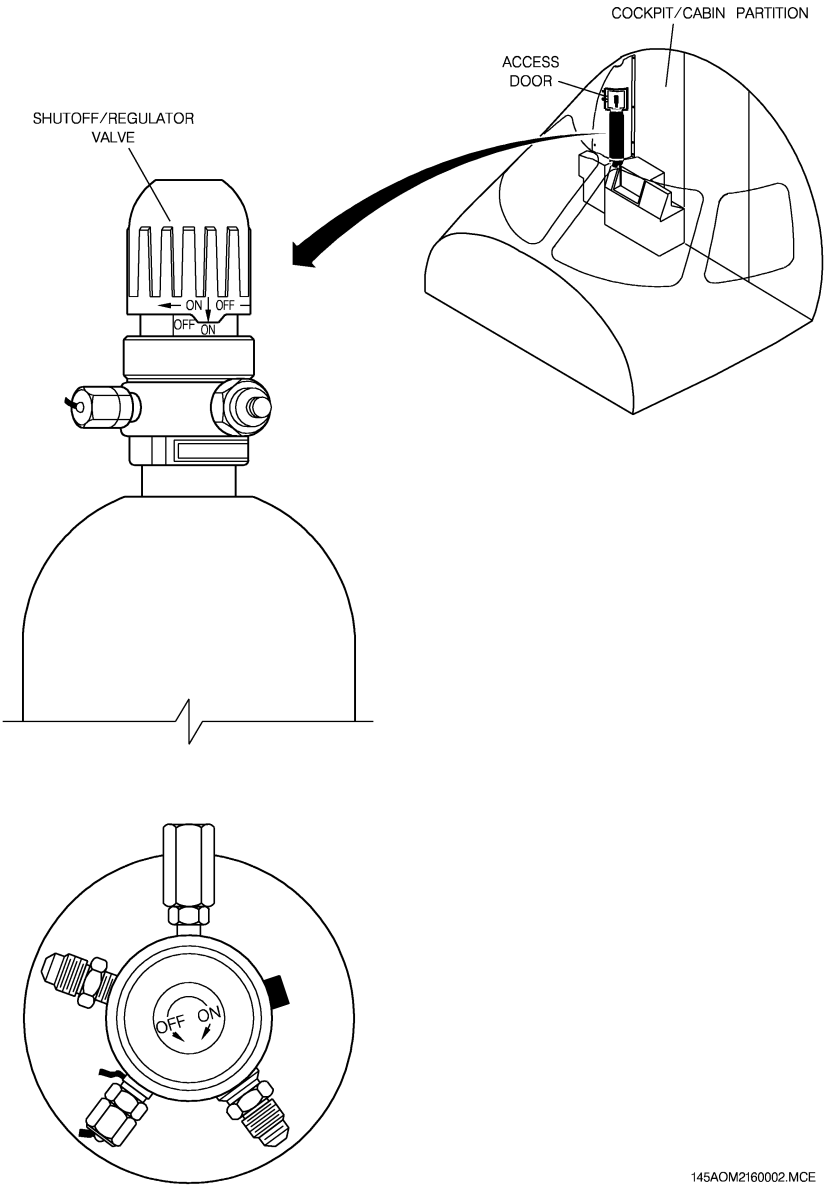
FLIGHT CREW OXYGEN SYSTEM SCHEMATIC



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MAIN OXYGEN CYLINDER

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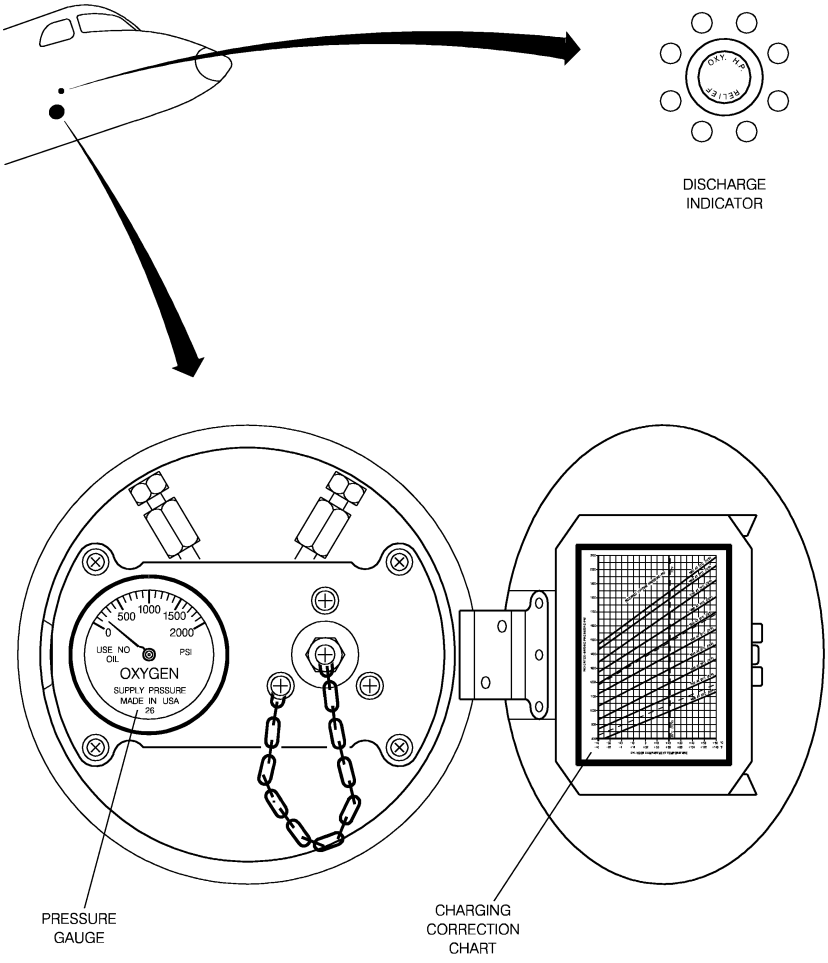

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OXYGEN SERVICE PANEL

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EICAS MESSAGE

TYPE	MESSAGE	MEANING
CAUTION	OXYGEN LO PRESS	Oxygen cylinder pressure below 400 psi. Remaining oxygen sufficient for about 12 minutes for pilot, copilot, and observer.

ECS PAGE ON MFD

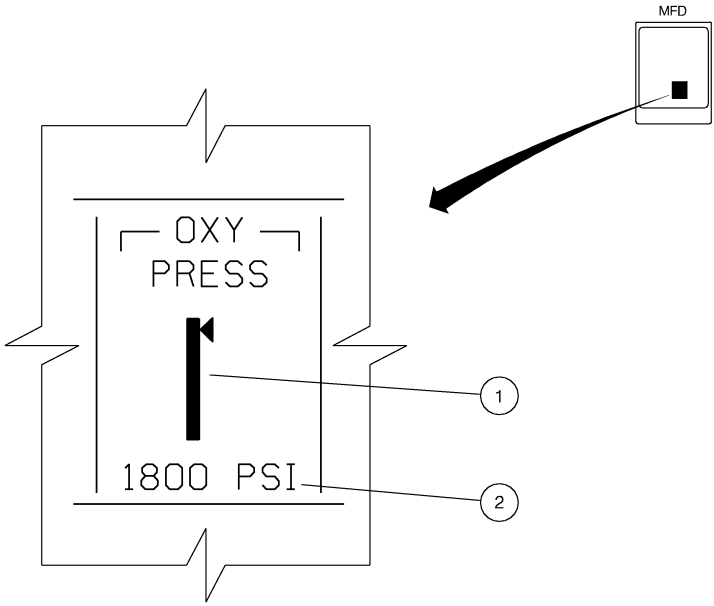
1 - ANALOGIC OXYGEN PRESSURE INDICATION

Pointer:

- Green between 410 to 1850 psi.
- Amber between 250 to 400 psi.
- Red between 0 to 240 psi.

2 - DIGITAL OXYGEN PRESSURE INDICATION

- Ranges from 0 to 1850 psi, with a resolution of 10 psi.
- Digits are green between 410 to 1850 psi.
- Digits are amber between 250 to 400 psi.
- Digits are red between 0 to 240 psi.



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ECS PAGE ON MFD

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CREW MASK STOWAGE BOXES

The crew mask stowage boxes are directly connected to the oxygen distribution line and to the communication system. The pilot and copilot boxes incorporate a shutoff valve, which keeps the mask regulator unpressurized while in the stowed position.

When the box doors are opened, the shutoff valve is brought to open position, thus allowing the oxygen flow to the mask.

After the mask has been taken out of the stowage box, the doors can be closed without interrupting oxygen supply to the mask. To stop the oxygen flow, it is necessary to close the left door and activate the Test/Shutoff Sliding Control.

Pilot and copilot mask stowage boxes are also provided with a flow indicator.

NOTE: The observer's mask stowage box is not provided with Test/ Shutoff Sliding Control (EROS Mask) or Test/Reset Button (PURITAN Mask) and, although the masks are permanently pressurized, oxygen will flow only on demand.

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CREW MASK

The crew mask is a quick-donning oro-nasal type that allows oxygen flow on demand or under pressure, as required.

The mask is provided with an automatic oxygen dilution system that provides pure oxygen with cabin altitude over 33000 ft. It can also be manually selected to the 100% position to provide pure oxygen at all altitudes or to EMERGENCY position to maintain positive pressure in the venting orifice.

The quick-donning operation is as follows:

- Hold the mask with one hand by the hose and the inflation control valve (red ears).
- Pull the mask out of the box.
- Press the inflation control valve (red ears) firmly. The harness inflates rapidly, and takes a shape large and rigid enough to allow the user to don it quickly.
- Release the regulator ears. The harness will then deflate, securing the mask to the user's face.

NOTE: The EROS Mask is provided with two red ears, while the PURITAN Mask possesses one red ear and one black ear.

The pilot and copilot masks are provided with a venting valve, a venting orifice (refer to smoke goggles in this section) and a microphone.

The observer's mask is similar to that of the pilot and copilot, with the exception that the observer's mask has no venting valve and features a flow indicator installed in the supply hose.

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CONTROLS AND INDICATORS (EROS MASK)

MASK STOWAGE BOX/CREW MASK

1 - TEST/SHUTOFF SLIDING CONTROL (spring-loaded in the pilot and copilot boxes only)

- When pressed, with the mask stowed, allows testing of the oxygen mask. Flow indicator turns yellow for a short time. The OXY ON flag appears on the lid face.
- When pressed, with the mask not stowed and the left door closed, shuts off oxygen to the mask. The OXY ON flag disappears on the lid face.

2 - OXY ON FLAG (white)

- Appears when the box shutoff valve is open and oxygen is supplied to the mask.

3 - FLOW INDICATOR (pilot and copilot boxes only)

- A yellow star appears when oxygen is flowing.

4 - VENTING VALVE CONTROL (pilot and copilot masks only)

- When actuated forward, opens the venting valve.
- A red band is visible to indicate that the control is actuated.

5 - HARNESS INFLATION CONTROL VALVE (red ear)

- When pressed, inflates the harness and allows mask donning.

6 - FLOW INDICATOR (observer mask only)

- The black shutter disappears when pressure is applied to the mask.

7 - TEST/EMERGENCY SELECTOR KNOB

- When rotated clockwise, 100% oxygen is supplied under positive pressure at all cabin altitudes. This mode must be selected when using smoke goggles.
- When pressed, tests if the regulator demand mechanism operates satisfactorily.

8 - NORMAL/100% SELECTOR

N - Oxygen/air mixture is supplied on demand. Mixture ratio is dependent on the cabin altitude. Above 33000 ft, pure oxygen is supplied.

100% - Pure oxygen is supplied at all cabin altitudes on demand. This mode must be selected in conjunction with EMERGENCY position, when protective breathing is required.

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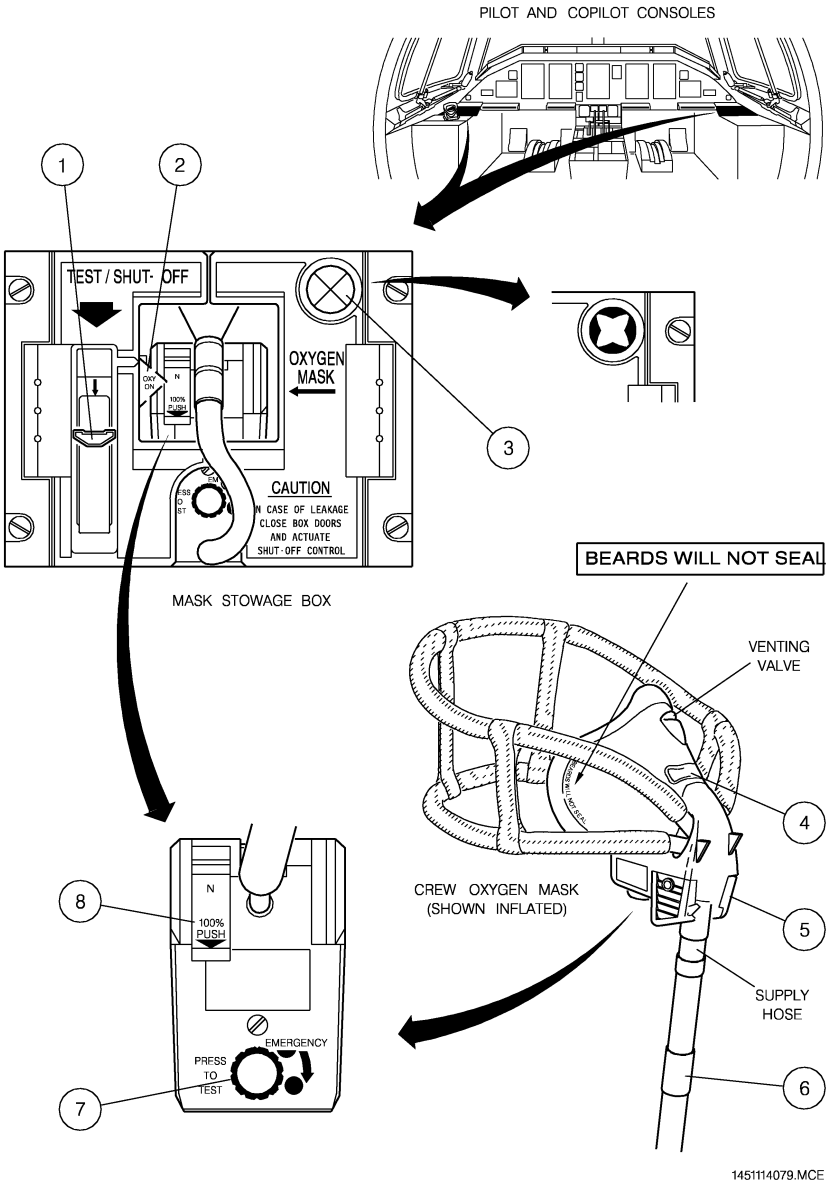

MASK STOWAGE BOX/CREW MASK (EROS MASK)

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CONTROLS AND INDICATORS (PURITAN MASK)

MASK STOWAGE BOX/CREW MASK

1 - FLOW INDICATOR (pilot and copilot only)
- A bright star appears when oxygen is flowing.

2 - TEST/RESET Button (spring-loaded in the pilot and copilot boxes only)
- When pressed, with the mask stowed, allows testing the oxygen mask. Flow indicator shows a bright contrast for a short time. The OXY ON flag appears on the lid face.
- When pressed, with the mask not stowed, shuts off oxygen to the mask. The OXY ON flag disappears on the lid face.

3 - OXY ON FLAG (white)
- Appears when the box shutoff valve is open and oxygen is supplied to the mask.

4 - PURGE VALVE (pilot and copilot masks only)
- Automatically opens when the smoke goggles are donned.
- Supplies oxygen only in EMERGENCY position.

5 - FLOW INDICATOR (observer mask only)
- Indicates oxygen pressure.
- Color: Green for proper pressure.
  Red for low pressure.

6 - HARNESS INFLATION CONTROL VALVE (red ear)
- When pressed, inflates the harness and allows mask donning.

7 - CONTROL KNOB
- When rotated, allows selection of oxygen supply modes.
- Oxygen supply mode is indicated by a white mark.

8 - NORMAL POSITION
- Oxygen/air mixture is supplied. Mixture ratio depends on the cabin altitude.
- In the event of an emergency decompression, a 100% oxygen flow will be provided.

9 - 100% POSITION
- Pure oxygen is supplied at all cabin altitudes.

10 - EMERGENCY POSITION
- Pure oxygen with a slight positive pressure is supplied at all cabin altitudes.

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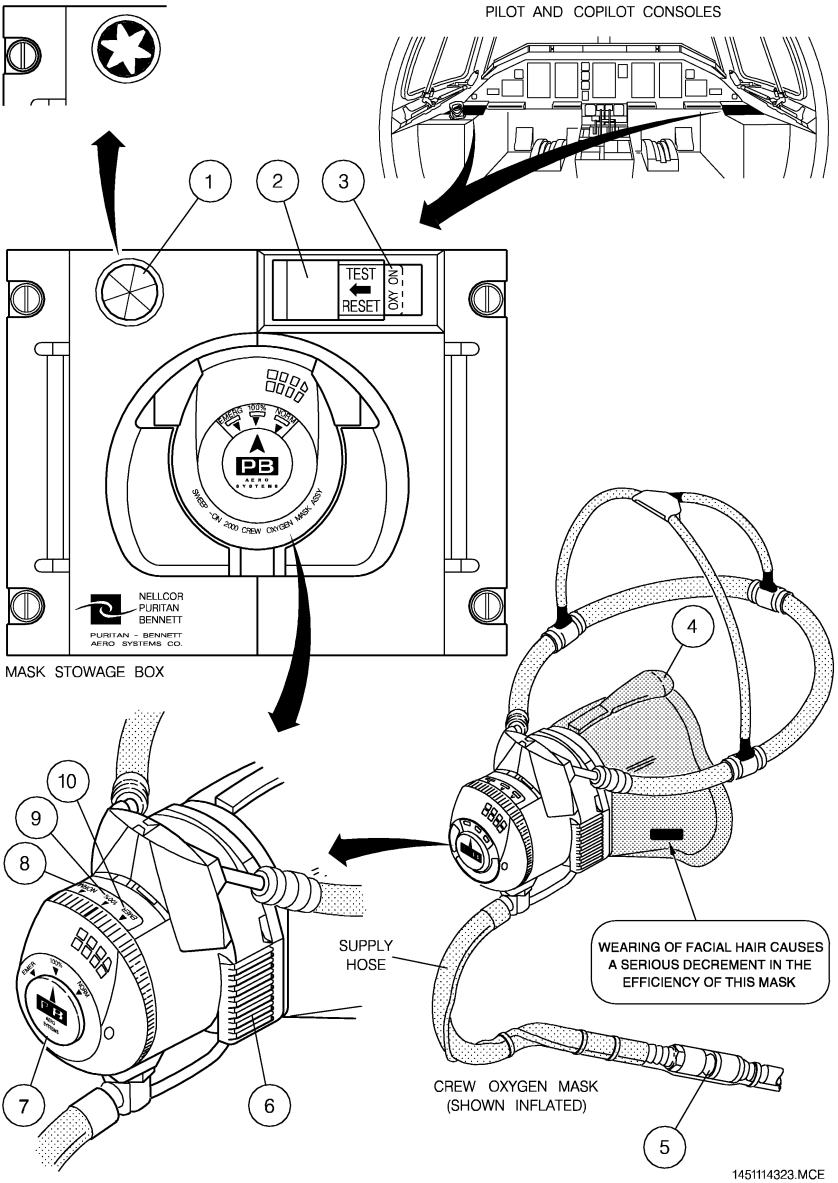

MASK STOWAGE BOX/CREW MASK (PURITAN MASK)

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SMOKE GOGGLES

The smoke goggles were designed for use with the crew mask assembly, matching the mask face cone. The venting valve, located on the mask shell and manually actuated by the user, allows direct communication between venting orifice and goggles.
When mask regulator is selected to emergency position, a metered oxygen flow will be directed to the goggles' cavity so as to allow continuous venting and preventing any infiltration of harmful gases.

NOTE: For the Puritan Mask, the purge valve automatically opens when the smoke goggles are donned.

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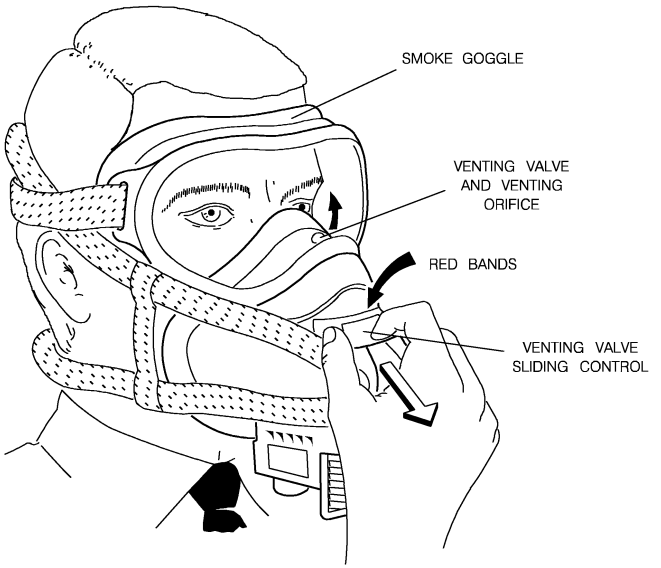

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SMOKE GOGGLES

PASSENGER OXYGEN

Oxygen supplied to the passengers and flight attendants comes from chemical oxygen generators and continuous-flow masks installed in proper dispensing units.

For airplanes Post-Mod. SB 145-35-0008 or equipped with an equivalent modification factory incorporated, gaseous oxygen supply is provided in the lavatories.

The dispensing units are located in the right and left overhead bins, lavatory, and flight attendant stations. Some airplanes are optionally equipped with an extra dispensing unit installed at the galley area. Each unit is equipped with one, two, or three continuous flow masks. The oxygen masks are held in a mask retainer. The mask must be pulled out of the retainer.

The Passenger Oxygen Control Panel is at the right lateral console, above the mask stowage box of the copilot. The system is automatically activated, provided the Passenger Oxygen Selector Knob is set to the AUTO position and cabin pressure altitude is above 14000 ft (*). The system may be activated manually, at any altitude, by setting the Passenger Oxygen Selector Knob to MANUAL position.

NOTE: (*) For airplanes equipped with High Altitude Takeoff and Landing system, passengers masks deploy at 14500 ± 500 ft cabin altitude.

Dedicated altimetric switch and electric latches assure the automatic release of the oxygen masks by opening the dispensing units. A timer circuit is provided to maintain electric latches energized during 6 seconds on automatic or manual mode activation. The oxygen ON indicator light, on the Passenger Oxygen Control Panel, illuminates to indicate that the electric latches are energized. In this case, the NO SMOKING and FASTEN SEAT BELTS signs in the passenger cabin are automatically illuminated. These indicators and passenger advisory lights remain illuminated until the oxygen system is reset.

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Activating the system causes the masks to drop from their dispensing units. Each oxygen generator is activated when any mask in the associated dispensing unit is released. Pulling one mask down causes all masks in that unit to drop and 100% oxygen flows to all masks. Oxygen flows for approximately 12 minutes. Once oxygen flow was started, there is no way to stop it.

CAUTION: ONCE ACTUATED, EACH CHEMICAL GENERATOR SUPPLIES OXYGEN CONTINUOUSLY, WHETHER THE MASKS CONNECTED TO IT ARE BEING USED OR NOT.

NOTE: When oxygen is supplied, high temperature is produced in the oxygen chemical generator.

An in-line flow indicator is visible in the transparent oxygen hose whenever oxygen is flowing to the mask.

If the system is activated and the door of a dispensing unit does not open, the attendant may drop the masks through a door-opening tool. This tool is located near the cabin attendant stations.

A portable oxygen cylinder and a Protective Breathing Equipment (PBE) unit are installed near each cabin attendant station.

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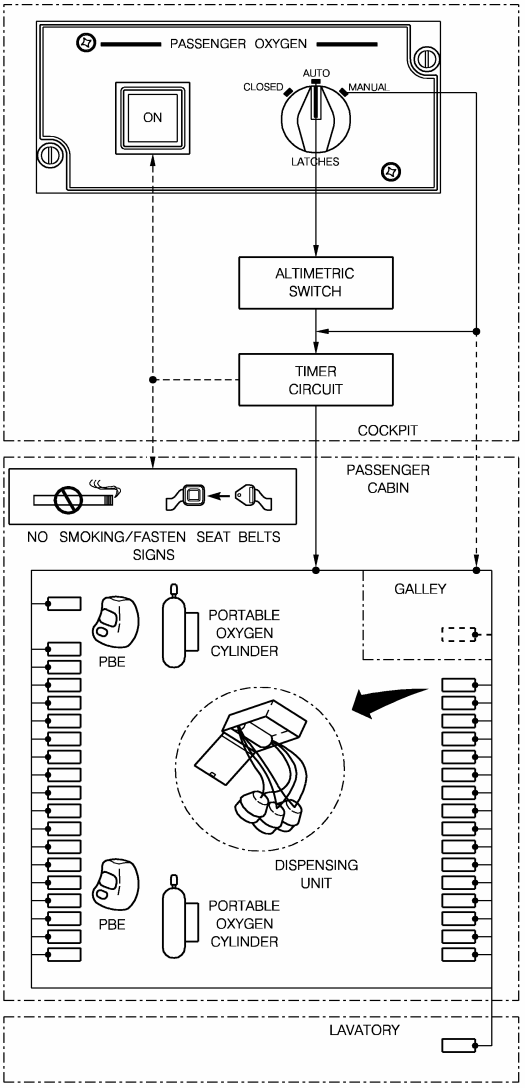

PASSENGER OXYGEN SYSTEM SCHEMATIC

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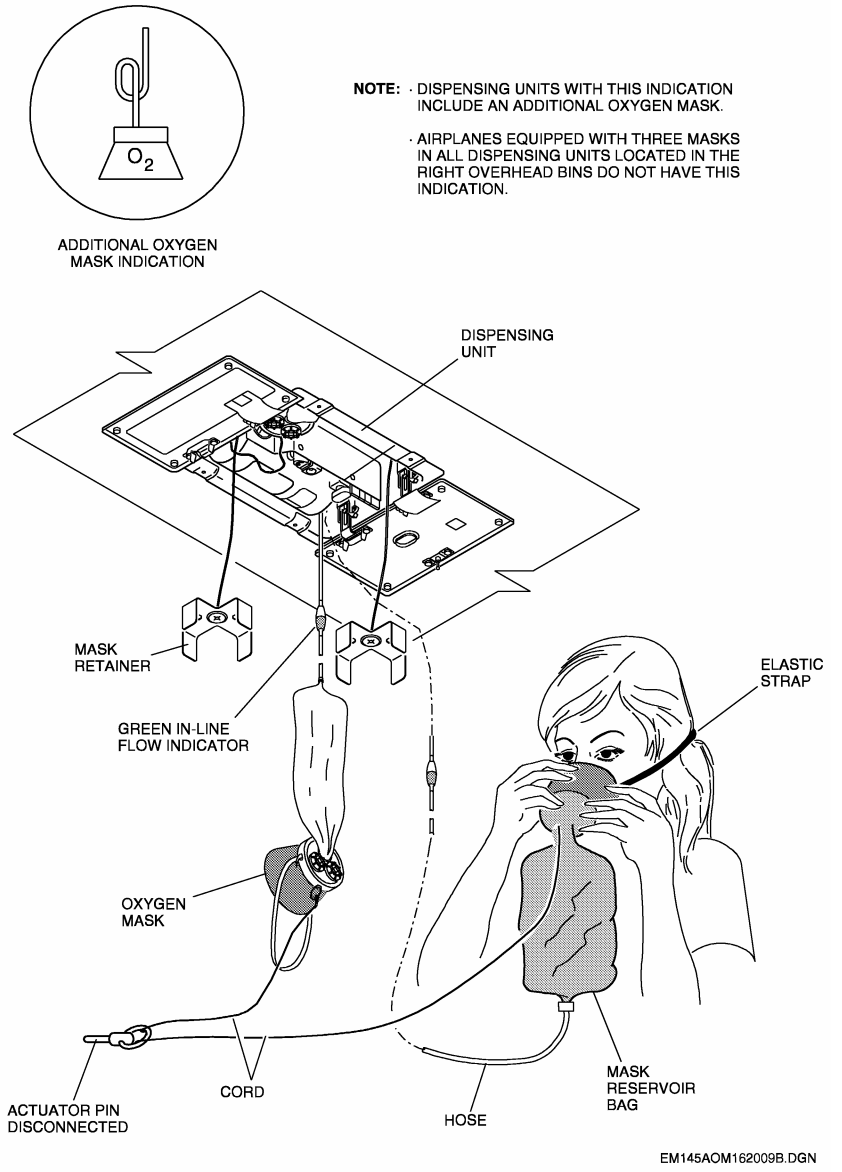

DISPENSING UNITS/PASSENGER MASKS

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CONTROLS AND INDICATORS

PASSENGER OXYGEN CONTROL PANEL

1 - OXYGEN ON INDICATOR LIGHT (WHITE)

- Indicates that the electric latches are energized.

2 - PASSENGER OXYGEN SELECTOR KNOB

CLOSED - Disables the automatic deployment of passenger masks. Also resets oxygen ON indicator and passenger cabin signs after system activation either on automatic or manual mode.

AUTO - Automatically deploys the passenger masks provided that cabin pressure altitude is above 14000 ft (*).

NOTE: (*) For airplanes equipped with High Altitude Takeoff and Landing system, passengers masks will deploy at 14500 ± 500 ft cabin altitude.

MANUAL (momentary position) - Actuates the passenger oxygen system at any altitude, overriding the altimetric switch, and may be used in case of AUTO mode failure.

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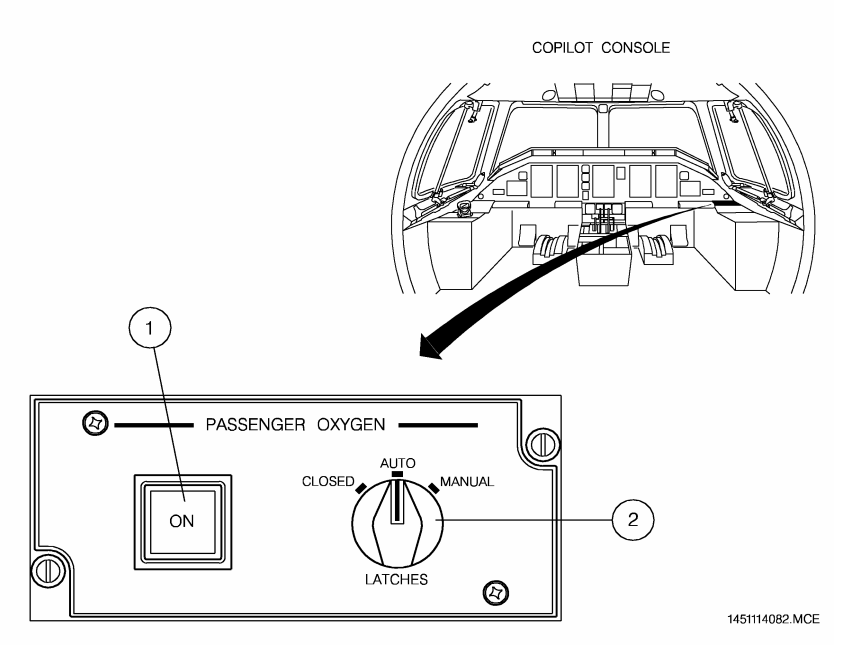

PASSENGER OXYGEN CONTROL PANEL

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PORTABLE OXYGEN CYLINDER

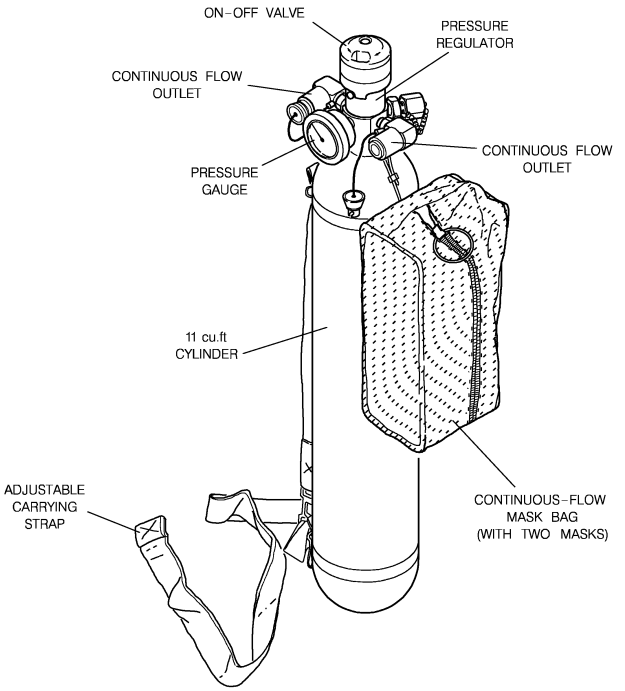
The cylinder has 312 liters (11 cu.ft) holding 280 liters of usable oxygen and is provided with an ON-OFF regulator installed on the cylinder neck. Two continuous-flow masks go with the cylinder.

A gauge is provided to monitor the cylinder pressure.

The cylinder is equipped with two outlets that permit the connection of the continuous-flow masks furnished in the cylinder bag. The supplied masks when connected to the bottle are designed to deliver a maximum of 4 liters per minute of oxygen.

The cylinders are positioned near the cabin attendant stations and are to be used exclusively for therapeutic first-aid purposes.

The minimum portable oxygen cylinder pressure for dispatch is 1200 psi for oxygen bottle P/N 176965-14 (11 cu.ft or 311 liters) and 1550 psi for oxygen bottle P/N 5500A1UBF25A (4.25 cu.ft or 120 liters); both will last at least 30 minutes.



PORTABLE OXYGEN CYLINDER

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PROTECTIVE BREATHING EQUIPMENT

The airplane is equipped with three EROS or PURITAN smoke hood-type Protective Breathing Equipment (PBE) units. The PBE unit is an emergency equipment that offers a 15-minute minimum oxygen supply for crewmember and flight attendant protection against the effects of smoke, toxic gases, and hypoxia.

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EROS (AIR LIQUIDE) PBE UNIT

Operation automatically starts when the hood is donned, with no additional device actuation. An actuation lever is pushed up to a vertical position by user head and thus breaks a frangible valve that releases oxygen into the hood. User can hear oxygen flow release inside the hood..

Due to the neoprene neck collar, phonic membrane, and regulated overpressure inside the hood, no toxic gases or smoke can enter the hood.

The rigid visor cannot be folded and features an anti-fogging treatment for good visibility. The phonic membrane allows good communications characteristics. The hood protects user's head from flames or incandescent objects that may fall from burning structures or interiors parts.

The smoke hood is stowed inside a vacuum-sealed aluminized bag, itself contained and attached to the bottom, internal side of a rigid flat orange box that is provided with a green "good condition" indicator, which indicates that the mentioned bag was not opened yet. Should the indicator be red, this indicates that there no longer exists a vacuum inside the bag and the PBE unit must be replaced.

Extraction of the hood automatically tears the aluminized container bag and thus allows a direct presentation of the hood.

OPERATION

When use of hood is needed:

1 - Take the box and push the spring lock.

2 - Pull the box cover upward.

3 - Extract the hood and deploy the hood by a brisk downward movement.

4 - Open the neck collar seal by placing thumbs in front of the red pointers to facilitate hood donning, especially when spectacles are worn by user.

5 - Don the hood. Next, pick up the fire extinguisher and combat the onboard fire and/or smoke.

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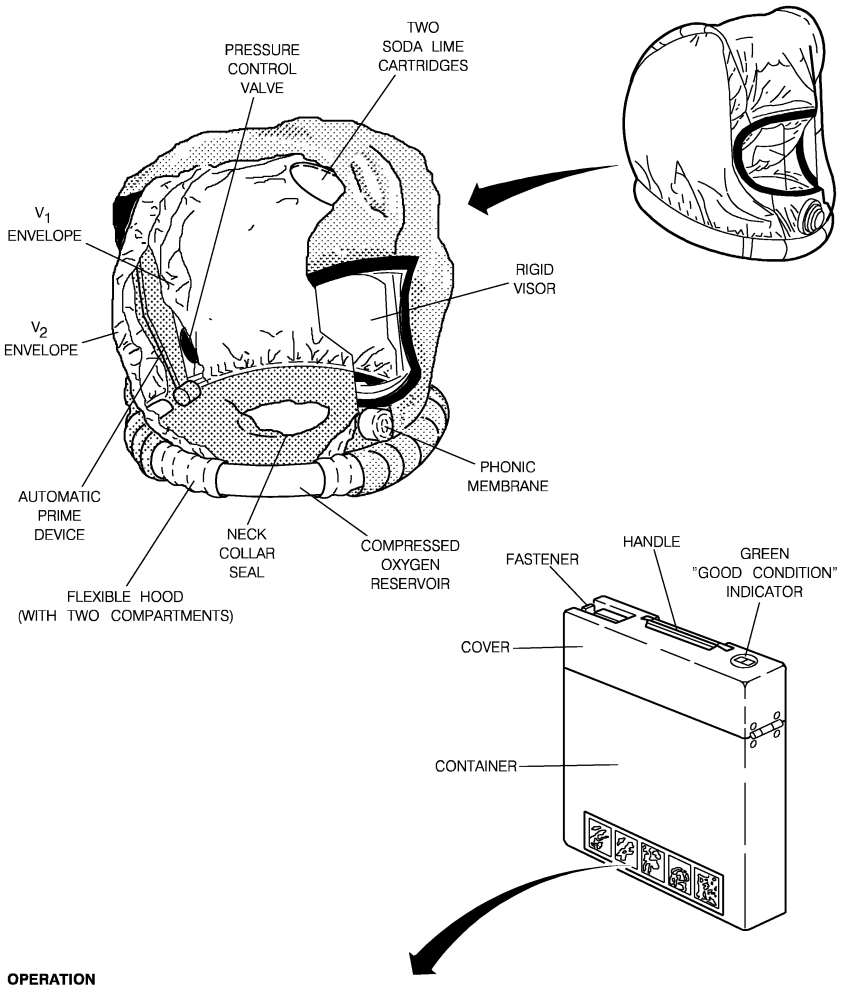

OPERATION

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HOOD SCHEMATIC AND STOWAGE - EROS

PURITAN BENNET PBE UNIT

During the donning sequence, a chlorate candle is automatically actuated as the adjustment straps are pulled to secure the oronasal mask cone against the face. The oxygen generated by a chlorate candle will inflate the hood, providing adequate initial breathing volume.

A speaking diaphragm is installed in the oronasal mask cone to enhance communication.

Determining the unit's serviceability consists in visually checking the vacuum seal through the clear access door of the hood's container. If the sealed bag appear tightly compressed, the seal is in good condition. On the other hand, if the sealed bag appears inflated, the unit should be replaced.

OPERATION

When use of the hood is needed:

1 - Grasp and strongly pull red access handle to disengage the cover. Locate red I.D. tag and pull sharply to tear open vacuum-sealed bag.

2 - Pull PBE out of sealed bag and shake hood to open.

3 - Place both hands inside the neckseal opening with palms facing each other and PBE visor facing downward with the CO2 container resting on top of hands.

4 - With the head bent forward, guide PBE neckseal over the top of the head and down over the face using the hands to shield the face and glasses from the oronasal mask cone.

5 - With both hands, grasp the adjustment straps at the lower corners of the visor and pull outward sharply to actuate the starter candle. Within 1-5 seconds, a rushing noise of oxygen entering the hood will be heard and inflation will be evident.

CAUTION: THE OXYGEN PRODUCED BY PBE UNIT WILL VIGOROUSLY ACCELERATE COMBUSTION. DO NOT INTENTIONALLY EXPOSE THE PBE UNIT TO DIRECT FLAME CONTACT OR REMOVE IT IN THE IMMEDIATE PRESENCE OF FIRE OR FLAME. DUE TO OXYGEN SATURATION OF THE HAIR. DO NOT SMOKE OR BECOME EXPOSED TO FIRE OR FLAME IMMEDIATELY AFTER REMOVING PBE UNIT.

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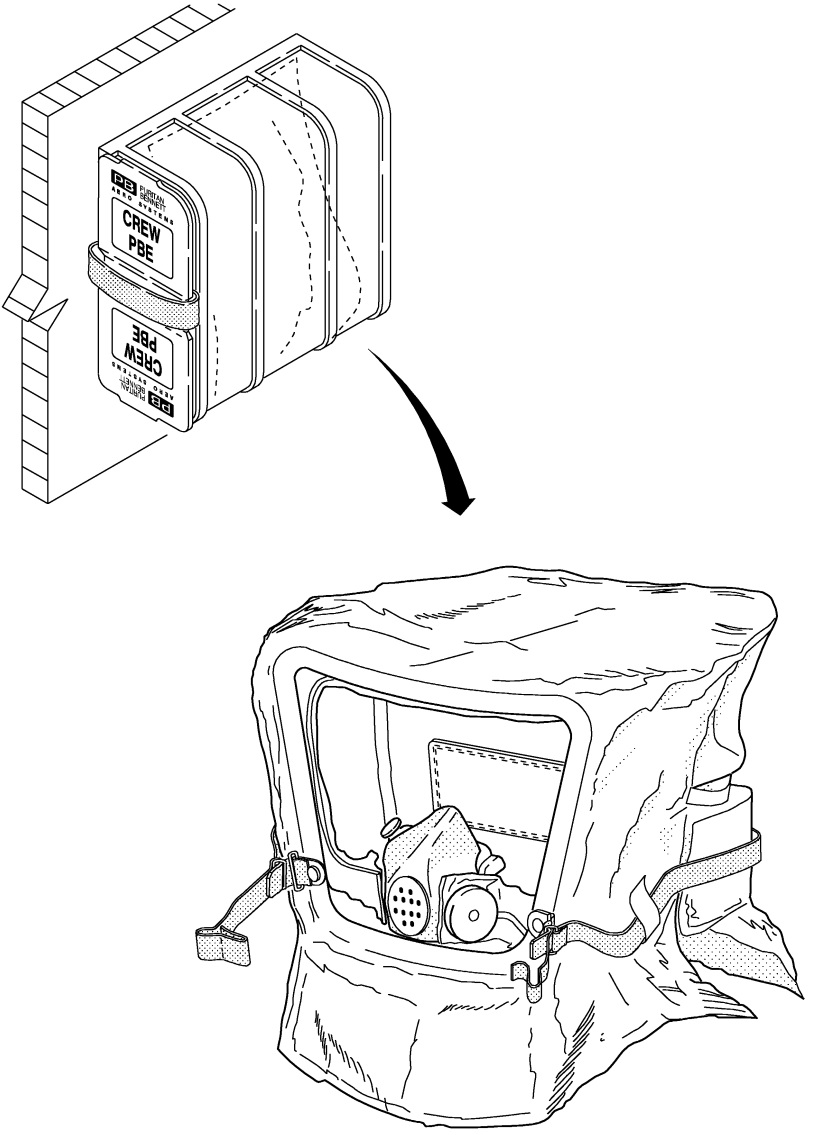

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HOOD SCHEMATIC AND STOWAGE - PURITAN

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MINIMUM OXYGEN PRESSURE FOR DISPATCH

FLIGHT CREW OXYGEN SYSTEM

Crew Comprising Pilot and Copilot: 1100 psi

Crew Comprising Pilot, Copilot and Observer: 1500 psi

NOTE: The minimum oxygen pressure for dispatch was calculated at an ambient temperature of 21°C (70°F). For other temperatures, refer to Oxygen Pressure Correction Chart as a function of the cylinder compartment temperature.

For additional oxygen consumption, refer to Additional Pressure Required Table to calculate how much Additional Oxygen Cylinder Pressure will be required for dispatch.

ADDITIONAL OXYGEN PRESSURE REQUIRED

ALTITUDE: 8.000 UP TO 14.000 FT
CYLINDER VOLUME: 50 CU.FT
UNIT: PSI FOR 1 MINUTE

	Oxygen/air mixture mode supplied for the mask	
	NORMAL	**100%**
1 crewmember	3.70	16.77
2 crewmembers	7.40	33.54
3 crewmembers	11.10	50.31

PORTABLE OXYGEN CYLINDER

For airplane dispatchability, the minimum pressure shown on the gauge of the portable oxygen cylinder must be in accordance with the minimum guideline set either for the airline or regulator authority.

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OXYGEN PRESSURE CORRECTION CHART

An Oxygen Pressure Correction Chart is located on the oxygen service panel door. This chart is provided for the maintenance personnel's use when recharging the oxygen cylinder. Additionally, it may be used by the crew to check if the oxygen cylinder's pressure is above the minimum oxygen pressure for dispatch.

To use the chart for recharging purposes:

Enter the chart with the cylinder compartment temperature (cockpit temperature) and go vertically up to the desired pressure at 21°C. From the intersection point, trace to the left to read the indicated gauge pressure to be attained.

To use the chart for dispatching purposes:

Enter the chart simultaneously with the cylinder compartment temperature (cockpit temperature) and indicated gauge oxygen pressure (on MFD or oxygen service panel). The intersection determines the oxygen cylinder's equivalent pressure at 21°C, by interpolating the two adjacent standard curves.

EXAMPLE

Associated condition:

- Crew..... PILOT, COPILOT AND OBSERVER
- Indicated gauge pressure ..... 1600 PSI
- Cylinder compartment temperature ..... 30°C

As the intersection is above the dashed line for the associated condition, the airplane may be dispatched.

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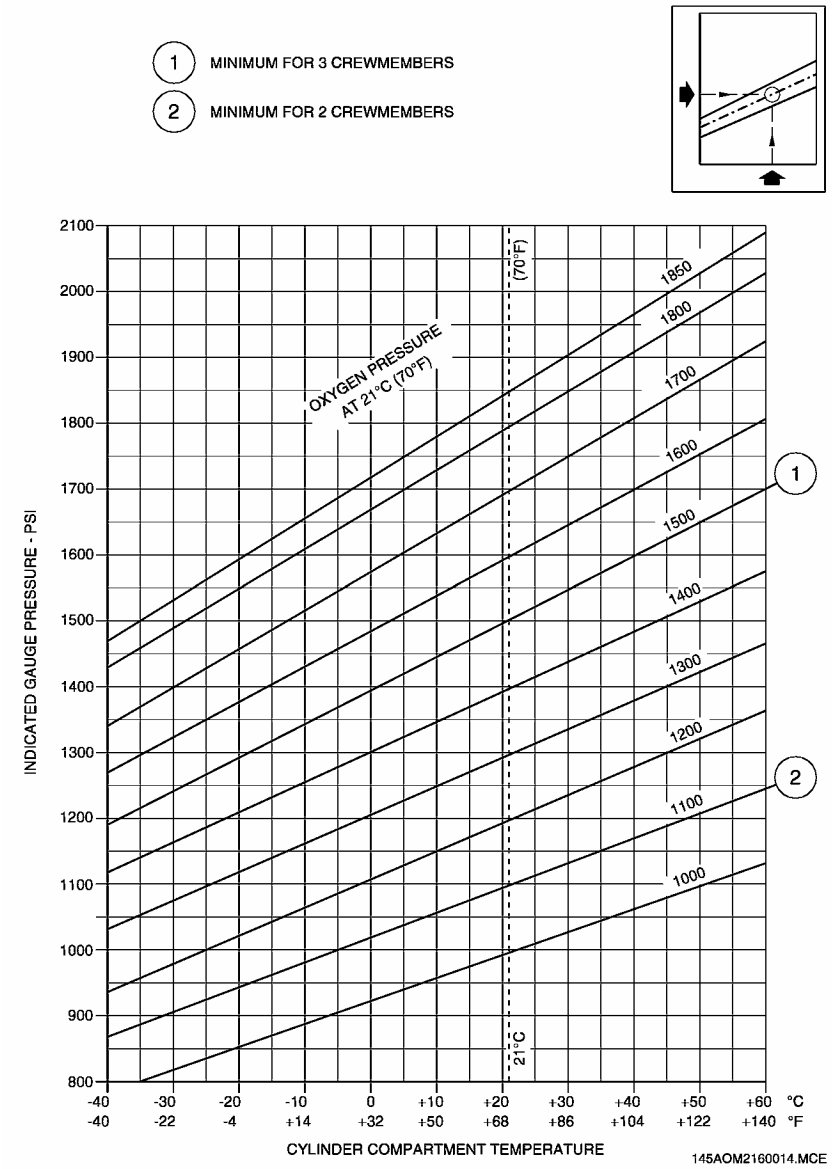

OXYGEN PRESSURE CORRECTION

OXYGEN CONSUMPTION CHART

The Oxygen Consumption Chart is provided to allow the Flight Crew to know the remaining number of pre-flight oxygen mask tests available before the oxygen cylinder recharging is necessary. This chart should be used by the maintenance personnel to choose the best moment to recharge the oxygen cylinder.

The Oxygen Consumption chart has been plotted for 21°C (70°F) conditions. For different temperatures, the Oxygen Pressure Correction chart must be used to obtain the pressure at 21°C and then see what is the number of the remaining oxygen mask tests.

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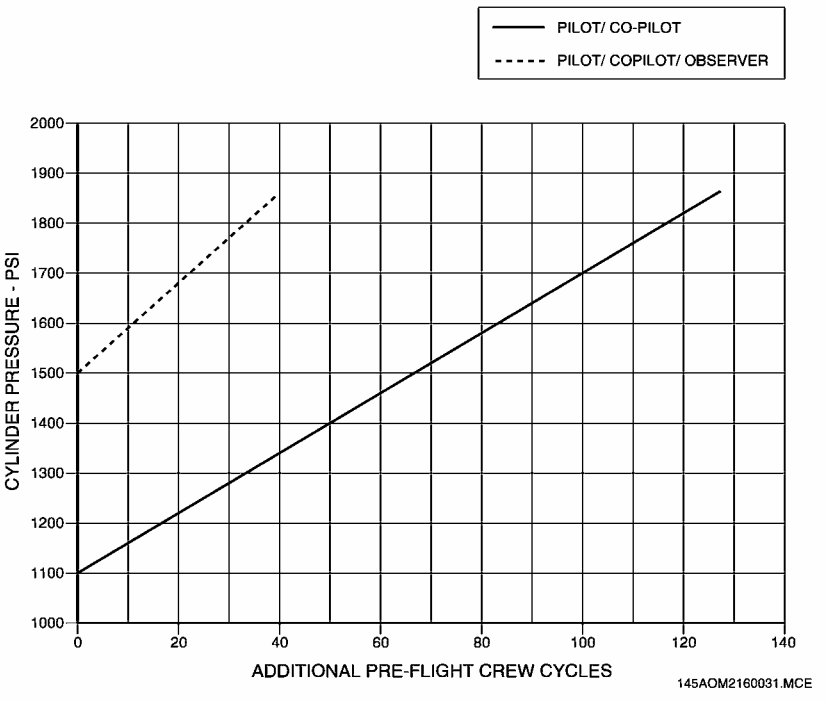
EXAMPLE

Associated condition:

- Crew..... PILOT, COPILOT, AND OBSERVER
- Indicated Gauge Pressure ..... 1750 psi
- Cylinder Compartment Temperature ..... 30°C

According to the Oxygen Pressure Correction chart, for the associated conditions, the pressure for 21°C is 1700 psi.

According to the Oxygen Consumption chart, for 1700 psi there are approximately 22 remaining pre-flight tests before recharging the oxygen cylinder becomes necessary. The airplane's dispatch being therefore allowed.



NOTE: The Oxygen Consumption chart has been plotted for 21°C (70°F) conditions.

OXYGEN CONSUMPTION

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SECTION 2-17

FLIGHT INSTRUMENTS

TABLE OF CONTENTS

	Block	Page
General	2-17-05	..01
Air Data System (ADS)	2-17-10	..01
Flight Instruments	2-17-15	..01
Standby Instruments	2-17-20	..01
Radio Altimeter System	2-17-25	..01
Chronometer/Clock	2-17-30	..01
Flight Data Recorder System	2-17-35	..01

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GENERAL

The Flight Instruments System comprises the Air Data System (ADS), the attitude, altitude, airspeed, and vertical speed indications on the Primary Flight Display (PFD), the Flight Data Recorder System (FDRS), and the Digital Clock.

The conventional flight data information is presented on the Primary Flight Display (PFD).

Standby electromechanical instruments are provided as backup, should there occur a complete failure in the electronic flight instrument system. The standby instruments are Magnetic Compass, Airspeed Indicator, Altitude Indicator, and Attitude Indicator.

Optionally the airplane may be equipped with an Integrated Standby Instrument System (ISIS) that replaces the standby electromechanical instruments (except the Magnetic Compass) in a single display.

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AIR DATA SYSTEM (ADS)

The Air Data Systems are designed for sensing, processing, and transmitting air data information to various systems and instruments of the airplane.

The ADS 1 (LH) consists of one Air Data Computer (ADC), one Pitot Tube, one Total Air Temperature Probe (TAT) and two Static Ports.

The ADS 2 (RH) consists of one Air Data Computer (ADC), one Pitot Tube, one Total Air Temperature Probe (TAT) and two Static Ports.

The Standby System consists of one Pitot/Static Tube, one Standby Altimeter and one Standby Airpeed Indicator.

The Pitot and Pitot/Static tubes, TAT probes and Static Ports are heated for anti-icing purposes. For further information about the anti-icing system, refer to Section 2-15, Ice and Rain Protection.

The ADSs 1 and 2 interface with the airplane's systems through the ADCs, as follows:

- IC-600 - Both ADCs supply pressure altitude, barometrically corrected altitude, true airspeed, calibrated airspeed, vertical speed, Mach number, static air temperature, V_{MO} and total air temperature to both IC-600.
- FADEC - The ADC 1 supplies the FADEC 1A and 2A, and the ADC 2 supplies the FADEC 1B and 2B with total pressure, Mach number, and total air temperature.
- HSCU - The ADCs provide calibrated airspeed for the HSCUs.
- TRANSPONDER - Both ADCs provide pressure altitude information for both transponders/TCAS.
- AHRS (AH-900 only) - The ADC 1 supplies AHRS 1 and ADC 2 supplies AHRS 2 with true airspeed.
- FMS - The ADC 1 provides true airspeed for the FMS.
- WEATHER RADAR - The ADC 2 provides altitude data for the weather radar.
- SPS - Both ADCs provide Mach number information for the Stall Protection System.
- GPWS - The ADC 1 provides airspeed (CAS and TAS), altitude, and vertical speed information for the GPWS.

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- CPCS - Both ADCs provide pressure altitude, barometric correction, and altitude rate of change data for the pressurization Digital Controller.
- ICE PROTECTION - Both ADCs provide altitude trip point for the ice protection system.
- RUDDER SYSTEM - Both ADCs supply the rudder system with the calibrated airspeed trip point.
- AWU - Both ADCs supply the AWU with the overspeed warning output.

The ADCs functional test mode is entered when the momentary ADC Test Switch, located on the Maintenance Panel, is commanded to test, provided the airplane speed is below 50 kt and the airplane is on the ground.

The barometric pressure data discrete inputs to the ADCs are set on the PFD Bezel (barometric pressure selection and correction).

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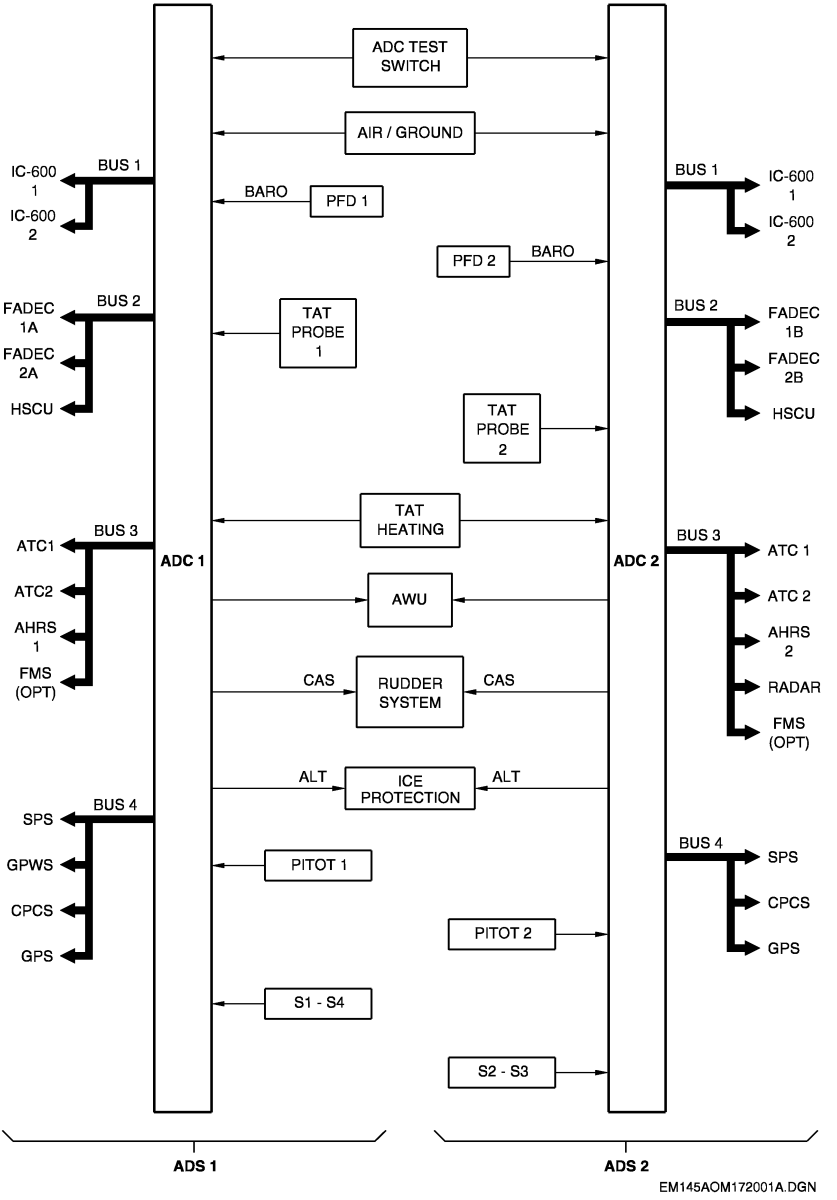

AIR DATA SYSTEMS SCHEMATIC

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ADS SENSORS

Pitot tubes 1 and 2 are positioned on the top of the airplane's nose. Pitot/Static tube 3 is positioned on the right side of the airplane's nose.

Pitot tubes 1 and 2 supply total air pressure to the respective ADC.

Four Static ports supply static pressure to both ADCs.

The Pitot/Static tube 3 supplies total air pressure to the Standby Airspeed Indicator, and static pressure to the Standby Airspeed Indicator and Standby Altimeter. Furthermore, Pitot/Static tube 3 supplies static pressure to the Cabin Pressure Acquisition Module (CPAM).

The TAT probe 1 is installed on the left side of the airplane's nose, and the TAT probe 2 is installed at the right side of the airplane's nose.

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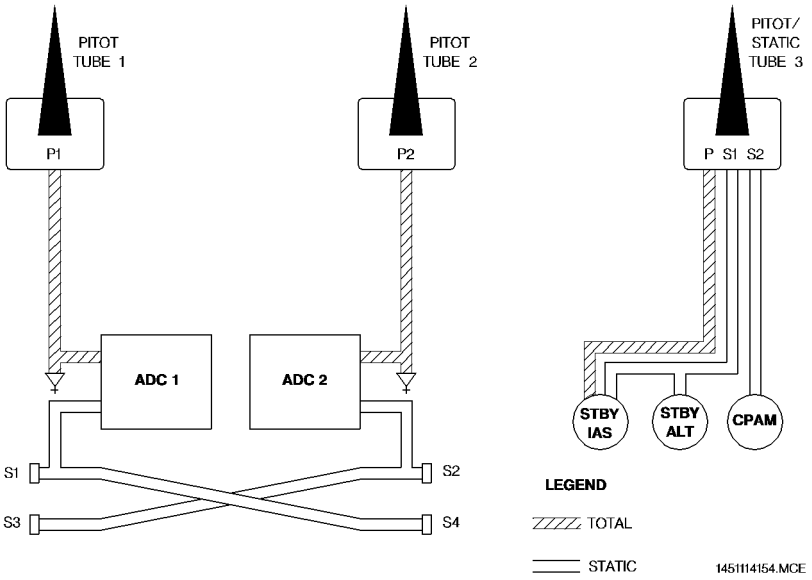
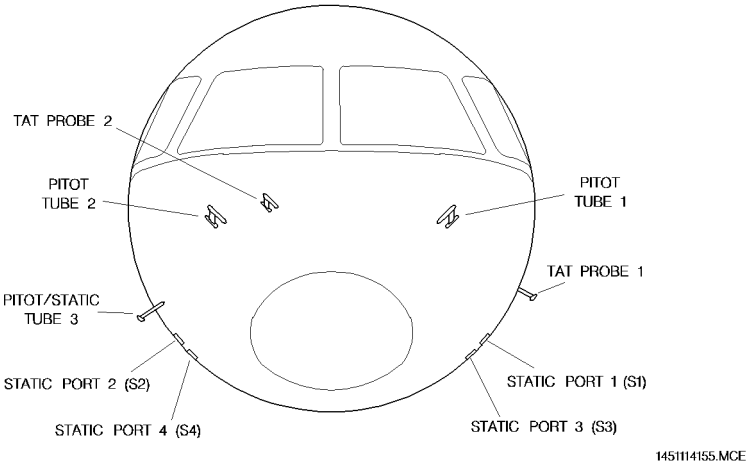


ADS SENSORS SCHEMATIC



ADS SENSORS POSITIONING

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ADS INDICATIONS

MFD

1 - STATIC AIR TEMPERATURE (SAT) INDICATION

- The SAT is presented as a digital readout in degrees Celsius.
- Colors:
  - Digits: green
  - Labels: white
- Ranges from –99 to +99°C with a resolution of 1°C.
- In the event of ADC failure or invalid SAT, the digits are replaced by three amber dashes.

2 - TOTAL AIR TEMPERATURE (TAT) INDICATION

- The TAT is presented as a digital readout in degrees Celsius.
- Colors:
  - Digits: green
  - Labels: white
- Ranges from –99 to +99°C with a resolution of 1°C.
- In the event of ADC failure or invalid TAT, the digits are replaced by three amber dashes.

3 - TRUE AIRSPEED (TAS) INDICATION

- The TAS is presented as a digital readout in knots.
- Colors:
  - Digits: green
  - Labels: white
- Ranges from 0 to 999 kts with a resolution of 1 kt.
- In the event of ADC failure or invalid TAS, the digits are replaced by three amber dashes.

PFD

1 - AIR DATA SOURCE ANNUNCIATION

- Label: ADC1 or ADC2.
- Color: amber when only one ADC is supplying both sides or each ADC is supplying opposite side systems (ADC or SG pressed on the Reversionary Panel - refer to section 2-4, Crew Awareness).
- Annunciation is removed when each ADC is supplying the respective side systems (ADC 1 supplying captain's side and ADC 2 supplying copilot's side).

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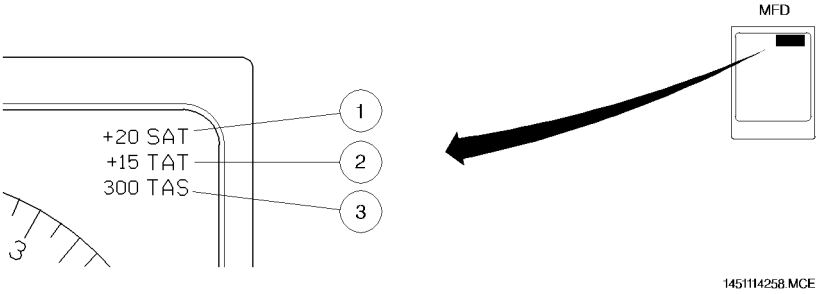
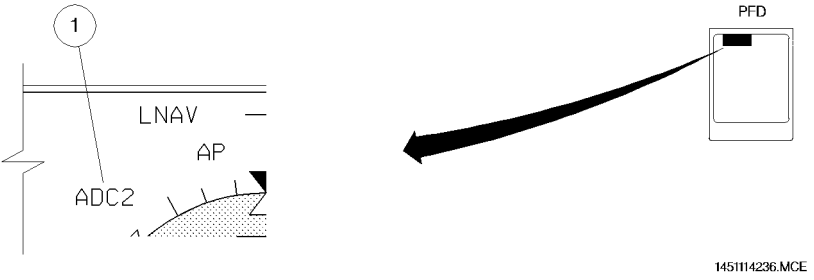


ADS INDICATIONS ON THE MFD



ADS INDICATION ON THE PFD

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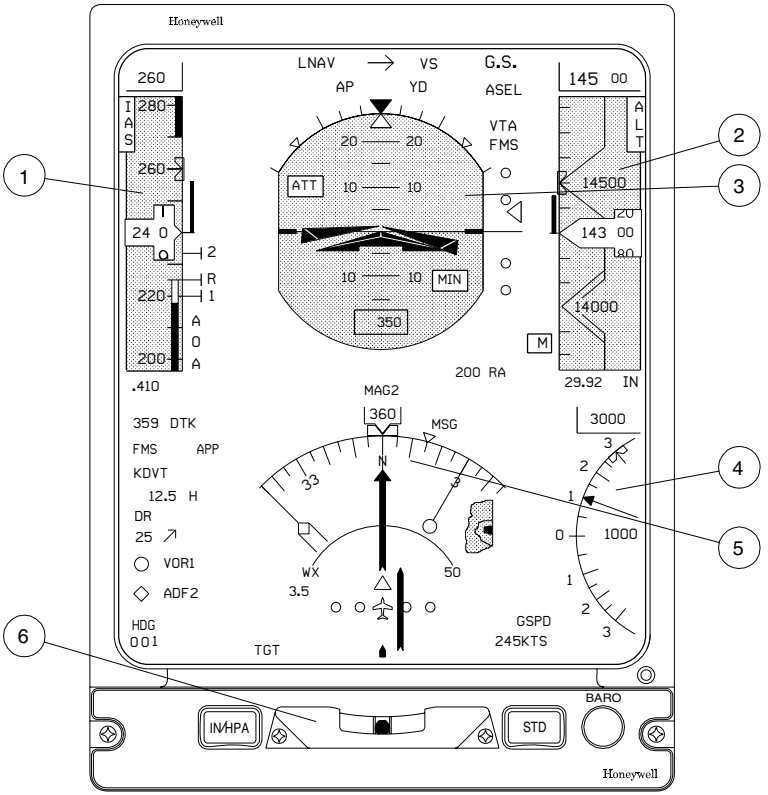
FLIGHT INSTRUMENTS

The primary flight instruments are presented on the PFDs.

Indicated airspeed (1), altitude (2) and vertical speed (4) are provided by the ADS.

Attitude (3) and heading (5) information are provided by the AHRS or IRS. For further information on these systems and indications, refer to section 2-18, Navigation and Communication.

Slip/Skid indicator (6) is a purely mechanical system.



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PRIMARY FLIGHT INSTRUMENTS ON THE PFD

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AIRSPEED INDICATION

SPEED INDICATION ON THE PFD

The KIAS and Mach number are displayed in tape format on the PFDs. The speed tape also displays target speed and respective speed bug, set through the Flight Guidance Controller (refer to section 2-19, Autopilot), reference speed bugs, to be used during takeoff and landing operations (refer to “speed bugs setting through MFD”, in this section), speed trending vector and overspeed visual warnings.

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1 - OVERSPEED INDICATION BAR

- Color: red
- Extends from V_{MO}/M_{MO} to higher airspeeds on the scale. If the airplane exceeds V_{MO}/M_{MO}, the digits in the airspeed window and the digital Mach readout will be displayed in red, and an aural warning will be triggered. If the acceleration trend vector exceeds V_{MO} or M_{MO}, the digits in the airspeed window and the digital Mach readout are displayed in amber.

2 - AIRSPEED SCALE AND VERTICAL TAPE

- Color:
  - Scale: white
  - Tape: gray
- Ranges from 40 to 400 KIAS with a resolution of 10 KIAS.
- The vertical tape provides a trend indication of IAS and displays digital airspeed each 20 KIAS.

3 - AIRSPEED TREND VECTOR

- Color: magenta
- The airspeed trend vector is an indication of the acceleration direction and it represents the airspeed that the airplane would attain in 10 seconds if the current airplane acceleration is maintained.
- The trend vector extends vertically from the center of the airspeed vertical tape.
- Extends upward for positive acceleration and downward for negative acceleration.
- Disabled during takeoff.

4 - REFERENCE SPEED BUGS (V1, VR, V2, AP)

- Color:
  - V_1: magenta
  - V_R: cyan
  - V_2: White
  - AP: green
- Presented when the associated digital indication is selected or above 40 KIAS on the ground.
- Removed above V_2 + 42 kt.
- May be out of view, if airspeed is reduced below 230 KIAS followed by an increase above 230 KIAS. To display the speeds again, press the reference speed buttons.
- When the airplane speed is below 40 knots, V_1, V_R, and V_2, as set on the MFD, are displayed in the bottom portion of the airspeed tape in the form of a digital indication. Upon power up, the digital indications for the set bugs are dashes.

5 - MACH NUMBER DIGITAL INDICATION

- Color:
  - Green for normal airspeeds.
  - Amber for V_{MO}/M_{MO}.
  - Red from V_{MO}/M_{MO} to higher airspeeds.
- Ranges from 0.05 to 1.000 M with a resolution of 0.001 M.
- Mach number and label are displayed when speed exceeds 0.45 M and remains until it drops below 0.05 M.

6 - LOW AIRSPEED AWARENESS

- Displayed in the airspeed scale when the airspeed is near stall speed for the current configuration.
- Colors:
  - White: indicates the speed range from 1.23 V_S to 1.13 V_S.
  - Amber: indicates the speed range from 1.13 V_S to V_S. Stick shaker may be activated in this range.
  - Red: indicates V_S. Stick pusher is activated.

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7- CURRENT AIRSPEED DISPLAY

- Color:
  - Green for normal airspeeds.
  - Amber for V_{MO} /$M_{MO.}$
  - Red from V_{MO}/M_{MO} to higher airspeeds.
- Ranges from 40 to 400 KIAS with a resolution of 1 KIAS.

8 - AIRSPEED COMPARISON MONITOR DISPLAY

- Color: amber
- Label: IAS
- Displayed in case of a difference of 5 KIAS between the airspeed indication on the PFDs.
- Flashes for 10 seconds and then becomes steady.

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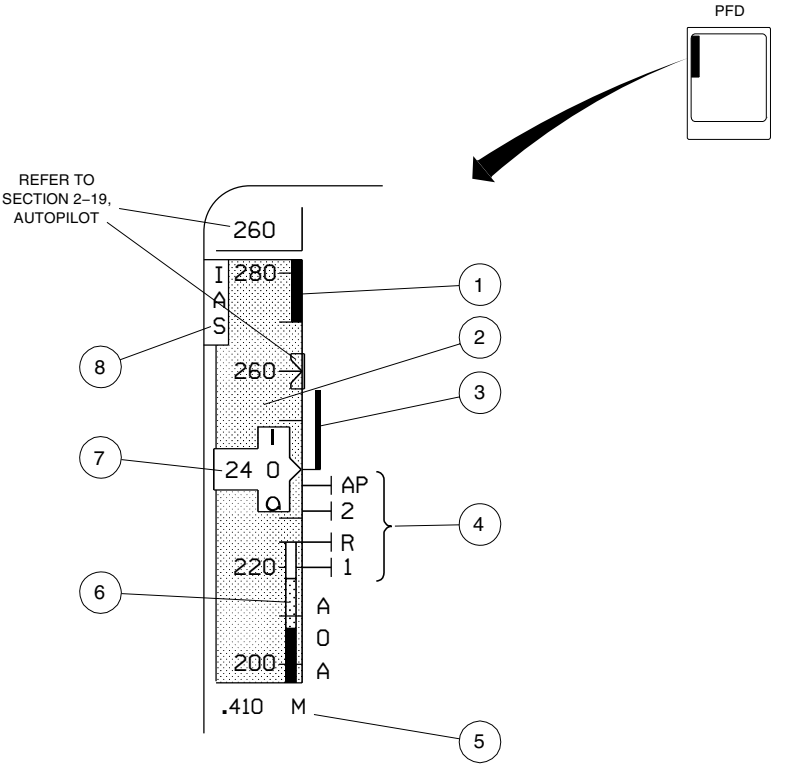

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AIRSPEED INDICATION ON THE PFD

SPEED BUGS SETTING THROUGH MFD

The MFD SPDS submenu allows setting speed bugs on the PFD speed tape. This submenu is accessed by selecting the MFD submenu, then the SPDS submenu.

1 - REFERENCE SPEED DIGITAL INDICATIONS

- Minimum value is:
  - V_1 : 89 kt
  - V_R : 89 kt or V_1, whichever is higher.
  - V_2 : 89 kt or V_R, whichever is higher.
  - AP : 89 kt
- Values are removed from the PFD when airplane is airborne.
- Displays dashes on power-up system.
- When selected, dashes are replaced by speed value.
- Selected Reference Speed is surrounded by two white boxes.

2 - REFERENCE SPEED SET KNOB

- When rotated clockwise or counterclockwise, increments or decrements the associated airspeed value and moves the associated bug accordingly (if the bug is in view).

3 - REFERENCE SPEED BUTTONS (V_1, V_R, V_2, AP)

- Allows selection of V1, V2, VR or AP speeds, for setting purposes.
- Enables movement of the associated speed bug on the PFD.
- Sequentially pressing each button causes the following:
  - First pressing causes the associated speed indication dashes to be replaced by the speed value and two white boxes to be displayed around the indication.
  - Next pressing removes the inner box and displays the associated bug on the PFD.
  - Next pressing removes the outer box and the associated bug on the PFD.

4 - HIGH ALTITUDE LANDING AND TAKEOFF (HI ALT) OPERATION BUTTON

- Activates HI ALT mode for takeoff and landing operations in altitudes above 8000 ft up to and including 10000 ft.

NOTE: HI ALT operation is available for airplanes equipped with HI ALT system and certified to operate in HI ALT mode.

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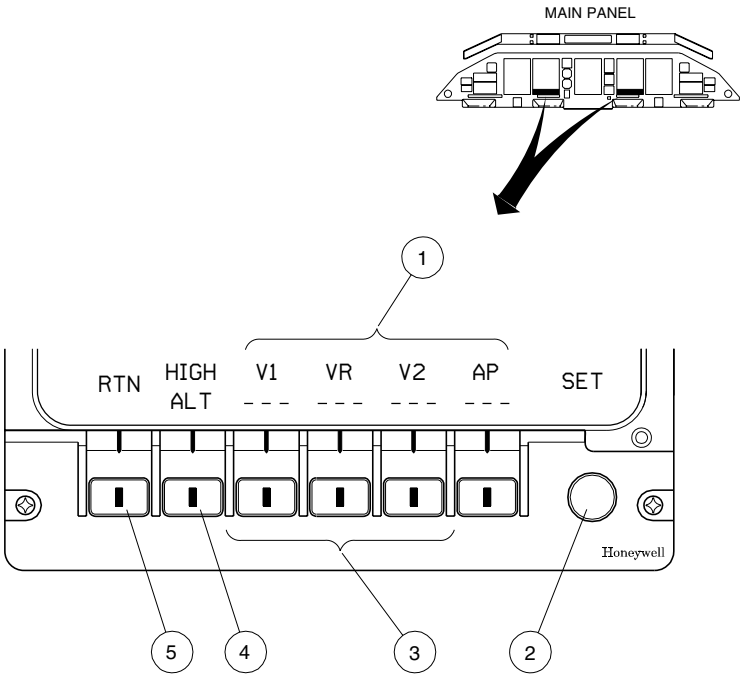
5 - RETURN BUTTON

- Returns the MFD to the MAIN Menu.
- If any of the speeds are displayed with both surrounding inner and outer boxes, pressing the RTN Button removes the inner box before returning the menu to the MFD Bezel Menu.



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MFD SPDS SUBMENU

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ALTITUDE INDICATION

ALTITUDE INDICATIONS ON THE PFD

The altitude is displayed in tape format on the PFD. The altitude tape also displays the Flight Guidance Controller preselected altitude (ASEL), respective preselected altitude bug (refer to section 2-19, Autopilot), and altitude trending vector.

1 - ALTITUDE SCALE AND VERTICAL TAPE

- Color:
  - Scale: white
  - Tape: gray
- Ranges from –1000 to 60000 ft, with a resolution of 100 ft.
- The vertical tape moves behind the current altitude window and displays a range of ± 550 ft from the actual altitude.
- The vertical tape displays digital altitude every 200 ft for altitudes from zero up to 10000 ft and every 500 ft for altitudes above 10000 ft.

2 - ALTITUDE COMPARISON MONITOR DISPLAY

- Color: amber
- Label: ALT
- Displayed in case of a difference of 200 ft or more between the altitude indications on PFDs.
- Flashes for 10 seconds and then becomes steady.

3 - ALTITUDE CHEVRON

- Color: White
- The double line chevron indicates multiples of 1000 ft. The single line chevron indicates every 500 ft increments.

4 - CURRENT ALTITUDE DISPLAY

- Color: green
- Ranges from –1000 to 60000 ft with a resolution of 20 ft.

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5 - ALTITUDE TREND VECTOR

- Color: magenta
- The altitude trend vector represents the altitude that the airplane should attain in 6 seconds if the current altitude rate (Vertical Speed) is maintained.
- Displayed as a vertical bar that extends from the center of the altitude tape upward for positive vertical speeds and downward for negative vertical speeds.

6 - LOW ALTITUDE AWARENESS

- Color:
  - band: brown
  - limiting line: yellow
- Provided through a raster band that will be displayed on the bottom of the altitude tape in case the radio altitude is below 550 ft.
- Covers the lower half of the altitude tape when the airplane is on ground.

7 - BAROMETRIC ALTITUDE CORRECTION DISPLAY

- Color:
  - digits: cyan
  - label: white
- Ranges from 542 to 1083 hPa (16.00 to 32.00 inHg) with a resolution of 1 hPa (0.01 inHg).

8 - BARO KNOB

- Allows setting barometric altitude correction value.
- Rotating clockwise or counterclockwise increments or decrements barometric altitude correction.

9 - STANDARD BUTTON

- Adjusts barometric altitude correction to standard setting (29.92 inHg or 1013.25 hPa).

10 - IN/HPA BUTTON

- Selects barometric pressure unit between inches of mercury (inHg) and hectopascals (hPa).

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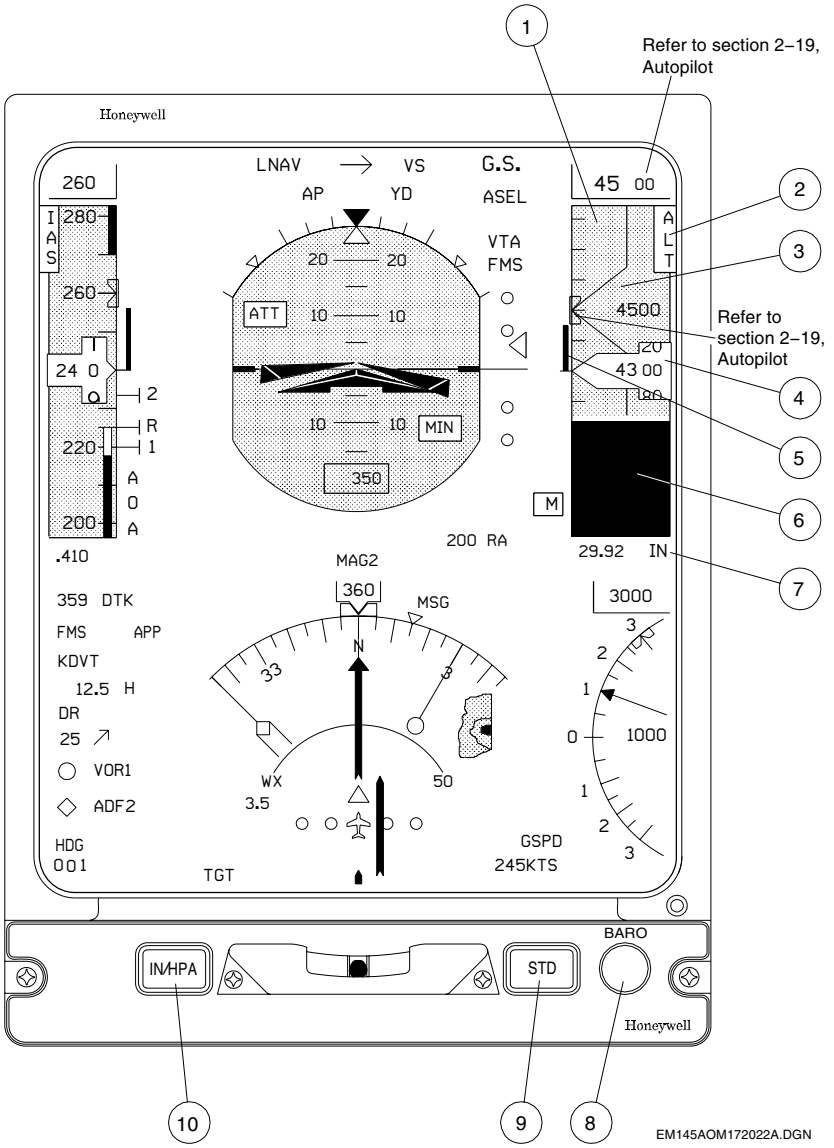

ALTITUDE INDICATION ON THE PFD

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VERTICAL SPEED INDICATION

The vertical speed is displayed in analogic and digital formats on the PFD.

Besides presenting the current vertical speed, the Vertical Speed Indicator (VSI) also displays target vertical speed and respective bug, set through the Flight Guidance Controller (refer to section 2-19, Autopilot).

The PFD VSI also indicates vertical direction and minimum vertical speed to be attended during evasive maneuvers, according to TCAS commands. For further information on TCAS, refer to Section 2-4, Crew Awareness.

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1 - ANALOGIC VERTICAL SPEED INDICATION

- Color:
  - Scale: white
  - Pointer: green
- Ranges from –3000 to +3000 ft/min
- Scale has marks every 500 ft/min up to 3000 ft/min, with labels every 1000 ft/min.
- The scale is non-linear to provide increased resolution around zero vertical speed.

2 - DIGITAL VERTICAL SPEED INDICATION

- Color: green
- Ranges from –9999 to +9999 ft/min with a resolution of 50 ft/min.
- Indication is displayed in the center of the scale.
- Indication is displayed when vertical speed exceeds –550 ft/min or +550 ft/min, and remains until it returns to –500 ft/min or +500 ft/min.

NOTE: For invalid vertical speed, the pointer and the digital indication are removed from the display and replaced by a red boxed V over S.

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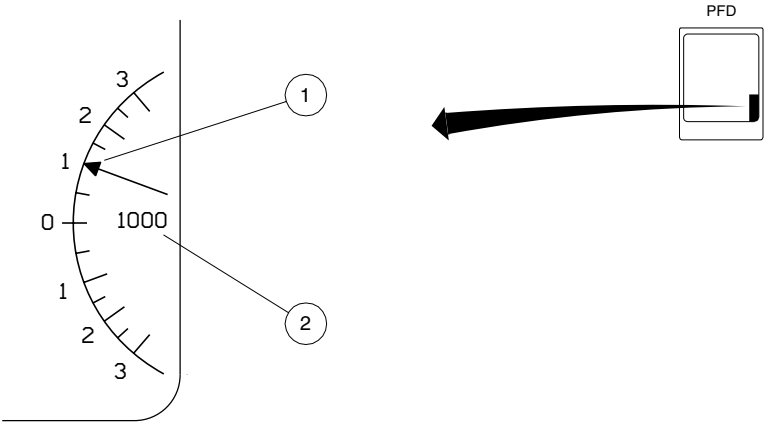

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VERTICAL SPEED INDICATION ON PFD

STANDBY INSTRUMENTS

Standby instruments are provided to supply flight data information in case of PFD and MFD loss.

The standby instruments comprise the following functions: pitch and roll attitudes, airspeed, altitude and magnetic heading.

Such instruments are conventional units and most of them are available even in case of total loss of electrical power.

Optionally, the conventional units may be replaced by a single display, the Integrated Standby Instruments System (ISIS). However, as the magnetic heading displayed by this equipment is received from the AHRS 1 or IRS 1, the conventional Magnetic Compass is provided as a back-up unit.

The pilot is responsible for checking the standby instruments indications against PFD indications, in order to ensure that the back-up units will present reliable indication in an emergency situation.

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MAGNETIC COMPASS

The Standby Magnetic Compass indicates the airplane's magnetic heading by sensing the earth's magnetic field. The magnetic heading is indicated by reading a graduated horizontally-mounted card against a fixed lubber line, which represents the airplane's longitudinal axis.

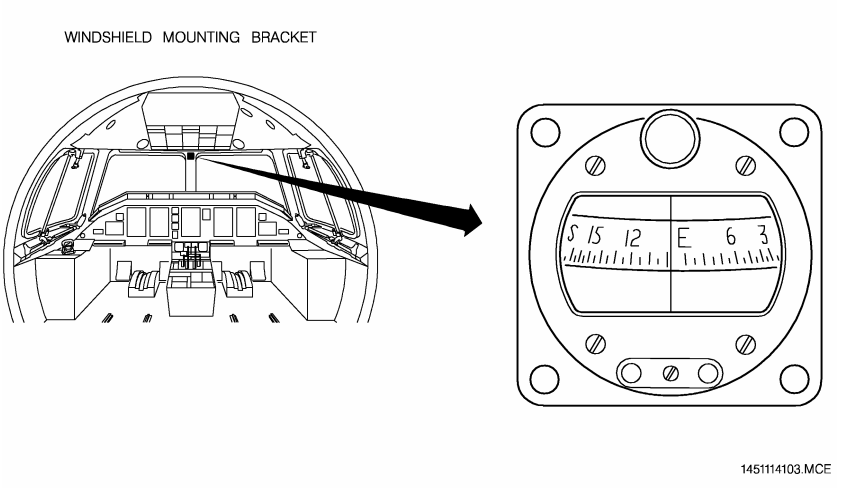
This card is graduated as follows:

- Half dots between the tens dots (005°, 015°, 025°,...).
- Full dots every ten degrees (010°, 020°,...).
- Full dots and respective magnetic heading indication every 030° (030°, 060°,...).
- Full dots and the N, E, S and W characters at the respective cardinal points (North, East, South and West).

Two calibration cards are supplied for the compass, one for normal operational condition (pitots on and windshield heating off) installed above the compass, and one for electrical emergency condition, installed on the main panel left corner.

The Standby Magnetic Compass receives 5 V DC for internal lighting.

NOTE: Magnetic compass reading shall always be done considering conditions written in applicable calibration cards.



MAGNETIC COMPASS

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STANDBY AIRSPEED INDICATOR

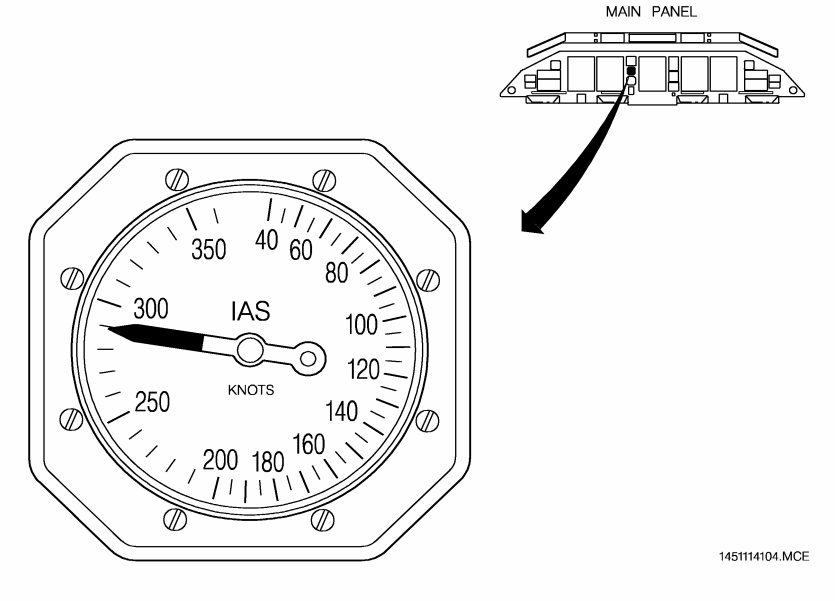
The Standby Airspeed Indicator provides airspeed indication by means of a pointer moving over a fixed scale, calibrated in knots.

The scale is graduated form 40 to 360 KIAS as follows:

- Half dots between the tens dots (45, 55, 65,...).
- Full dots every ten dots (40, 50, 60,...).
- Full dots and respective airspeed indication every 20 KIAS (40, 60, 80,...).

The Pitot/Static tube 3 provides dynamic pressure to this indicator.

The Standby Airspeed Indicator is powered 5 V DC for internal lighting.



STANDBY AIRSPEED INDICATOR

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STANDBY ALTIMETER

The Standby Altimeter consists of an aneroid barometer, with the altitude scale graduated in feet, and the barometric adjustment scale graduated in inches of mercury or hectopascals.

The Pitot/Static tube 3 provides static pressure to this indicator.

This instrument receives 5 V DC for internal lighting.

1 - ALTITUDE COUNTER

- Indicates pressure altitude.
- Ranges from –1000 ft to 50000 ft with the following increments:
  - Right drum counter is numbered at 100 ft intervals.
  - Center drum counter is numbered at 1000 ft intervals.
  - Left drum counter is numbered at 10000 ft intervals.
- First digit (left drum counter) is replaced by an orange and white crosshatched area for negative altitudes, and by a black and white crosshatched area for altitudes below 10000 ft.

2 - SCALE

- Full dots every 100 ft.
- Half dots every 20 ft.

3 - ALTIMETER SETTING COUNTER

- Displays the adjusted reference pressure.
- Ranges from 22.15 to 31.00 inHg (750 to 1050 hPa), with 0.01 inHg (1hPa) increments .

4 - BARO KNOB

- Allows setting the reference pressure.

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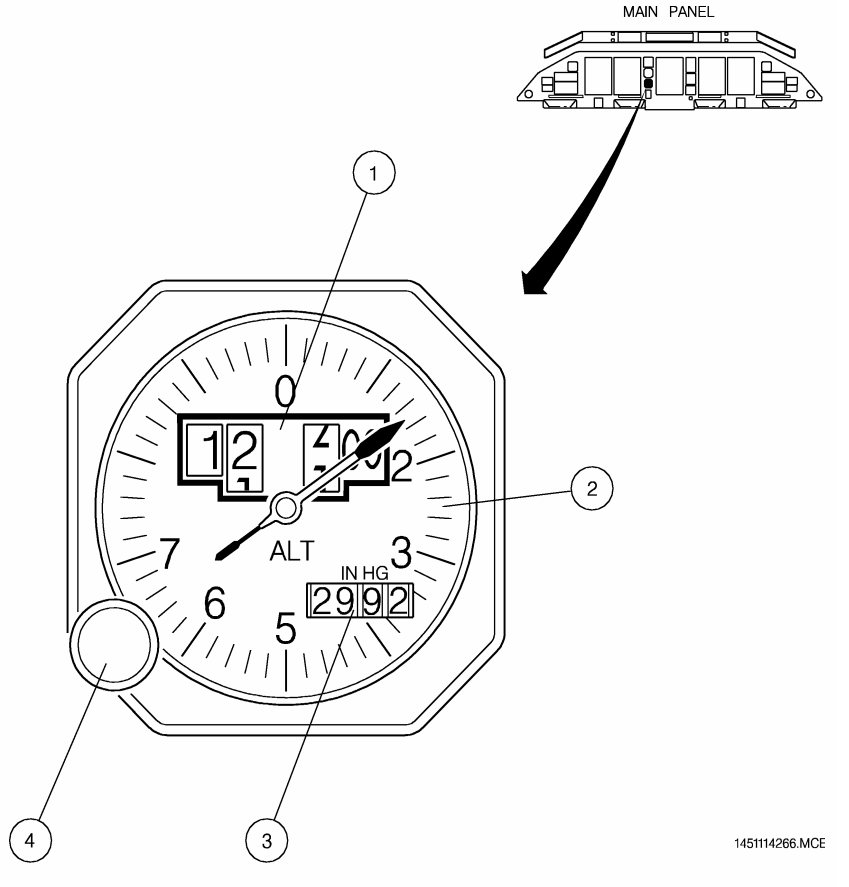

STANDBY ALTIMETER (TYPICAL)

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STANDBY ATTITUDE INDICATOR

The Standby Attitude Indicator is a conventional electrically powered attitude gyro, whose primary purpose is to supply attitude information in the event of a total loss of the PFD and MFD.

The Standby Attitude Indicator is powered by 28 V DC, from the Essential DC Bus 2. In case of an electrical emergency, it will operate solely on the airplane batteries, and for about 40 minutes. In case of total electrical power loss to this equipment, it is capable of providing a minimum of 9 minutes of useful attitude information due to high-rotor speed and mechanical erection system. Internal lighting is provided by 5 V DC.

It is recommended that the indicator be caged before the airplane is energized and after the airplane is deenergized. Its indication will be reliable after its rotor speed is completely stabilized, which occurs within 3 minutes after it is uncaged.

Any adjustment during the flight, although not normally required, should be made by momentarily caging the indicator with the airplane in level flight.

NOTE: Never cage an operating indicator while the airplane is pitching or rolling.

During normal operation, Standby Attitude Indicator may present induced errors during transient airplane conditions, such as acceleration and deceleration or turns.

Horizontal acceleration experienced during takeoff, climb-out, descent and landing might cause gyro precession inducing display errors. Acceleration and decelerations ranging from 20 kt/min to 100 kt/min may induce errors from 1° to 5° (pitch up) and from 1° to 2° (roll). When the airplane is turning with less than 10° of bank angle, the Standby Attitude Instrument may present induced errors of up to 2°/min. For bank angles greater than 10° it may present induced errors around 1°/min.

During normal operation the errors are automatically corrected at a nominal 2.5°/min when the airplane is stabilized in straight and leveled flight.

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1 - ROLL INDEX

- Roll scale graduated to provide measurement of bank angle by the roll pointer.
- Full dots at 0°, 30°, 60° and 90°, and half dots at 10° and 20°.

2 - ROLL POINTER

- Indicates the bank angle against the roll index scale.

3 - HORIZON LINE

- Earth's horizon relative line.
- The field below the horizon line is indicated in black ("dive"), and above, in light blue ("climb").

4 - CAGE KNOB

- Pull to the fully extended position, rotate clockwise and release at the detent position to cage the indicator.
- Pull, rotate counterclockwise and release smoothly to uncage.

5 - MINIATURE AIRPLANE

- Indicates airplane roll and pitch attitudes relative to the horizon line.

6 - PITCH SCALE

- Gives direct reading of airplane pitch attitude.
- Marked every 5° in pitch.

7 - POWER WARNING FLAG

When in view, indicates power off, caged condition, open motor winding, or loss of power.

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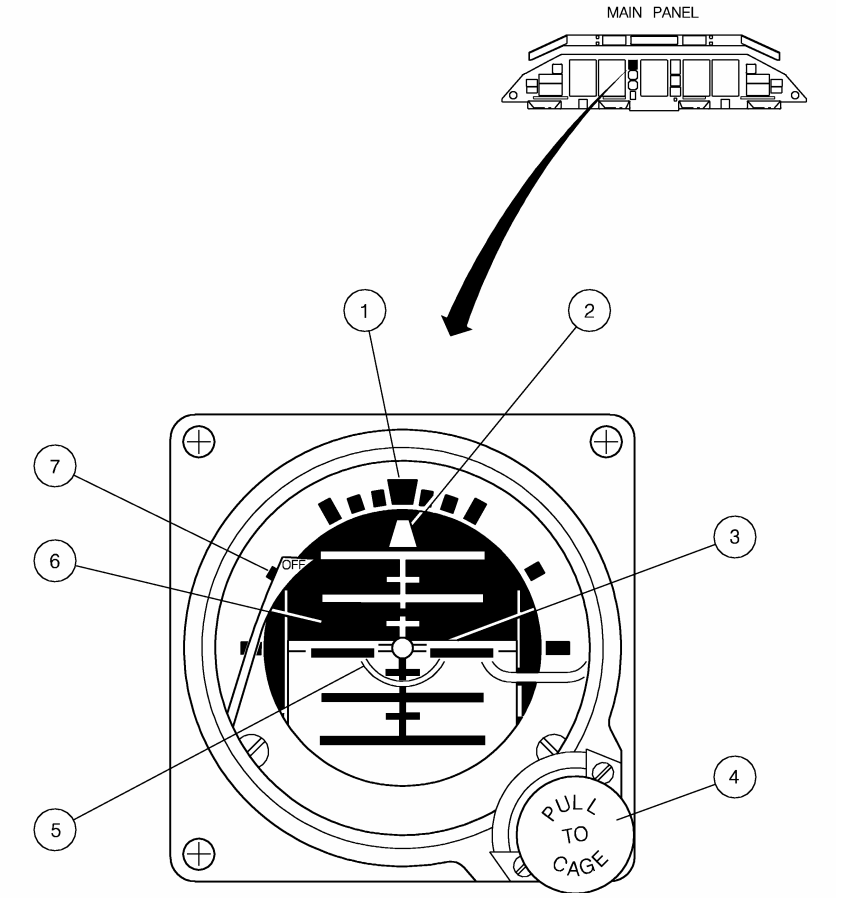

STANDBY ATTITUDE INDICATOR

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INTEGRATED STANDBY INSTRUMENT SYSTEM (ISIS THALES)

The ISIS provides the following parameters:

- Attitude (pitch and roll);
- Standard or barometric-corrected altitude and associated barometric pressure;
- Indicated airspeed;
- Indicated Mach number;
- VMO (Maximum Operating Speed);
- Skid/Slip information;
- Magnetic heading (from AHRS 1or IRS 1).

For all EMB-145 models except EMB-145 XR model the ISIS relies on 28 V DC power, provided by the Essential DC Bus 2. In case of an electrical emergency, it will operate solely on the airplane batteries for approximately 40 minutes.

For the EMB-145 XR model, the ISIS relies on 28 V DC power, provided by the Backup Hot Bus. In case of an electrical emergency, it will operate solely on the airplane batteries for approximately 240 minutes.

For the EMB-145 XR model, the ISIS will be de-energized when the battery knobs are positioned to OFF while the airplane is powered by the GPU or generators.

The system is powered as soon as the airplane batteries are switched to AUTO. Then, the ISIS starts its alignment phase, which takes about 90 seconds to be completed and can be identified on the screen by the “INIT 90 s” flag.

NOTE: The airplane must not be moved during the first 90 seconds after power-up, while the ISIS is undergoing alignment. Moving the airplane during this period can cause in-flight attitude indication errors, that are not noticeable on ground. For ISIS Post-Mod. SB 145-34-0049 and on, the “ATT” flag is displayed in this case.

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ATTITUDE

Using the data from the respective sensors after its conversion to digital format, the system computes and displays attitude.

The CAGE button resets attitude to provide a fast erection function. The CAGE function is not operational during the initialization mode and must only be used in stabilized flight conditions.

If a failure of the attitude function is detected by internal monitoring, attitude display information, e.g. brown and blue background, pitch scale, roll scale and roll pointer is removed and replaced by black background, and an ATT flag is displayed.

ALTITUDE

Altitude data is provided by processing static pressure sensed by Pitot/Static tube 3.

Altitude is displayed in tape format. Pushing the STD button sets the ISIS reference barometric pressure to standard (QNE). The barometric pressure can be adjusted, starting from the standard value, by using the rotary BARO knob.

In case a failure of the altitude function is detected by the internal monitoring system, the altitude tape is removed and an ALT flag is displayed.

INDICATED AIRSPEED

Airspeed data is provided by processing dynamic pressure sensed by Pitot/Static tube 3.

Airspeed is presented in tape format. In case a failure is detected by the internal monitoring system, the airspeed tape and pointer are removed and a SPD flag is displayed.

SECONDARY PARAMETERS

In addition to primary parameters, the system computes and displays the following secondary parameters:

- Magnetic heading.
- Mach number.
- VMO.
- Lateral acceleration/Slip indication.

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ISIS CONTROLS AND INDICATORS

1 - BRIGHTNESS ADJUSTMENT

- Push buttons labeled + and - adjust brightness.

2 - AIRSPEED INDICATION

- Airspeed tape positioned vertically on the upper left segment of the display.
- Ranges from 40 to 520 kt and the scale is graduated every 5 kt between 40 and 250 kt. From 250 to 520 kt the scale is graduated every 20 kt with digital indications every 20 kt. The indications and graduations are displayed in white.

3 - VMO/MMO

- VMO is indicated by a red tape associated to the airspeed tape.
- Digits of the airspeed tape and Mach number display are green when the airspeed and Mach number are lower than V_{MO}/M_{MO} and red when the airspeed and Mach number are equal to or greater than V_{MO}/M_{MO}.

4 - ROLL INDICATION

- Roll scale graduated at 0°, 10°, 20°, 30°, 45° and 60°, to provide bank angle measurement, indicated by the roll pointer.

5 - STD BUTTON

- Pushing the button sets the barometric setting to Standard Atmospheric Pressure.

6 - REFERENCE BAROMETRIC PRESSURE

- Displayed in cyan on a digital read-out in hPa or inHg.
- When Standard Atmospheric Pressure is selected, the 1013 value is displayed in cyan instead of barometric pressure value.
- HPA or IN displayed in white and in upper case.

7 - LATERAL ACCELERATION

- The range is $\pm$ 0.2 g.

Symbol displayed in black surrounded in white, just below the roll reference triangle.

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8 - ALTITUDE INDICATION

- Altitude tape positioned vertically on the upper right segment of the display.
- Ranges from -2000 to 50000 ft with 5 digits green display read-out in a yellow frame. A NEG indication is displayed vertically in white in case of negative altitude.

9 - PITCH INDICATION

- The pitch scale comprises white reference lines every 2.5° between -30° and +30°, and the associated pitch angle values, in white, every 10° between -50° and +50° and at ±80°. The sector above the horizon line of the screen is blue and the sector below is brown.
- Beyond ±30°, red chevrons are displayed to indicate excessive pitch angle and the direction to follow in order to reduce it.

10 - BARO ROTARY KNOB

- Allows performing QFE/QNH settings.
- When the knob is turned at a slow rate, the value increases in 0.01 inHg or 1 hPa increments. When turned at a faster rate, the increment is in 0.05 inHg or 5 hPa steps.

11 - MAGNETIC HEADING

- Given by the horizontal displacement of the heading scale.
- Indication symbol yellow and heading scale graduated by white dots every 5°, with a white two-digit indication every 20°. The last digit (0) is not shown (e.g., 320° is thus presented as 32). The visible range is 50°.

12 - CAGE BUTTON

- Resets attitude to provide a fast erection function.
- When it is maintained pressed for more than two seconds, resets the horizon function to zero and warning a “ATT 10s” flag is displayed.

13 - MACH NUMBER INDICATION

- The range is from 0.1 to 1 M and is displayed for Mach above 0.45 and when decreasing until Mach 0.40.

The decimal point and the two digits on the lower left corner of the display are green when the airspeed and Mach number are lower than V_{MO}/M_{MO} and red when the airspeed and Mach Number are equal to or greater than V_{MO}/M_{MO}.

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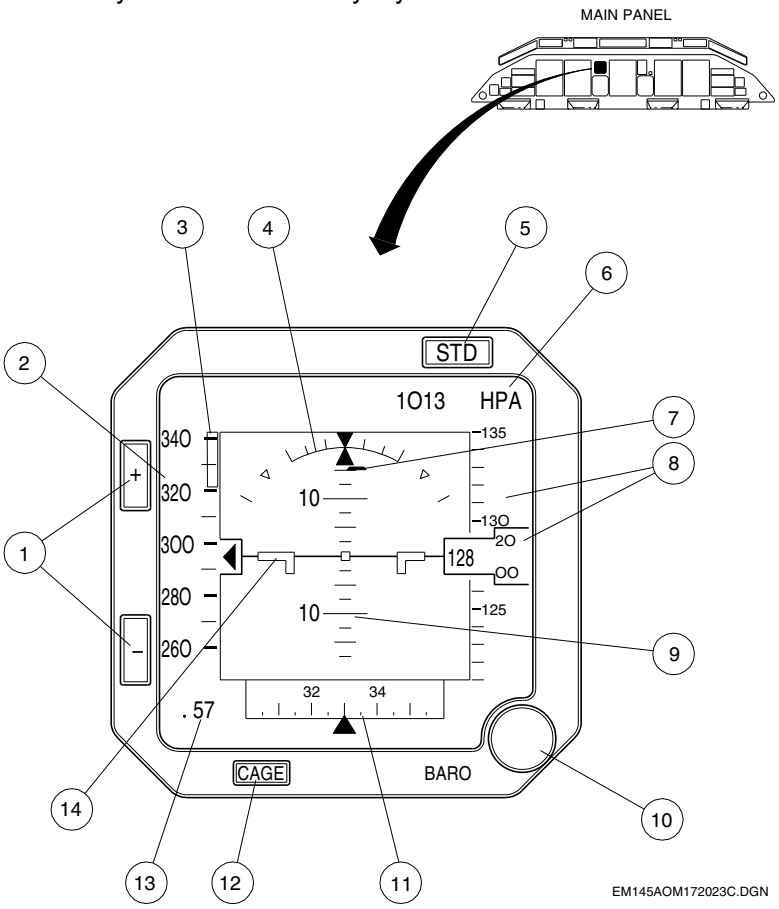
14 - AIRCRAFT SYMBOL

- Displayed on the center of the horizon area.
- Black symbol surrounded by a yellow area.



INTEGRATED STANDBY INSTRUMENT SYSTEM

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ISIS ABNORMAL OPERATION

In case of abnormal operation or failure detection in one or several ISIS functions, the following flags are displayed:

LABEL	MEANING	ACTION
ALT (white digits inside a red filled box)	Indicates loss of altitude function. It is displayed instead of the altitude scale.	Report to maintenance.
ATT (white digits inside a red filled box)	If during alignment phase, indicates an ISIS failure to align.	The system's electrical power must be reset. Make sure the airplane is stationary during subsequent ISIS alignment.
	If during any other phase of operation, indicates loss of attitude function.	Report to maintenance.
ATT : CAGE (black digits inside an yellow filled box)	Indicates that ISIS has to be caged. It is displayed in the upper mid-section of the screen.	Hold the airplane in straight and level flight and at constant speed. Press the CAGE Button for at least 2 seconds until the ATT 10s flag is removed.
HDG (white digits inside a red filled box)	Indicates loss of magnetic heading function. It is displayed in place of the heading scale.	Report to maintenance.

Continued

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LABEL	MEANING	ACTION
M (white digit inside a red filled box)	Indicates loss of Mach number function. It is displayed instead of the Mach number.	Report to maintenance.
MAINT (white digits)	Indicates a parity error presented by the discrete inputs. In this case, the previous discrete input configuration is maintained.	Report to maintenance.
OUT OF ORDER (white digits)	Indicates failure detection with loss of integrity. It is displayed with the associated code failure. The associated parameters are saved in memory for future equipment maintenance.	Report to maintenance.
SPD (white digits over a red filled box)	Indicates loss of airspeed function. It is displayed instead of the airspeed scale.	Report to maintenance.
VMO (white digits over a red filled box)	Indicates VMO error. It is displayed in the upper left corner of the screen, in lieu of the “MAINT” flag.	Report to maintenance.
WAIT ATT (black digits over an yellow filled box) (ISIS V1) or ATT RST (cyan digits over a black filled box) (ISIS V2)	Indicates that IMU is out of domain attitude. In this case, the roll and pitch scale, the lateral acceleration, and the airplane symbol are not displayed. WAIT ATT is displayed in the upper mid-section of the screen. ATT RST is displayed in the lower mid-section of the screen.	Report to maintenance.

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RADIO ALTIMETER SYSTEM

The Radio Altimeter system is a high-resolution, short-pulse radio altitude indicator designed for automatic continuous operation, providing radio altitude, low altitude awareness, and decision height information on the PFD.

The system consists of a radio altimeter transceiver and two flush-mounted antennas (RA 1), and is controlled through the Display Control Panels. Optionally a second Radio Altimeter Subsystem (RA 2) can be installed.

The decision height setting is provided through the decision height setting knob on the Displays Control Panel. The decision height and the associated RA label are displayed adjacent to the lower right side of the attitude sphere.

The Radio Altimeter interfaces with the Aural Warning Unit to provide an warning audio signal for autopilot disconnection. For further information, refer to section 2-18, Autopilot.

RADIO ALTIMETER EICAS MESSAGES

TYPE	MESSAGE	MEANING
ADVISORY	RAD ALT FAIL	Indicates the RA has failed on airplanes equipped with a single unit, or both RAs have failed, on airplanes equipped with two RAs.
	RAD ALT 1 (2) FAIL	On airplanes equipped with two RA, the associated unit has failed.

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RADIO ALTIMETER CONTROLS AND INDICATORS

DISPLAYS CONTROL PANEL

1 - DECISION HEIGHT SETTING KNOB

When rotated, allows decision height setting.

2 - TEST BUTTON

In flight conditions only, this button allows testing the associated Radio Altimeter.

To perform the Radio Altimeter test the DH must be set to 200 ft and the button must be kept pressed. The following indications are presented on the PFD:

- A magenta TEST annunciation is presented adjacent to the upper left side of the attitude sphere.
- An amber MIN label is displayed in the RA Minimum annunciator. The label flashes for about 5 seconds, and then becomes steady.
- An amber RA comparison label is displayed in the down left side of the attitude sphere.
- The Radio Altitude field indicates 100 ± 10 ft.

Additionally, the following EICAS messages are presented according to the following configuration:

- For airplanes equipped with one Radio Altimeter:
  - If tested at LH side:
    - (E)GPWS INOP
    - WINDSHEAR INOP
    - RAD ALT 2 FAIL
  - If tested at RH side:
    - (E)GPWS INOP
    - WINDSHEAR INOP
    - RAD ALT 1 FAIL
- For airplanes equipped with two Radio Altimeters with RA1 connected to the EGPWS:
  - If tested at LH side:
    - (E)GPWS INOP
    - WINDSHEAR INOP
  - If tested at RH side:
    - No message associated

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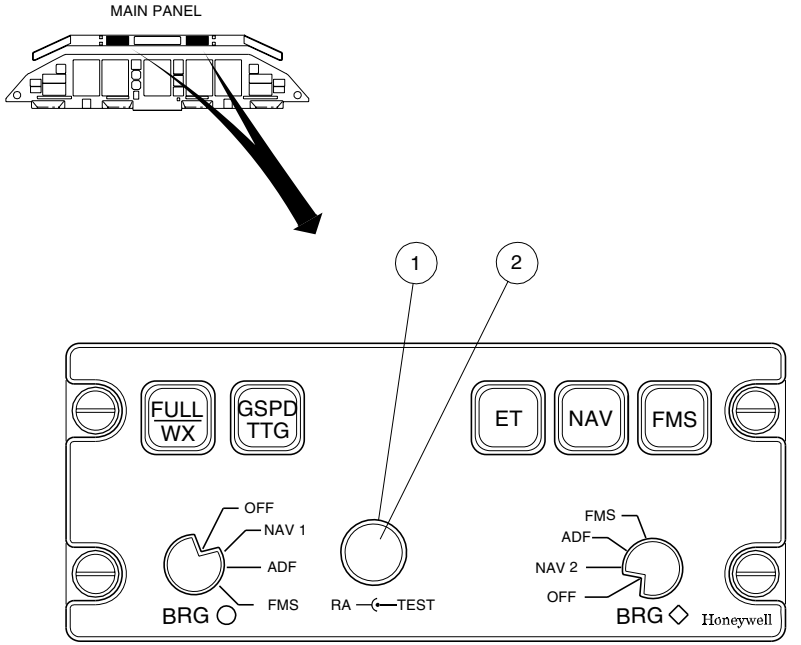
- For airplanes equipped with two Radio Altimeters both connected to the EGPWS:
  - If LH or RH side are tested separately:
    - No message associated
  - If both sides are tested at the same time:
    - (E)GPWS INOP
    - WINDSHEAR INOP

When released, the PFD indications resume the initial condition and the EGPWS voice message may occur:

- TOO LOW TERRAIN

On the ground, pressing this button allows testing the IC-600 computers. For more details, refer to Section 2-4, Crew Awareness.



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DISPLAYS CONTROL PANEL

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PFD

1 - RA MINIMUM ANNUNCIATOR

- Color:
  - Box: white
  - MIN label: amber
- Indicates that the airplane radio altitude is within a certain range of the decision height.
- When an armed RA Minimum condition occurs and the radio altitude is in the range of 100 ft above the decision height setting, a black box appears on the annunciator field.
- At radio altitudes equal to or below the decision height setting, a MIN label is displayed inside the box. The label will flashe for 10 seconds, and then becomes steady.
- The RA Minimum annunciator is armed when the following conditions occur simultaneously:
  - Airplane in flight.
  - Radio Altitude and decision height are valid.
  - Radio Altitude greater than 100 ft above the decision height setting for at least 5 seconds.
  - A decision height is being displayed.
- In the event of a Radio Altimeter failure, the RA Minimum annunciator is removed from the display.

2 - RADIO ALTITUDE INDICATION

- Color:
  - Digits: green.
  - Box: white
- Ranges from –20 to 2500 ft.
- Resolution: 5 ft below 200 ft, 10 ft above 200 ft.
- Displayed inside a box on the bottom center of the attitude sphere.
- In the event of all Radio Altimeters failure, the radio altitude digits will be replaced by an amber label RA inside an amber box.

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3 - DECISION HEIGHT INDICATION

- Color:
  - Digits: cyan
  - RA label: white
- Ranges from 5 to 999 ft.
- Resolution: 5 ft below 200 ft, 10 ft above 200 ft.
- If the decision height is set to zero, the indication is removed from the display.
- In the event of a Radio Altimeter failure, the decision height digits are replaced by amber dashes.

4 - RADIO ALTITUDE COMPARISON MONITOR DISPLAY

- Label: RA
- Color: amber
- Displayed when the difference between the on-side and cross-side radio altitude is greater than a set point which is variable with radio altitude.
- An amber RA1 is displayed in the event of Radio Altimeter 2 failure. Radio Altitude source is RA1.
- An amber RA2 is displayed in the event of Radio Altimeter 1 failure. Radio Altitude source is RA2.

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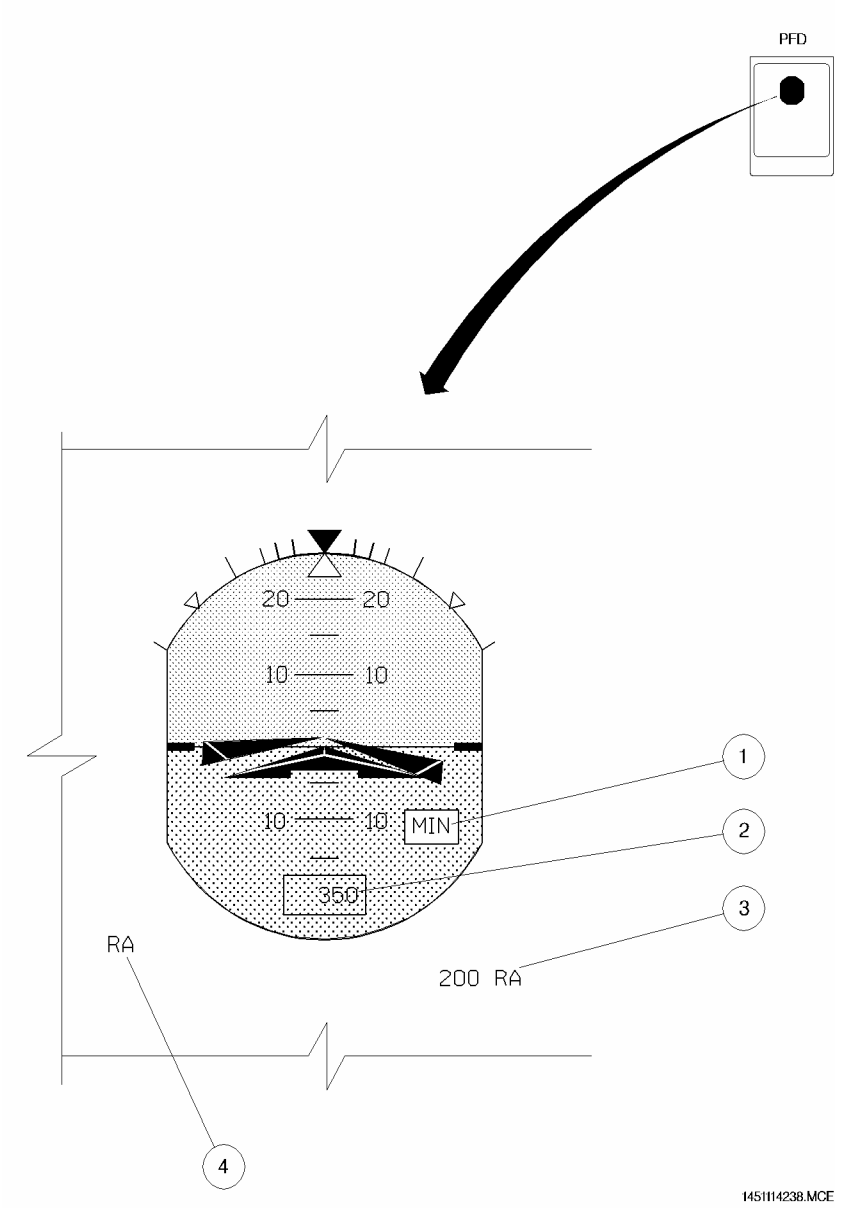

RADIO ALTIMETER INDICATIONS ON THE PFD

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CHRONOMETER/CLOCK (TYPICAL)

The chronometer/clock provides the flight crew with Greenwich Mean Time (GMT), local time (LOC), elapsed time (ET), chronological time (CHR), DATE, and flight number. The instrument is powered by the airplane's electrical system and an internal battery. When the airplane is deenergized, the displays are blanked, although the functions continue to be updated in the memories with exception of the ET and chronometer functions. Display may also blank when a failure exists in the instrument.

CHRONOMETER/CLOCK CONTROLS AND INDICATORS

1 - CHRONOMETER BUTTON

- Successive pressings control start, stop, and reset of the chronometer indicator and pointer providing the following:
  - START: Replaces elapsed time by chronometer indications, starting its counting.
  - STOP: Freezes chronometer indicator and pointer.
  - RESET: Returns the chronometer pointer to zero and replaces chronometer indication by elapsed time.

NOTE: A chronometer button is also provided on each control wheel.

2 - GMT, LOC, DATE, AND FLIGHT NUMBER INDICATOR

- Displays Greenwich Mean Time in the 24-hour format. A fixed dot appears between the two-hour digits, above the GMT inscription.
- Displays local time in the 24-hour format. A fixed dot appears between the two minute digits, above the LOC inscription.
- Displays the date, alternating between month/day and year every second.
- Displays the flight number from 0000 to 9999.

3 - CHRONOMETER POINTER

- Measures chronometer seconds over an analog scale.

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4 - ELAPSED TIME AND CHRONOMETER INDICATOR

- Displays elapsed time (ET), which corresponds to the flight time (from 0 to 99 hours and 59 minutes). Elapsed time reading starts only when the airplane takes off and can only be reset to zero when the airplane is on the ground.
- Displays chronometer minutes from 0 to 99. When CHR is used, accumulated elapsed time is not affected.

5 - ELAPSED TIME BUTTON

- Successive pressings supply the following:
  - On ground: Displays ET.
    Resets ET to zero.
    Displays chronometer minutes.
  - In flight: Displays ET.
    Displays chronometer minutes.

6 - MULTIPLE SELECTOR

SET - Allows time setting. When in the SET position, successive pressings of the ET button causes the selector to cycle between GMT minutes, GMT hours, LOC minutes, LOC hours, days, months, and years (with power up, the year is pre-selected to 90). Once the function is selected (it flashes on and off), the CHR button may be used to increment the selected digit at a rate of one unit every half second (continuous pressing) or manually, step by step.

GMT - Selects Greenwich Mean Time to be displayed on the associated indicator.

LOC - Selects the local time to be displayed on the associated indicator.

DATE - Selects the date to be displayed on the associated indicator.

FLT NR - Selects the FLIGHT NUMBER to be displayed on the associated indicator.

- To set the flight number, proceed as follows:
  - With the selector in the FLT NR position, repeatedly press the ET button to select the digit to be set in the following order: thousands, hundreds, tenths, and units.
  - Press the CHR button to increment the selected digit at a rate of one unit per half second or manually, step by step.

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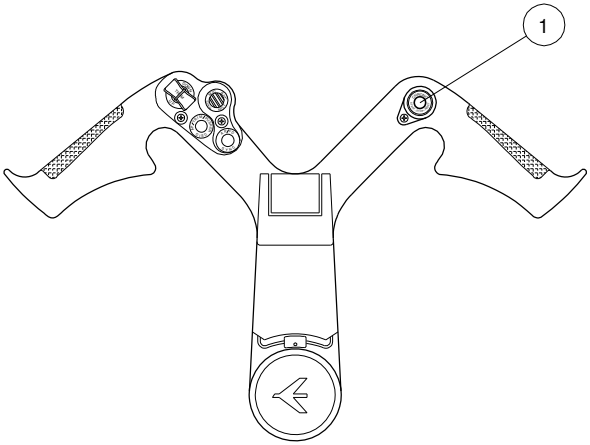

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CONTROL WHEEL

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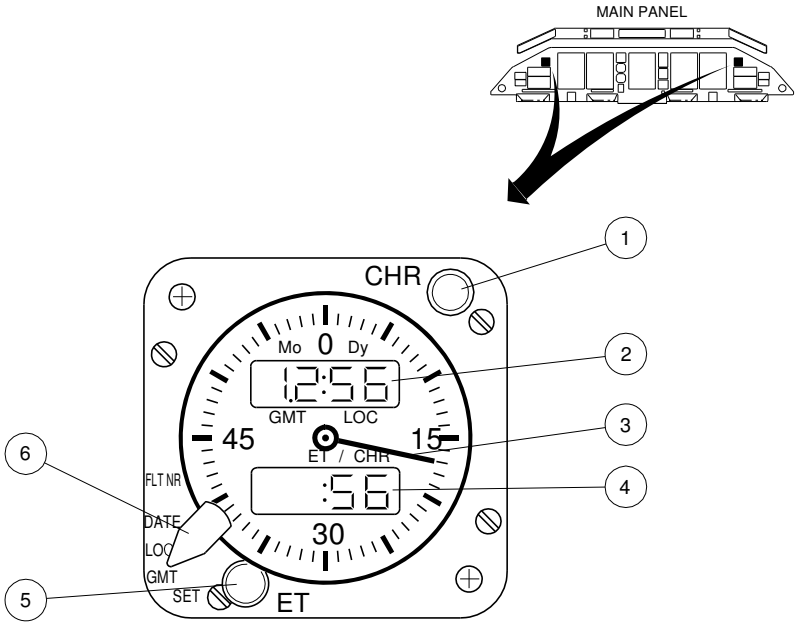

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CLOCK

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DIGITAL CHRONOMETER/CLOCK (OPTIONAL)

The digital chronometer/clock provides the flight crew with Greenwich Mean Time (GMT), local time (LOC), elapsed time (ET), chrono time (CHR), DATE, and flight number. It includes tactile dome switches and an additional functionality: the synchronization with GPS. Also, the chronometer time – minutes and seconds – is presented in digital form (instead of indicating seconds in analog form by a sweep hand).

The instrument is powered by the airplane's electrical system and an internal battery. When the airplane is deenergized, the displays are blanked, although the functions continue to be updated in the memories with exception of the ET and chronometer functions. Display may also blank when a failure exists in the instrument.

DIGITAL CHRONOMETER/CLOCK CONTROLS AND INDICATORS

1 – SEL ET PUSH-BUTTON

- This push-button selects Elapsed Time to be displayed.

2 – RST ET PUSH-BUTTON

- This push-button resets Elapsed Time displayed.

3 – 6-DIGIT DISPLAY

- Displays Universal Time Coordinated (UTC) in hours, minutes and seconds,
- Date (DT) in months, days and years,
- Local time (LT) in hours, minutes and seconds,
- GPS time (GPS) in hours, minutes and seconds,
- And Flight number format: XX XX Fn.

4 – 4-DIGIT DISPLAY

- Displays chronometric time (CHR) in minutes and seconds,
- Displays elapsed time (ET) in minutes and hours.

5 – CHRONOMETER PUSH-BUTTON

- This push-button selects Chronometer to be displayed.

6 – PUSH-BUTTON MODE SELECTOR

- This push-button selects the following features: DATE (DT),
- GPS,
- INT – internal computed,
- LOCAL TIME (LT),
- And F/N – flight number.

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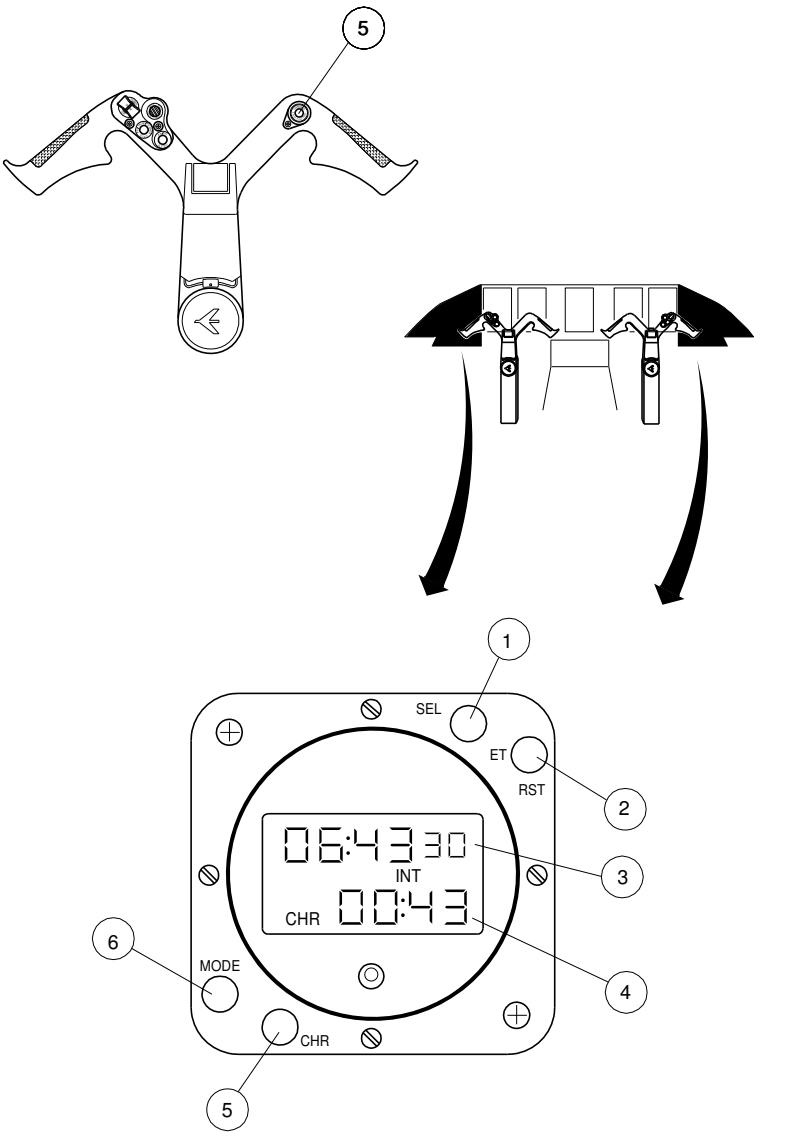

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DIGITAL CHRONOMETER

FLIGHT DATA RECORDER SYSTEM

The Flight Data Recorder System (FDRS) has been designed to automatically acquire and record several airplane and system parameters, without pilot action, from engine start to engine shutdown on every flight.

The FDRS comprises the following units and components:
- One solid-state Flight Data Recorder.
- One underwater locator beacon attached to the Crash Survivable Memory Unit (CSMU) case.
- One triaxial accelerometer.
- Five wirewound precision potentiometers.
- One impact switch.
- Two Data Acquisition Units (DAUs).
- One Auxiliary Flight Data Acquisition Unit (AFDAU) (optional).
- Five surface position sensors (optional).
- Eight load cells sensors to measure the pilot/copilot force into control commands (optional).
- One Analog Digital Converter dedicated to load cells sensors (optional).

An FDR malfunction is detected by means of the power-up built-in test or the continuous self-checking test. An EICAS message is generated to indicate the failure.

The CSMU is a shock-and-heat-resistant container, which records all inputs in the last 25 hours, in a high-density solid-state memory.

The DAUs interface with various airplane systems, in order to supply data to the FDRS.

The AFDAU is solely used for the FDR system and is the unit responsible for receiving all airplane inputs (data to be acquired DAU's, etc.) and sending them to the FDR unit.

An AFDAMU is an AFDAU plus a DMU. The function of the DMU is to process data acquired by the DAU and additional parameters in order to store them in a manner that can be easily accessed for analysis by the operator. AFDAMU performs the function of AFDAU and QAR equipment.

Operational data is recorded when the Red Beacon is switched ON or the airplane is airborne.

The setting of the required flight number to be recorded, along with the system data, is made on the clock as described in this section.

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QUICK ACCESS RECORDER SYSTEM

The airplane may be equipped with an Extended Quick Access Recorder (EQAR) or an Optical Quick Access Recorder (OQAR), which have been designed to automatically acquire and record the flight data sent from DAU 1 and DAU 2 to FDR and CMC, without pilot action, as soon as the airplane is energized.

All the information is recorded in a removable rewritable magnetic optical disk, thus reducing the time for ground data analysis to a minimum. No provision has been made to warn flight crew about system status; consequently, there is no EICAS message associated with this equipment.

FDRS EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	DFDR FAIL	Flight Data Recorder System failure.
ADVISORY	FDAU FAIL	Auxiliary Flight Data Acquisition Unit failure.

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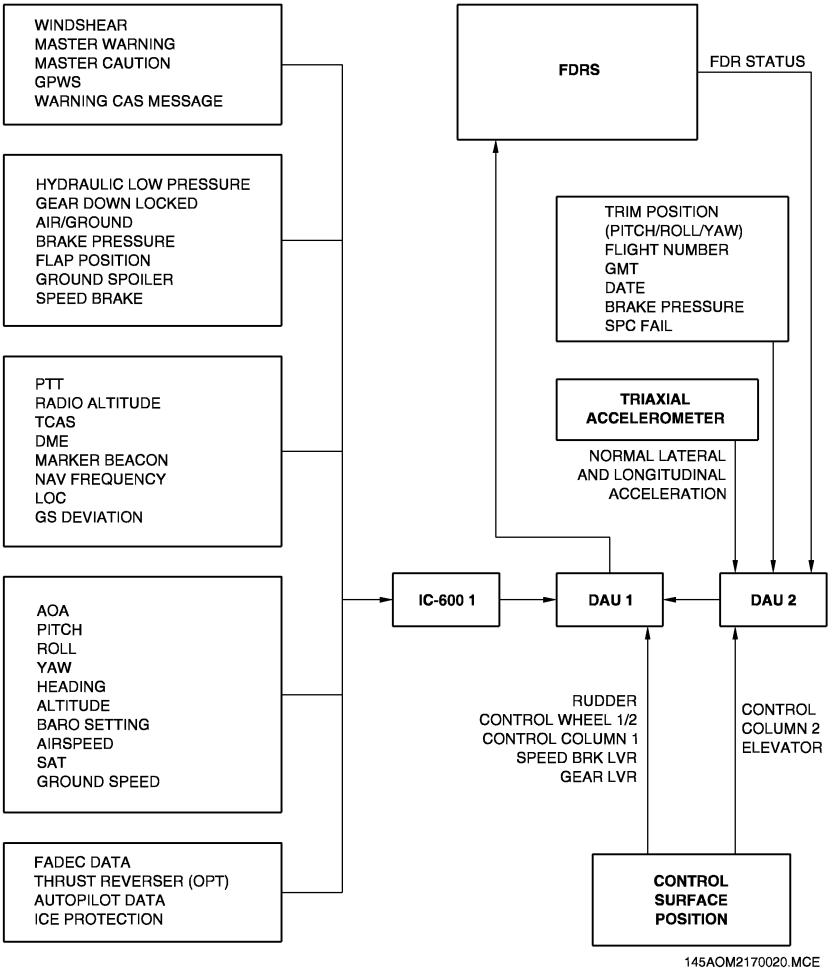

FLIGHT DATA RECORDER SYSTEM SCHEMATIC

(for airplanes not equipped with AFDAU)

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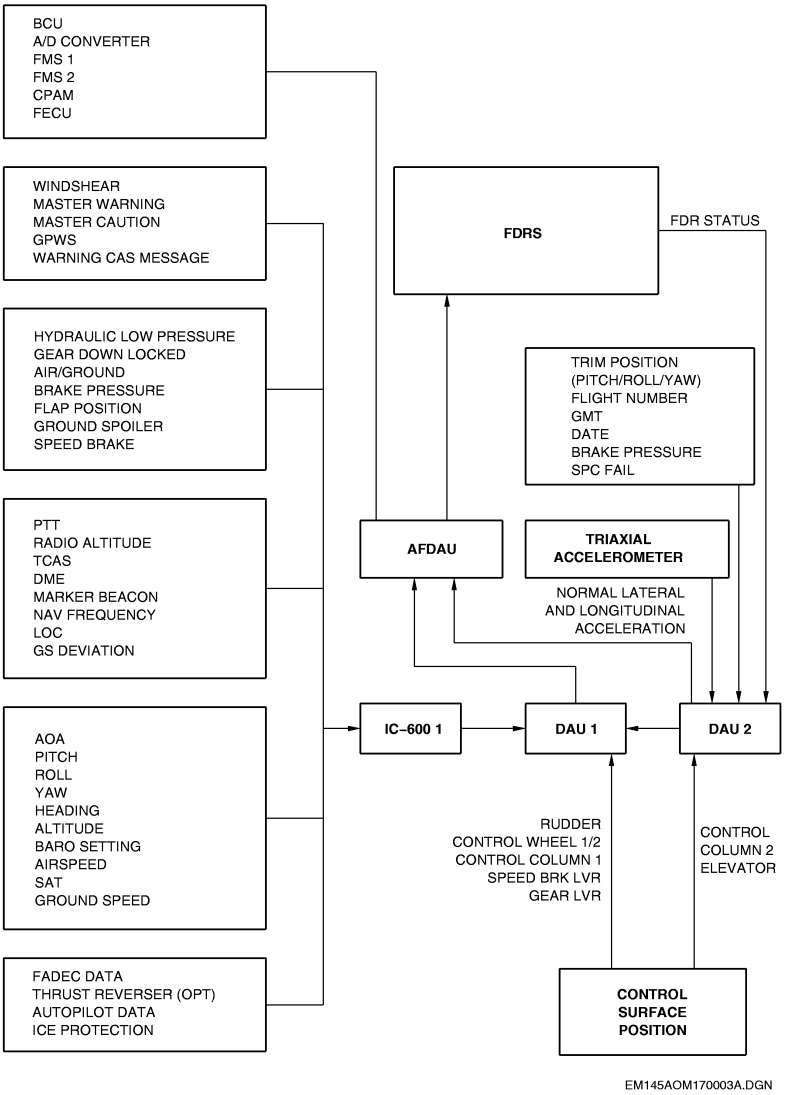

FLIGHT DATA RECORDER SYSTEM SCHEMATIC

(for airplanes equipped with AFDAU - FDR 88 parameters)

AOM-145/1114

SECTION 2-18
NAVIGATION AND COMMUNICATION

TABLE OF CONTENTS

	Block	Page
General	2-18-01	01
Radio Management System (RMS)	2-18-05	01
Integrated Communication Unit (RCZ-851E)	2-18-07	01
Integrated Navigation Unit (RNZ-851)	2-18-09	01
Radio Management Unit (RMU)	2-18-11	01
RMU Pages	2-18-11	01
RMU Normal Operation	2-18-11	03
RMU Abnormal Operation	2-18-11	09
RMU Controls and Indicators	2-18-11	10
Tuning Backup Control Head	2-18-13	01
Normal Mode	2-18-13	01
Emergency Mode	2-18-13	01
Self-Test	2-18-13	01
TBCH Controls and Indicators	2-18-13	02
Digital Audio Panel	2-18-15	01
Normal Mode	2-18-15	01
Emergency Mode	2-18-15	01
Digital Audio Panel Controls and Indicators	2-18-15	03
EICAS Messages	2-18-19	01
Communication Controls and Indicators	2-18-20	01
HF Communication System - HF-230 (*)	2-18-21	01
HF Operating Modes	2-18-21	01
HF Normal Operation	2-18-21	03
HF Controls and Indicators	2-18-21	09
HF Communication System - KHF-950 (*)	2-18-21	01
HF Operating Modes	2-18-21	01
HF Normal Operation	2-18-21	03
HF Controls and Indicators	2-18-21	08

NOTE: Optional equipment are marked with an asterisk (*) and its description may not be present in this manual.

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HF Communication System - KHF-1050 (∗) ..... 2-18-21 ..01
Third VHF Communication System (∗) ..... 2-18-22 ..01
Third VHF COM Controls and Indicators ..... 2-18-22 ..01
Third VHF Navigation/Communication System (∗) ..... 2-18-22 ..01
Third VHF NAV/COM Controls and Indicators ..... 2-18-22 ..01
Third VHF Navigation System (∗) ..... 2-18-22 ..01
Third VHF NAV Controls and Indicators ..... 2-18-22 ..01
SELCAL System (∗) ..... 2-18-23 ..01
SELCAL Controls and Indicators ..... 2-18-23 ..02
Aircraft Communication Addressing and
Reporting System (ACARS) (∗) ..... 2-18-24 ..01
ACARS Operation ..... 2-18-24 ..04
ACARS Controls and Indicators ..... 2-18-24 ..05
Honeywell Mark III CMU (∗) ..... 2-18-24 ..01
CMU Normal Operation ..... 2-18-24 ..04
CMU Abnormal Operation ..... 2-18-24 ..04
CMU Controls and Indicators ..... 2-18-24 ..06
Printer Controls and Indicators ..... 2-18-24 ..08
Cockpit Voice Recorder ..... 2-18-25 ..01
Self-Test ..... 2-18-25 ..01
Erase Function ..... 2-18-25 ..02
Cockpit Voice Recorder Controls and Indicators ..... 2-18-25 ..02
Passenger Address System ..... 2-18-27 ..01
Passenger Address Operating Modes ..... 2-18-27 ..02
Passenger Address Controls And Indicators ..... 2-18-27 ..04
Satcom System (∗) ..... 2-18-28 ..01
Introduction ..... 2-18-28 ..01
Satcom Operation ..... 2-18-28 ..01
Satcom Controls and Indicators ..... 2-18-28 ..05
Attitude And Heading Reference System (AHRS) (∗) ..... 2-18-30 ..01
AH-800 AHRS Version ..... 2-18-30 ..04
AH-800 Operating Modes ..... 2-18-30 ..05
AH-800 EICAS Messages ..... 2-18-30 ..06
AH-800 Controls and Indicators ..... 2-18-30 ..08

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AH-900 AHRS Version ..... 2-18-30 .. 10
AH-900 Operating Modes ..... 2-18-30 .. 11
AH-900 EICAS Messages ..... 2-18-30 .. 13
AHRS Indications on the PFD ..... 2-18-30 .. 16
Inertial Reference System (IRS) (∗) ..... 2-18-30 .. 01
Inertial Reference System Components ..... 2-18-30 .. 04
IRS Operating Modes ..... 2-18-30 .. 05
IRS Operating Procedures ..... 2-18-30 .. 10
IRS EICAS Messages ..... 2-18-30 .. 12
IRS Controls and Indicators ..... 2-18-30 .. 14
IRS Indications on the PFD ..... 2-18-30 .. 16
Flight Management System (∗) ..... 2-18-35 .. 01
FMS Operating Modes ..... 2-18-35 .. 02
FMS Controls and Indicators ..... 2-18-35 .. 06
FMS Operating Modes (FMZ 2010 – FMS NZ 6.1.1) ..... 2-18-35 .. 10
FMS Controls and Indicators (FMZ 2010 – FMS NZ 6.1.1) ..... 2-18-35 .. 13
Navigation Displays ..... 2-18-40 .. 01
Displays Controls and Indicators ..... 2-18-40 .. 02
Weather Radar System 2-18-45 p01
General ..... 2-18-45 .. 03
Weather Radar Normal Operation ..... 2-18-45 .. 04
Interpreting Weather Radar Images ..... 2-18-45 .. 04
Radar Warm Up Period ..... 2-18-45 .. 06
Ground Operation Precautions ..... 2-18-45 .. 06
Weather Radar Operating Modes and Functions ..... 2-18-45 .. 07
Radome ..... 2-18-45 .. 18
Weather Radar Behavior ..... 2-18-45 .. 19
Weather Radar Controls and Indicators ..... 2-18-45 .. 21
Lightning Sensor System (LSS) (∗) ..... 2-18-50 .. 01
LSS Operation ..... 2-18-50 .. 02
LSS Controls and Indicators ..... 2-18-50 .. 05
Barometric Vertical Navigation (Baro-VNAV) (∗) ..... 2-18-60 .. 01
Baro-VNAV Components ..... 2-18-60 .. 01
VNAV Indications ..... 2-18-60 .. 03
PFD Indications ..... 2-18-60 .. 03
EICAS ..... 2-18-60 .. 07
CDU ..... 2-18-60 .. 08

NOTE: Optional equipment are marked with an asterisk (∗) and its description may not be present in this manual.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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VNAV Submodes ..... 2-18-60 ..09
VNAV Arm (VNAV) ..... 2-18-60 ..09
VNAV Flight Level Change (VFLC) ..... 2-18-60 ..09
VNAV Altitude Capture (VASL) ..... 2-18-60 ..12
VNAV Altitude Hold (VALT) ..... 2-18-60 ..12
VNAV Path (VPTH) ..... 2-18-60 ..12
Vertical DIRECT-TO ..... 2-18-60 ..17
VNAV Vertical Glide Path (VGP) ..... 2-18-60 ..20
VNAV and Holding or Orbit Patterns ..... 2-18-60 ..21
Go-Around Operations
(Missed Approach Procedure) ..... 2-18-60 ..22
Speed Command ..... 2-18-60 ..23
Speed Protection ..... 2-18-60 ..23
Temperature Compensation ..... 2-18-60 ..24
Required Navigation Performance (RNP) (*) ..... 2-18-65 ..01
RNP Indications ..... 2-18-65 ..01
RNP Operation ..... 2-18-65 ..03
Localizer Performance with Vertical Guidance (LPV) (*) .. 2-18-70 ..01
LPV Approach Loading ..... 2-18-70 ..01
LPV Indications ..... 2-18-70 ..03
LPV Armed Annunciation ..... 2-18-70 ..04
LPV Active Annunciation ..... 2-18-70 ..05
Final Approach Segment (FAS)
Data Block ..... 2-18-70 ..06
LPV Unavailable Annunciation ..... 2-18-70 ..07
LPV Alerts and Advisory Messages ..... 2-18-70 ..09
Missed Approach Following an LPV Approach ..... 2-18-70 ..10
LPV Inactive Status ..... 2-18-70 ..10
EGPWS Mode 5 Alerting ..... 2-18-70 ..10
LPV Miscompare Monitors ..... 2-18-70 ..10
Head-Up Guidance System (HGS) (*) ..... 2-18-75 ..01
HGS Components ..... 2-18-75 ..04
HGS Modes of Operation ..... 2-18-75 ..07
HGS EICAS Messages ..... 2-18-75 ..14
HGS Capability Test ..... 2-18-75 ..14
HGS Controls and Indicators ..... 2-18-75 ..14
Identification Friend or Foe System (IFF) (*) ..... 2-18-80 ..01
Selector Panel ..... 2-18-80 ..02
IFF Transponder Controls and Indicators ..... 2-18-80 ..04

NOTE: Optional equipment are marked with an asterisk (*) and its description may not be present in this manual.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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Tactical V/UHF Communication System (∗) ..... 2-18-90 .. 01
Introduction ..... 2-18-90 .. 01
Main Components ..... 2-18-90 .. 02
Transceiver XT 6011 ..... 2-18-90 .. 02
Remote Control Unit GB 6500 ..... 2-18-90 .. 03
Operation ..... 2-18-90 .. 04
Built-In Test (BIT) Design ..... 2-18-90 .. 04
Normal Operation ..... 2-18-90 .. 04
Tactical U/VHF Selection ..... 2-18-90 .. 06
Abnormal Operation ..... 2-18-90 .. 06
Controls and Indicators ..... 2-18-90 .. 07
Remote Control Panel GB 6500 ..... 2-18-90 .. 07
Automatic Dependent Surveillance Broadcast (ADS-B OUT) ..... 2-18-95 .. 01
Introduction ..... 2-18-95 .. 01
Controls and Indicators ..... 2-18-95 .. 03
RMU ATC/TCAS Control Page ..... 2-18-95 .. 03
RMU Radio Page - ATC/TCAS Window ..... 2-18-95 .. 05

User: fhherna0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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GENERAL

The standard EMB-145 navigation and communication resources are provided by the Radio Management System (RMS). The RMS is controlled through two Radio Management Units (RMU 1 and 2), an auxiliary control unit, the Tuning Backup Control Head (TBCH), and three individual Digital Audio Panels (DAP).

The two RMUs provide radio frequency and mode control. Alternatively, the RMU 2 frequencies may be selected through the TBCH.

The Audio System is controlled via three individual Digital Audio Panels, available for the captain, copilot and observer.

The Radio Management System also provides interface with the Passenger Address System, Aural Warning Unit and Cockpit Voice Recorder.

Optional communication equipment includes an HF transceiver, Third VHF NAV/COM, SELCAL and Aircraft Communication Addressing and Reporting System (ACARS).

The navigation may be performed using only the standard navigation radio sensors, or using the Flight Management System (FMS) resources. The FMS is an optional equipment that uses the standard navigation radio sensors, GPS (Global Positioning System) sensors, and, also optionally, the IRS (Inertial Reference System) for positioning and navigation.

Heading inputs to the Integrated Navigation Unit are provided by the AHRS (Attitude and Heading Reference System) or by the IRS. These equipment also provide roll and pitch attitudes for the Electronic Attitude Director Indicator (EADI).

The navigation information is normally presented on the PFD and MFD and may also be available on the RMU, through its navigation backup page.

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RADIO MANAGEMENT SYSTEM (RMS)

The EMB-145 models are equipped with a Radio Management System (RMS) that provides management of the following equipment and associated functions:

- Dual VHF COM
- Dual VHF NAV (VOR, LOC, GS and Marker Beacon)
- Single or dual (optional) ADF
- Single or dual (optional) Transponder (ATC and Mode S)
- TCAS
- MLS (optional)
- Single or dual (optional) DME (including DME Hold)
- Digital Audio Panel

The RMS consists basically of the following major components:

- Remote mounted:
  - Integrated Navigation Unit (INU)
  - Integrated Communication Unit (ICU)
- Cockpit Mounted:
  - 2 Radio Management Unit (RMU)
  - 1 Tuning Backup Control Head (TBCH)
  - 3 Digital Audio Panel (DAP)

With the exception of the Digital Audio Panel, all components of the RMS are connected through the digital Radio System Buses (RSB) that allows complete control and information exchange between the units of the entire RMS. Audio switching control is provided by means of the controls on the Digital Audio Panel itself. The audio signals are transmitted from the remote units to the Digital Audio Panel through dedicated digital audio buses.

The navigation and communication data are displayed on the RMU, PFD and MFD displays.

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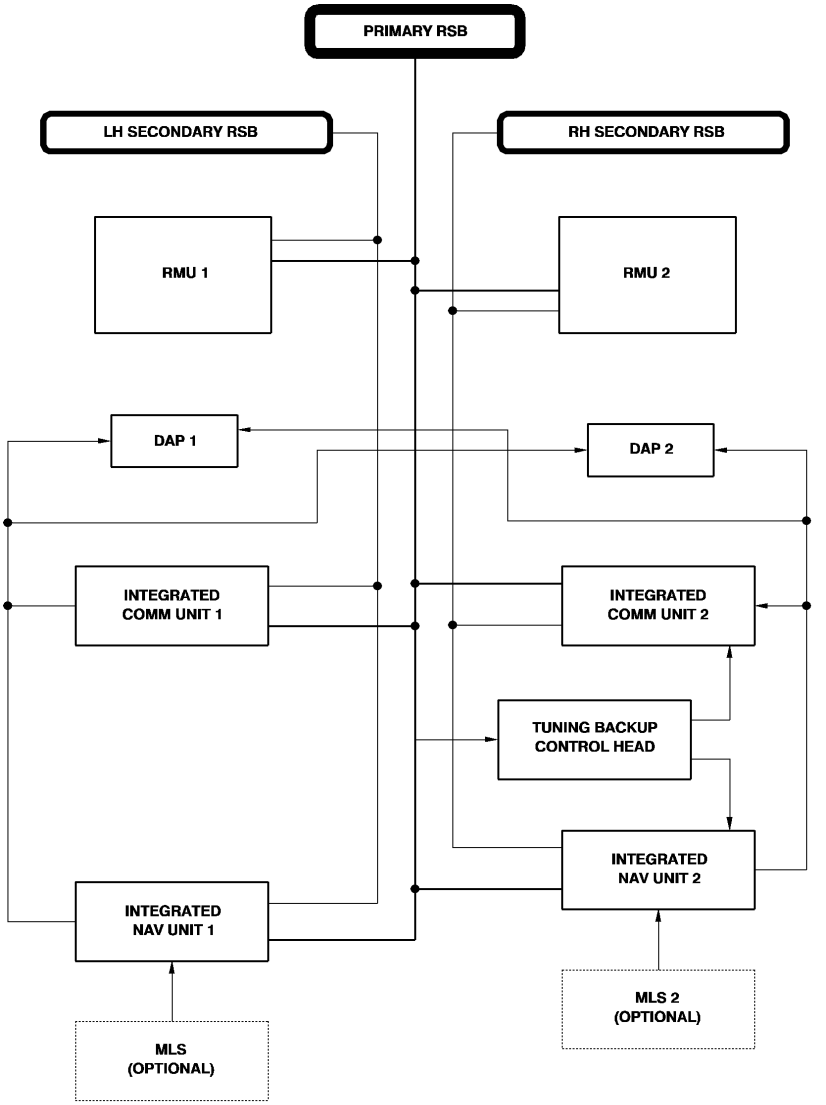

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RMS SCHEMATIC

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INTEGRATED COMMUNICATION UNIT (RCZ-851E)

The Integrated Communication Unit incorporates an internal VHF communication transceiver module and the ATC transponder module which interfaces through a cluster module to the Radio System Bus for operation.

This unit provides digitized audio signals to the Digital Audio Panel and conventional analog audio interfaces to other systems. The following modules may be provided in this unit:

- VHF Communication Transceiver Module (TR-850) - This module is a conventional VHF COM transceiver that operates in the frequency range of 118 to 136.975 MHz.

- Mode S Diversity Transponder Module (XS-852) - This transponder module provides full ATCRBS, Mode S and TCAS data communications capability. The Mode S Transponder module has the encoding and decoding capability required for Mode S operation in addition to the capability to operate as a conventional Air Traffic Control Radio Beacon Service (ATCRBS) transponder. The Mode S operation allows digital addressing of an individual airplane and the transmission of messages back and forth between the air and the ground.

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INTEGRATED NAVIGATION UNIT (RNZ-851)

The Integrated Navigation Unit is a complete self-contained navigation system. The system consists of the VOR, localizer, glide slope and marker beacon receiver modules, the ADF module, a six-channel scanning DME module, and audio digitizers. The system also incorporates two L-Band antenna (optional), two ADF antenna (optional), two MB antenna, two VOR/ILS antenna and one GS dual antenna.

The following modules are provided in this unit:

– VHF NAV Receiver Module (NV-850) - The VHF NAV receiver is a module of the Integrated Navigation Unit and houses the major navigation functions of the VOR/LOC receiver, glide slope receiver and marker beacon receiver.
The ILS meets Category II instrument landing requirements.
Housed within the NAV receiver is a glideslope receiver which provides 40 channels of glideslope information for the conventional ILS. Also includes a 75 MHz marker beacon receiver which detects and transmits the tones of the marker beacons to the Audio System.

– DME Transceiver Module (DM-850) - The DME module is a six-channel DME that simultaneously tracks four selected channels for distance, groundspeed and time to station as well as monitoring two additional channels for the ident functions. This feature gives the system the capability of tracking four channels and having the decoded identifier readily available from two additional channels. The unit dedicates two of the four selected channels to the FMS (if installed). Thus, with the FMS installed, there are two remaining channels to control and display ident, distance, time to station and ground speed. Even with the FMS installed, the preset or standby VOR channel, when selected, provides instant station identification since it was one of the two additional channel being monitored.

– ADF Receiver Module - The ADF System comprises the ADF receiver (DF-850) and the companion ADF antenna (AT-860). The ADF receiver operates in the frequency ranges of 100 to 1799.5 kHz and 2181 to 2183 kHz (marine emergency frequency range).

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RADIO MANAGEMENT UNIT (RMU)

The Radio Management Unit consists of a display and a bezel panel that provide control of the communications and radio navigation equipment. Additional airplane systems information is also available on specific RMU selectable pages.

The EMB-145 is equipped with two RMUs, each one responsible for controlling the on-side radio equipment (e.g., RMU 1 controls the NAV/COM 1). However, through the cross-side operating mode, it is possible to select the opposite side radio frequencies.

There is no master switch for the RMUs: when the airplane is energized, both RMUs (and the EICAS) are automatically turned ON. However, only the COM 1 radio is available (dashes on the remaining RMUs fields) until the AVIONICS MASTER is switched ON.

Additionally, in the event of an electrical emergency, the RMU is a backup display for the main panel (PFDs and MFDs). In this condition the main panel is turned off and the NAVIGATION Backup Page, which presents basic navigation information, may be accessed through RMU page.

RMU PAGES

Available RMU pages are as follows: RADIO Page, NAV and COM Pages, ATC/TCAS Control Page, NAVIGATION Backup Page, ENGINE Backup Pages 1 and 2, SYS SELECT Page (COM band options) and MAINTENANCE Page. For airplanes equipped with KHF-1050, HF MEMORY Page and HF Control Page are also available.

Pressing the Page Control Button (PGE) selects the Page Menu. Pressing the Line Select Button associated with the desired page will cause the respective page to be displayed. The RADIO Page will be displayed again when the Line Select Button associated with the RETURN TO RADIOS label is pressed.

RADIO PAGE

Normally presented after power up, the RADIO Page is divided into five dedicated windows. Each window groups the data associated with a particular function: COM, NAV, ATC/TCAS, ADF. HF and MLS may also be available. In addition, the windows provide complete control of the frequency and operating modes of the associated function.

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NAVIGATION/COMMUNICATION MEMORY PAGES

The Memory Page presents two similar displays called First Memory Page and Second Memory Page. The First Memory Page shows memory locations 1 through 6 and the Second Memory Page shows memory location 7 through 12. Both the COM and NAV Memory Pages are functionally identical.

HF MEMORY PAGE (only for KHF-1050)

The HF Memory Page manages the 12-channel non-volatile memory frequencies and their transmission/reception mode, mode of operation and squelch level .

HF CONTROL PAGE (only for KHF-1050)

The HF Control Page allows the pilot to select and adjust the active and preset frequency, transmission/reception mode, mode of operation, squelch level and Transmission (TX) power.

ATC/TCAS CONTROL PAGE

The ATC/TCAS Control Page allows the pilot to select various TCAS operational features:

- Intruder Altitude
  - REL: Target's altitude displayed relative to one's own airplane (default).
  - FL: Target's altitude displayed as flight level (reverts to REL after 20 sec).
- TA Display
  - AUTO: Traffic targets displayed only when TA or RA target conditions exist.
  - MANUAL: All traffic targets displayed within the viewing airspace.
- Flight ID
  Allows Mode S coding to reflect the current flight's call sign.
- ADS-B Status (only for airplanes Post-Mod. SB 145-34-0118 or equipped with an equivalent modification factory incorporated):
  - NORMAL (white): GPS data is received on the active transponder.
  - FAIL (yellow): No GPS data is received on the active transponder.
  - DEGRADED (yellow): GPS navigation integrity or accuracy parameters do not meet ADS-B standards, as recognized by the active transponder.

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- Flight Level 1/2
  Display of the transponder's encoded altitude and the air data source for that altitude.

NAVIGATION BACKUP PAGE

The NAVIGATION Backup Page consists of a backup navigation display that presents HSI, MB, DME, NAV (VOR) and ADF information

ENGINE BACKUP PAGE

The ENGINE Backup Page displays information normally presented on the EICAS, as engine and systems indications, as well as EICAS messages. The ENGINE Backup Page is divided into two pages. The first presents only engine indications, while the second presents systems indications and EICAS messages. For further information on Engine Backup Page refer to Section 2-10 - Powerplant and 2-4 - Crew Awareness.

SYSTEM SELECT PAGE

The SYS SELECT Page allows the selection of COM 1 and COM 2 between Narrow and Wide bands.

MAINTENANCE PAGE

This page displays test results information depending on the type of test that is being carried out (power on self-test or pilot activated self-test). Two pages may be presented if a failure is detected, depending on whether the failure is in the RMS or in one of the radios. This page is not available in flight.

RMU NORMAL OPERATION

RMU SELF-TEST

On the ground, the RMS performs a self-test each time power is applied after power off periods greater than 10 seconds. This test monitors the primary and secondary radio buses as well as the individual Radio Systems for proper operation. Each function test status is displayed in its respective window.

Under normal conditions, the COM will be operational within 7 seconds after power on and the remaining radio equipment units within 50 seconds. The test can be terminated by pressing the Test Button in the RMU Bezel Panel.

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If any bus or radio test parameter failure occurs, an associated error message will be displayed on the test failure window, below the COM and NAV windows. Radio System failures are displayed in the first failure window and function failures in a second failure window. The failure windows may be removed by pressing and holding the Test Button. If the test is successfully completed the RMU will display the RADIO Page with the same radio configuration prior to the last power down.

NOTE: Any radio equipment that is not powered up when the test is initiated by the RMU will generate an error message.

Additionally, the pilot may perform a test by pressing the Test Button on the RMU Bezel Panel, which causes the activation of the self-test of the component associated with the window in which the yellow cursor is located. Upon successful completion of this test, a PASS message will be displayed for a short time in the window, indicating the successful completion of the test. If this test is not successfully completed, an error message (ERR) will be displayed in the window.

NOTE: Errors detected by the self-test indicate one or more parameter outside their self-test limit, but may not necessarily indicate non-operation of the function. The pilot should verify the operation of the function.

CROSS-SIDE OPERATION

The RMU is provided with a feature called cross-side operating mode. This feature allows the RMU to be changed from its normal operating mode of tuning the on-side radio equipment to the mode of tuning the opposite side radio equipment.

The cross-side operation is selected by pressing the cross-side Transfer Button, labeled 1/2, on the RMU Bezel Panel, with the yellow cursor box in any window, except the ATC/TCAS window. The entire RMU display and operation is transferred from the opposite side to the side that has commanded the Cross-side Operating Mode. If the yellow cursor box is in the ATC/TCAS window, pressing the cross-side Transfer Button selects which transponder (1 or 2) will be in operation.

In the cross-side operation, the RMU Window/Control Side Ident will be displayed in magenta on the side that has selected the operation and any change made will be displayed in yellow on the opposite side RMU to indicate that the change was carried out remotely.

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COM OPERATION

The normal COM operation is enabled with the RMU RADIO Page displayed. The COM window has two frequency lines. The upper line displays the active COM frequency while the lower line displays the preset frequency. Pressing the Line Select Button associated with the preset frequency will cause the yellow cursor box to move to enclose that frequency. In this condition, the enclosed preset frequency may be changed through the Frequency Tuning Knobs. When the Frequency Tuning Knobs are actuated, the label MEMORY and the associated memory location number, both below the lower frequency line, will change to a TEMP label indicating that the new preset frequency is not yet stored in the memory of the RMU. Frequency storage may be accomplished by pressing the Memory Storage Button, labeled STO, on the RMU Bezel Panel. This action will also provide the previous MEMORY label and the associated memory location number to replace the TEMP label, indicating that the new preset frequency has been stored in the indicated memory location.

Placing the yellow cursor box to enclose the MEMORY label, by pressing a second time the Line Select Button beside the COM window, will allow scrolling through the entire RMU stored memory. This may be performed by rotating the Frequency Tuning Knob either clockwise to memory location increment or counterclockwise to decrement.

The exchange between the active frequency displayed in the upper line of the window and the preset frequency displayed in the lower line may be accomplished by pressing the Frequency Transfer Button on the upper left corner of the RMU Bezel Panel. This effectively causes the COM to change to the new active frequency that previously was the preset frequency. In this condition, the previous active frequency drops down to the second line of the COM window and becomes a temporary preset frequency. This is indicated by the TEMP label displayed under that frequency. The TEMP label also indicates, in this case, that the frequency displayed in the second line has not been stored in a memory location.

NOTE: The RMU controls the third VHF for airplanes equipped with Honeywell Third VHF System RCZ-833/853 models.

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- Direct COM Tuning

Direct COM tuning is accomplished by pressing and holding for approximately 3 seconds the Line Select Button beside the COM preset frequency line. The yellow cursor box will enclose the active frequency, allowing direct COM tuning to that frequency, and the preset frequency line will be blank.

To exit from direct COM tuning, press and hold the Line Select Button beside the preset frequency line, until the preset frequency appears on the COM window.

- Squelch Function

The COM squelch function is controlled through the Squelch Control Button, labeled SQ, on the RMU control bezel. Pressing this button will cause the COM radio to open its squelch and allow any noise or signal present in the receiver to be heard in the Audio System. The squelch open condition is indicated by the SQ label displayed on the top of the COM window. Pressing the Squelch Control Button again will close the radio squelch immediately.

- Automatic Time-Out

After approximately two minutes of continuous transmission, the transceiver turns its transmitter off and a beep sound in the audio system alerts the pilot to the fact. The transceiver then reverts to receiver mode in order to prevent a stuck microphone button from blocking the communications channel. Should the time-out occur, the pilot can reset it by simply releasing the push to talk button and pressing it again.

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NAV OPERATION

The NAV operation is identical to the COM operation. However, NAV controls are accomplished by actuation of the Frequency Transfer Button and the Line Select Button located on the upper RH of the RMU Bezel Panel. Furthermore, the NAV window has an additional function called DME Split Tuning Mode. The operation in the DME Split Tuning Mode is similar to the operation in the DME Hold Mode.

The NAV system also incorporates FMS auto-tuning capability. Through the NAV Memory Page it is possible for the FMS to perform automatic tuning of the navigation radios (raw data) along the route by pressing the upper RH Frequency Transfer Button, which enables or disables the FMS auto-tuning capability. When the VOR or the ILS frequency is auto-tuned by the FMS, a magenta VOR or ILS frequency and a magenta AUTO label will be displayed on the top border of the RADIO Page NAV window.

DME OPERATION

In normal DME operations only one of the six DME channels is paired with the VOR active frequency and one other with the preset VOR frequency. However, pressing the DME Select Button, labeled DME, on the RMU Bezel Panel, will enable the DME to be tuned independently of the VOR active frequency.

Pressing the DME Select Button once will cause the NAV window to split into two windows. The top window will display the active VOR frequency and the lower window, with the DME label, will display the active DME frequency in VHF format. When the NAV window is split, an H (DME Hold) label is displayed in the DME window to indicate that the DME is not paired with the active VOR/ILS frequency. In this case the DME hold condition will also be announced on the PFD. In this condition, the DME may be tuned directly by simply pressing the associated Line Select Button beside the DME window and tuning the new DME channel through the Frequency Tuning Knobs.

Pressing the DME Select Button again will cause the frequency to be displayed in the channel format (TACAN).

Pressing the DME Select Button for the third time will cause the NAV window to resume its normal mode with the active and preset frequencies being displayed while returning the DME to the condition of channeling with the active VOR frequency.

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HF OPERATION (only for KHF-1050)

The KHF-1050 High-Frequency Communications System operates in a frequency range of 2.0 to 29.9999 MHz with resolution of 100 Hz, and has different operating modes: Amplitude modulation (AM), upper side-band voice (UV), lower side-band voice (UL), upper side-band data (UD), lower side-band data (LD) and continuos wave (CW).

The AM, UV and UL operating modes may be used, and the UV operating mode is highly recommended due to its quality and range. The UD, LD and CW operating modes are inoperative and its use will take no effect. Therefore, the UD, LD and CW modes should not be selected.

Simplex Operation means that the transmission and reception frequencies are the same, while Split (or Semi-duplex) Operation means transmission (TX) and reception (RX) on different frequencies. International Telecommunication Union (ITU) is a Split Operation, and Emergency is a Simplex Operation, both with defined frequencies and selected by a channel number.

NOTE: - The use of Lower Side-band is legal for some international and off-shore communications, but is not authorized for use in the United States and most European countries.

- Be sure all personnel are clear of the HF antenna when performing radio checks. Serious RF burns can result from direct contact with the antenna and its terminals when the system is transmitting .

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During normal operation, the following annunciators may display:

COLOR	MESSAGE	MEANING
YELLOW	ERR	HF radio is annunciating a fault.
	RX INH	HF reception with one system is inhibited because the other system is transmitting or has just finished a transmission.
	SQ	Squelch is opened with the SQ function key (squelch test mode).
	TX INH	One system is keyed, but the other system was keyed first.
	TX MIN	HF is keyed and transmit power setting is minimum.
	TX MED	HF is keyed and transmit power setting is medium.
	TX	HF is keyed and transmit power setting is maximum.

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ADF OPERATION

The tuning of ADF frequencies is similar to that performed on the airplane's other radio equipment. Pressing the Line Select Button beside the ADF frequency display will move the yellow cursor box to surround the ADF frequency in the RMU display. Then, slowly turning the Frequency Tuning Inner Knob clockwise causes the ADF frequencies to advance in 0.5 kHz increments, while slowly turning the outer knob clockwise will cause the frequencies to advance in 10 kHz increments. ADF tuning through the Frequency Tuning Knobs is accomplished using proportional rate. If the knobs are turned in slow deliberate steps, the frequency will follow likewise. However, if the knob is turned rapidly, the frequency will skip several steps, depending upon the speed at which the knob is turned. This allows accomplishing large frequency changes with a very slight rotation of the knob.

The RMU also has the capability of storing an ADF frequency. This is accomplished by selecting the desired ADF frequency and then pressing the Memory Storage Button on the RMU Bezel Panel. To retrieve the stored frequency from memory, the ADF frequency Line Select Button must be pressed for 2 seconds.

The ADF is provided with a mode control capability. ADF operational modes can be selected by moving the yellow cursor box to the ADF modes field in the ADF window and then pressing the Line Select Button beside the ADF modes field or rotating the Frequency Tuning Knobs. Repeatedly pressing the Line Select Button will cause the modes to step in one direction while rotating the Frequency Tuning Knobs will select the modes either up or down the current location.

The ADF operational modes are the following:

- ANT - The ADF receives signal only.
- ADF - The ADF receives signal and calculates relative bearings to station.
- BFO - The ADF adds a beat frequency oscillator for reception of CW signals.
- VOICE - The ADF opens width of IF bandwidth for better aural reception.

NOTE: Bearing information is available in the ADF and BFO modes only.

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TRANSPONDER AND TCAS OPERATION

Transponder operation is similar to other radio equipment since it requires moving the yellow cursor box to a desired function. In order to tune a desired ATC code, press the Line Select beside the ATC code display. This action will enable the Frequency Tuning Knobs to change the ATC codes. The outer knob sets the thousands and hundreds digits and the inner knob sets the tens and ones digits.

Pressing and holding the code Line Select Button will recall the stored preset code (typically used for VFR). A new code may be stored by setting the code and then pressing the Memory Storage Button on the RMU Bezel Panel.

Pressing the Line Select Button associated with the transponder operating mode display will move the yellow cursor box to surround the mode annunciation in the ATC/TCAS window allowing to set a new transponder mode if a non-standby mode is selected. Once the mode annunciation is surrounded, pressing the Transfer Button 1/2 will select which transponder will be in operation (e.g., 1 ATC ON to 2 ATC ON).

The transponder operational modes are the following:

- ATC ON - Replies on Modes S and A, no altitude reporting.
- ATC ALT - Replies on Modes A, C and S, with altitude reporting.
- TA ONLY - TCAS Advisory Mode is selected.
- TA/RA - TCAS Traffic Advisory/Resolution Advisory Mode is selected.

RMU ABNORMAL OPERATION

Loss of the Primary Radio Bus will disable the cross-side control capability and also the TBCH. However, no radio functions will be lost. The radios on both sides will still be functional through the Secondary Radio Buses.

Loss of the left and/or right Secondary Radio Bus will not disable the radio functions. The radios may be tuned, in this condition, through the Primary Radio Bus or through the cross-side control feature.

As a safety feature of the RMU, if any component of the Radio System fails to respond to the commands from the RMU, the frequencies or the operating commands associated with that particular function will be removed from the RMU display and replaced with dashes.

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RMU CONTROLS AND INDICATORS

RMU BEZEL PANEL

1 - FREQUENCY TRANSFER BUTTON

- When pressed, the active frequency (upper line) and the preset frequency (lower line) in the COM or NAV windows exchange location and function.

2 - LINE SELECT BUTTONS

- The first press of the button moves a yellow cursor box to surround the data field associated with that particular Line Select Button. This enables the Frequency Tuning Knobs to change the data or the mode marked by the cursor. For some functions, additional pressing of the Line Select Button will toggle modes or recall stored frequencies. The Line Select Buttons, if kept pressed, allows ADF and ATC memories to be recalled, and to enter or exit Direct Tune Mode for COM and NAV.

3 - FREQUENCY TUNING OUTER KNOB

- Allows the data field enclosed by the cursor to be modified. The data may be frequency setting, stored frequencies or mode, depending upon the data field. When setting a frequency, this knob controls the digits to the left of the decimal point. Furthermore, this knob also controls the RMU brightness, which is enabled by pressing the Dimming Button.

4 - FREQUENCY TUNING INNER KNOB

- Is functionally similar to the Frequency Tuning Outer Knob except that when setting the frequency, this knob controls the digits to the right of the decimal point.

5 - MEMORY STORAGE BUTTON

- Pressing this button will cause a temporary (TEMP) COM or NAV pre-select frequency to be stored in the memory and assigned numbered location, provided the cursor has first been placed around that frequency.

NOTE: - ADF and ATC have only one memory location.

- For HF memory operation, refer to HF Memory Page description.

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6 - DME SELECT BUTTON

- Allows selection of the DME Hold Mode, tuning a different DME channel, not paired with the VOR/ILS frequency, without changing the active VOR frequency. Repeated pressing of this button enables display and selection of the DME channels in VHF and TACAN formats, and then back to the paired VOR/DME mode.

7 - CROSS-SIDE TRANSFER BUTTON

- With the cursor in any window, except the ATC, TCAS or HF display, pressing this button will transfer the entire RMU operation and display from the cross-side system.
- With the cursor in the ATC or TCAS window, pressing this button selects which transponder will be in operation.
- With enhanced TCAS, the button allows control of TCAS data in the cross-side display.
- With the cursor in the HF window, pressing this button toggles the display between HF1 and HF2 tuning pages. There will be dashes in the window if the HF in view is not the selected HF.

8 - TEST BUTTON

- When pressed, causes the component associated with the present position of the yellow cursor box to activate its internal self-test circuits for a complete end-to-end test of the function. To properly accomplish the equipment self-test, the Test Button must be pressed and held down as follows:
  - About 2 seconds for COM transceiver self-test.
  - From 5 to 7 seconds for DME, ATC and ADF self-test.
  - About 20 seconds for NAV (VOR/ILS) self-test.
- Releasing the Test Button at any time immediately returns the equipment to its normal operation in the actual function.
- If the Test Button is held pressed for 30 seconds or more, the radios are automatically commanded back into normal operation.

9 - PAGE CONTROL BUTTON

- Provides access to the page menu.

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10 - DIMMING BUTTON

- The RMU features an automatic screen brightness adjustment, within a limited range, to keep the display visibility optimized. The Dimming Button enables RMU brightness to be controlled manually through the Frequency Tuning Outer Knob. The manual dimming control can be disabled by pressing the Dimming Button again or any Line Select Button.

11 - TRANSPONDER IDENTIFICATION MODE BUTTON

- Selects the Transponder Identification Response Mode. The ident squawk will stop after 18 seconds.

12 - SQUELCH CONTROL BUTTON

- Causes the COM radio to open its squelch allowing any noise or signal present in the radio to be heard in the Audio System. The label SQ is displayed on the top line of the COM window when the squelch is open. When pressed a second time the Squelch Control Button closes the squelch.

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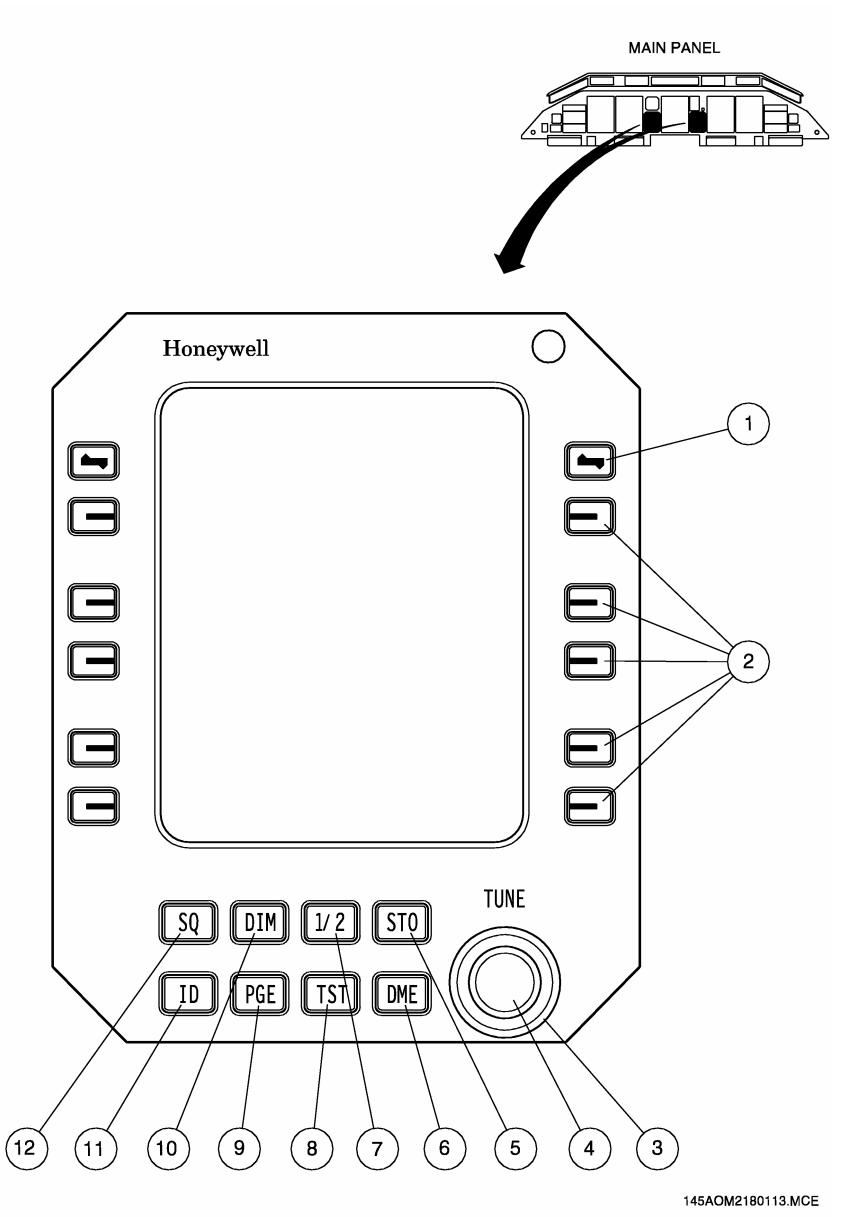

RMU BEZEL PANEL

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RMU DISPLAY

PAGE MENU

1 - PAGE MENU IDENTIFICATION

- Indicates that Page MENU is selected.
- Color: White.

2 - NAVIGATION PAGE LABEL

- To access the NAVIGATION Page, press the Line Select Button adjacent to this label.
- Color: Green.

3 - ENGINE PAGE LABEL

- To access the ENGINE Page, press the Line Select Button adjacent to this label.
- Color: Green.

4 - SYS SELECT PAGE LABEL

- To access the SYS SELECT Page, press the Line Select Button adjacent to this label.
- Color: Green.

5 - MAINTENANCE PAGE LABEL

- To access the MAINTENANCE Page, press the Line Select Button adjacent to this label.
- Color: Green.

6 - RETURN TO RADIOS PAGE LABEL

- To return to the RADIOS Page, press the Line Select Button adjacent to this label.
- Color: Green.

7 - ATC/TCAS PAGE LABEL

- To access the ATC/TCAS Page, press the Line Select Button adjacent to this label.
- Color: Green.

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8 - HF MEMORY (only for KHF-1050)

- To access the HF MEMORY Page, press the Line Select Button adjacent to the desired page.
- Color: Green .

9 - HF CONTROL (only for KHF-1050)

- To access the HF Control Page, press the Line Select Button adjacent to the desired page.
- Color: Green.

10 - COM AND NAV MEMORY PAGE LABEL

- To access the COM or NAV MEMORY Pages, press the Line Select Button adjacent to the desired page.
- Color: Green.

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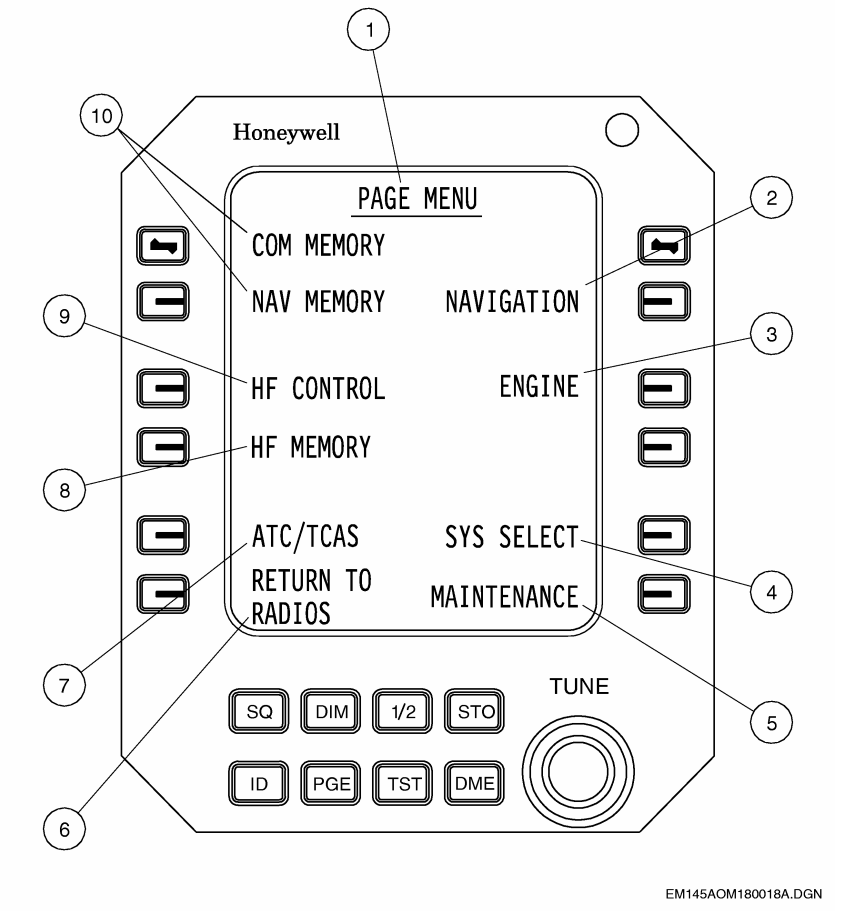

PAGE MENU

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RADIO PAGE

1 - PRESET FREQUENCY MEMORY LOCATION (ONLY FOR NAV AND COM WINDOWS)

- Identifies the preset frequency as temporary (TEMP label) or retrieved from the memory (MEMORY label followed by its memory location).
- Colors:
  - Cyan for on-side operation.
  - Yellow for cross-side operation.
- When marked by the yellow cursor box, the memory location labels and their associated stored frequencies can be scrolled by using the Frequency Tuning Knobs.

2 - COM WINDOW/CONTROL SIDE IDENTIFICATION

- Identifies the window and which source equipment (side 1 or 2) is active in that RMU.
- Colors:
  - White for on-side source.
  - Magenta for cross-side source.

3 - VHF COM ACTIVE FREQUENCY

- Indicates the active frequency for that window.
- Colors:
  - White for on-side operation.
  - Yellow for cross-side operation.
- Digits are replaced by dashes in case of any failure in the associated source.

4 - VHF COM PRESET FREQUENCY

- Indicates the preset frequency.
- Colors:
  - Cyan for on-side operation.
  - Yellow for cross-side operation.

NOTE: When DME Hold is not selected, the NAV Window also presents a similar preset frequency field.

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5 - NAV WINDOW/CONTROL SIDE IDENTIFICATION

- Identifies the window and which source equipment (side 1 or 2) is active in that RMU.
- Colors:
  - White for on-side source.
  - Magenta for cross-side source.

6 - VHF NAV ACTIVE FREQUENCY

- Indicates the active frequency for that window.
- Colors:
  - White for on-side operation.
  - Yellow for cross-side operation.
- Digits are replaced by dashes in case of any failure in the associated source.

7 - DME HOLD MODE ANNUNCIATION

- Indicates that the DME is in Hold Mode and the active DME channel is selected separately from the active VOR/ILS frequency.
- Color: Yellow.

8 - DME STATION IDENTIFICATION CODE

- Displays the digital identification code of the ground station to which the DME is tuned with.
- Color: White.

9 - DME HOLD MODE FREQUENCY

- Indicates the active frequency in DME Hold Mode operation, in VHF (represented) or TACAN formats.
- Color: White.

10 - ADF WINDOW/CONTROL SIDE IDENTIFICATION

- Identifies the window and which source equipment (side 1 or 2) is active in that RMU.
- Colors:
  - White for on-side source.
  - Magenta for cross-side source.

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11 - ADF ACTIVE FREQUENCY

- Indicates the active frequency for that window.
- Colors:
  - White for on-side operation.
  - Yellow for cross-side operation.
- Digits are replaced by dashes in case of any failure in the associated source.

12 - ADF MODES FIELD

- Displays the ADF modes as selected either through the second ADF Line Select Button (achieved by repeated pressing) or through the Frequency Tuning Knobs when the yellow cursor box is located in this field.
- Color: Green.

13 - HF WINDOW (only for KHF-1050)

- Identifies the window and which source equipment (side 1 or 2) is active in that RMU.
- Colors:
  - White for on-side source.
  - Magenta for cross-side source.

14 - HF ACTIVE FREQUENCY (only for KHF-1050)

- Indicates the active frequency for that window.
- Colors:
  - White for on-side operation.
  - Yellow for cross-side operation.

15 - RADIO FREQUENCY TRANSMISSION MODE

- Indicates the HF Transmission Mode.
- Color: Green.

16 - HF PRESET FREQUENCY (only for KHF-1050)

- Indicates the active frequency for that window.
- Colors:
  - White for on-side operation.
  - Yellow for cross-side operation.

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17 - TRANSPONDER OPERATING MODE ANNUNCIATION

- Displays the active transponder operating mode as selected through the Frequency Tuning Knobs when the yellow cursor box is located in this field. Pressing the Line Select Button beside this field will alternate between the pre-selected transponder mode and the standby mode.
- Color: Green.

18 - ATC CODE

- Displays the active ATC code number.
- Color: White.

19 - ATC/TCAS WINDOW

- Identifies the window as the ATC/TCAS window.
- Colors: White.

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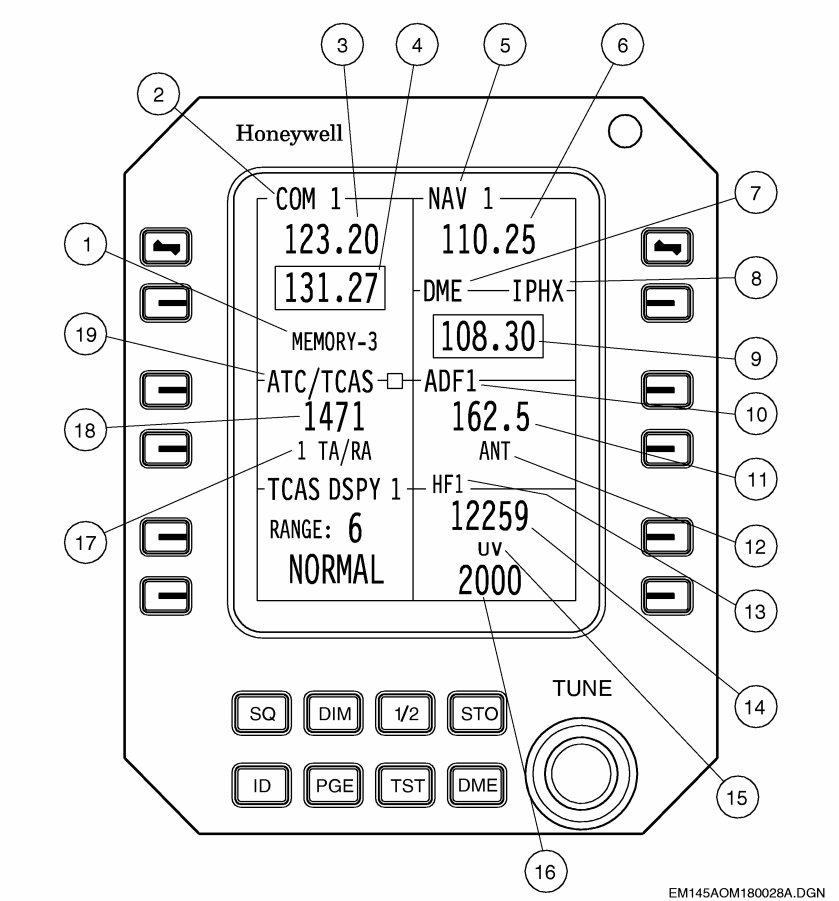

RMU RADIO PAGE

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COM MEMORY PAGE

1 - MEMORY PAGE IDENTIFICATION

- Identifies the page as a COM Memory Page.
- Color: White.

2 - ACTIVE COM FREQUENCY

- Identifies the COM frequency that is currently active.
- Color: White.

3 - SQUELCH MODE INDICATION

- Indicates if squelch is open.
- Color: Yellow.

4 - MEMORY PAGE SELECTED ANNUNCIATION

- Indicates that the Memory Page is selected.
- Color: Green.

5 - MEMORIES DISPLAY

- Displays the preset frequencies and their associated locations.
- When there is no frequency stored in a memory location only the location number will be displayed in the associated memory display line.
- Colors:
  - Memory identifications are green.
  - Frequency is cyan.

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6 - MEMORY INSERT PROMPT

- If it is desirable to insert a new frequency in a particular memory location, simply press the Line Select Button beside the location line, moving the yellow cursor box to that line. Then press the Line Select Button beside the Insert prompt label. This will cause all the data in memory from the insert location downward to shift one position down. The cursor will remain in the insertion selected location allowing the new frequency to be tuned and stored in that memory location. A MEM FULL (Memory Full) annunciation will be displayed in the RMU display if the 12 memory locations are filled and the Line Select Button associated with the Insert prompt is pressed.
- Color: Green.

7 - MEMORY DELETE PROMPT

- To delete a frequency from the memory, press the Line Select Button adjacent to the line associated with the frequency to be deleted. Then press the Line Select Button adjacent to the Delete prompt. The frequency enclosed by the cursor will be deleted from the memory. Higher numbered memory locations will then move upward to fill the empty memory location.
- Color: Green.

8 - RADIO PAGE RETURN PROMPT

- Pressing the associated Line Select Button will return the RMU display to the RADIO Page.
- Color: Green.

9 - MEMORY MORE PROMPT

- The More prompt allows to display memory locations 7 through 12, by pressing the associated Line Select Button. All actions described for memory locations 1 through 6 are also applicable to memory locations 7 through 12. If locations 1 through 6 are not filled, the Second Memory Page will not be accessible.
- Color: Green.

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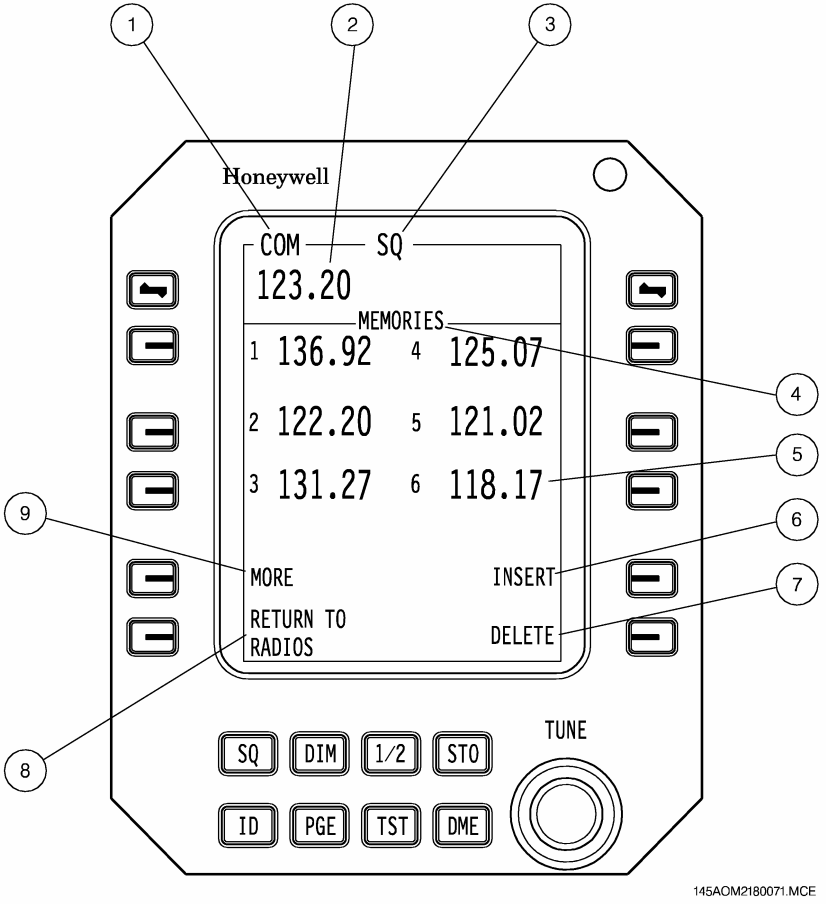

RMU COM MEMORY PAGE

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NAV MEMORY PAGE

1 - MEMORY PAGE IDENTIFICATION

- Identifies the page as a NAV Memory Page.
- Color: White.

2 - ACTIVE NAV FREQUENCY

- Identifies the NAV frequency that is currently active.
- Color: White.

3 - NAV FMS STATUS ANNUNCIATION

- In the NAV Memory Page, this field displays the FMS ENABLED or DISABLED annunciation. This will be present whether or not the Radio System interfaces with the FMS.
- Color: Yellow.

NOTE: When the VOR or the ILS frequency is auto-tuned by the FMS, a magenta VOR or ILS frequency and a magenta AUTO label will be displayed on the top border of the RADIO Page NAV window.

4 - MEMORY PAGE SELECTED ANNUNCIATION

- Indicates that the Memory Page is selected.
- Color: Green.

5 - MEMORIES DISPLAY

- Displays the preset frequencies and their associated locations.
- When there is no frequency stored in a memory location only the location number will be displayed in the associated memory display line.
- Colors:
  - Memory identifications is green.
  - Frequency is cyan.

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6 - MEMORY INSERT PROMPT

- If it is desirable to insert a new frequency in a particular memory location, simply press the Line Select Button beside the location line, moving the yellow cursor box to that line. Then press the Line Select Button beside the Insert prompt label. This will cause all the data in memory from the insert location downward to shift one position down. The cursor will remain in the insertion selected location allowing the new frequency to be tuned and stored in that memory location. A MEM FULL (Memory Full) annunciation will be displayed in the RMU display if the 12 memory locations are filled and the Line Select Button associated with the Insert prompt is pressed.
- Color: Green.

7 - MEMORY DELETE PROMPT

- To delete a frequency from the memory, press the Line Select Button adjacent to the line associated with the frequency to be deleted. Then press the Line Select Button adjacent to the Delete prompt. The frequency enclosed by the cursor will be deleted from the memory. Higher numbered memory locations will then move upward to fill the empty memory location.
- Color: Green.

8 - RADIO PAGE RETURN PROMPT

- Pressing the associated Line Select Button will return the RMU display to the RADIO Page.
- Color: Green.

9 - MEMORY MORE PROMPT

- The More prompt allows to display memory locations 7 through 12, by pressing the associated Line Select Button. All actions described for memory locations 1 through 6 are also applicable to memory locations 7 through 12. If locations 1 through 6 are not filled, the Second Memory Page will not be accessible.
- Color: Green.

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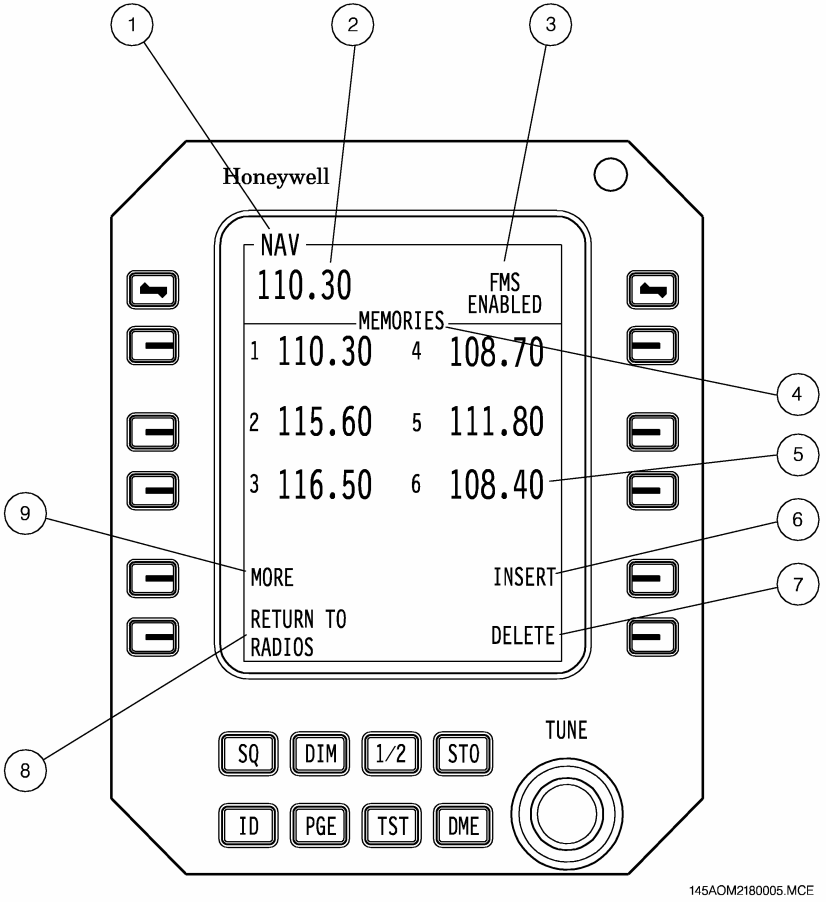

RMU NAV MEMORY PAGE

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HF MEMORY PAGE (only for KHF-1050)

1 - MEMORY PAGE IDENTIFICATION

- Identifies the page as an HF Memory Page.
- Color: White.

2 - MEMORY POSITION

- Identifies the Memory Position.
- Color: Green.

3 - MEMORY FREQUENCY

- Identifies the Memory Frequency.
- Color: Blue.
- Pressing the Upper Line Select Button positions the cursor around the active frequency.
- If in Split Mode, pressing the Upper Line Select Button positions the cursor around the Receive Frequency. It also toggles between the active Receive and Transmission frequency.
- If in Emergency or ITU mode, holding the Upper Line Select Button displays the corresponding frequency and emission mode, and releasing it returns the display to the active channel.

4 - MEMORY EMISSION MODE

- Identifies the HF emission mode (UV, LV, UD, LD, AM or CW) that is in Memory.
- Color: Green.

5 - SPLIT MODE MEMORY

- Example of a Split Mode Memory identifying the Receiving (RX) and Transmitting (TX) Modes and Frequencies.

6 - RADIO PAGE RETURN PROMPT

- Pressing the associated Line Select Button will return the RMU display to the RADIO Page.
- Color: Green.

7 - MEMORY MORE PROMPT

- Pressing the associated Line Select Button toggles the memory window through the 12 memory locations, displaying three memory locations at a time.
- Color: Green.

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8 - ACTIVE HF MODE OF OPERATION

- Pressing the associated Line Select Button changes the mode for the channel that is selected by the cursor box.
- Color: Green.

9 - LOAD PROMPT

- Pressing the associated Line Select Button loads the information from the memory location selected by the cursor box into the active channel.
- Color: Green.

10 - ACTIVE HF EMISSION MODE

- Identifies the HF transmission mode (UV, LV, UD, LD, AM or CW) that is currently active.
- Color: Green.

11 - ACTIVE HF FREQUENCY

- Identifies the HF frequency that is currently active.
- Color: White.

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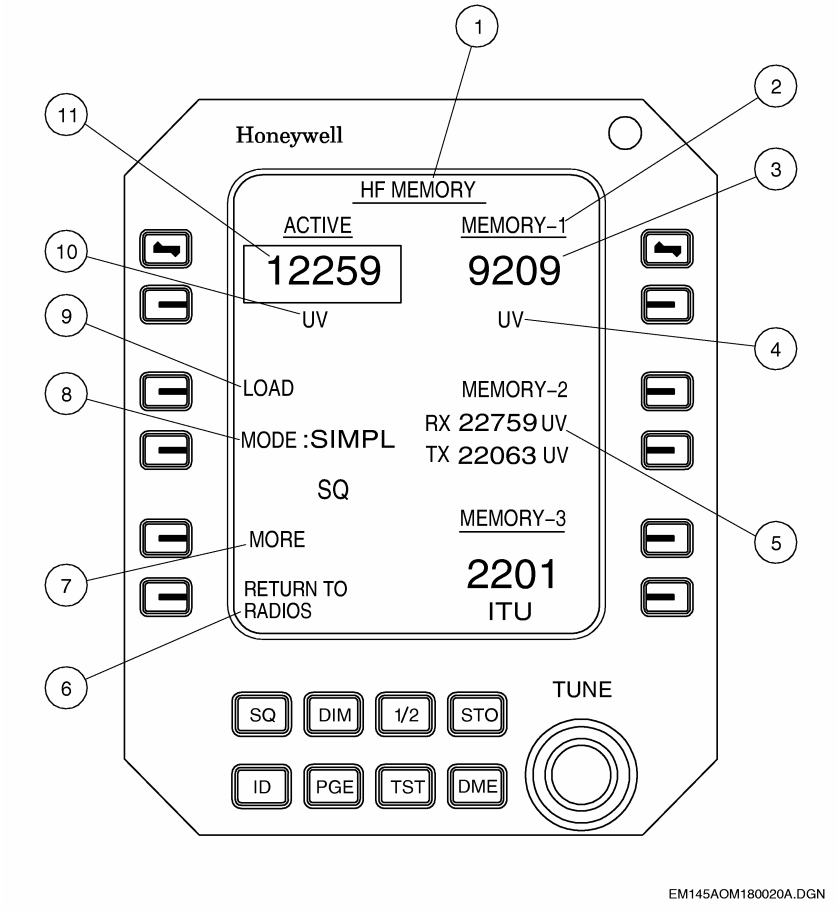

HF MEMORY PAGE (only for KHF-1050)

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HF CONTROL PAGE (only for KHF-1050)

1 - CONTROL PAGE IDENTIFICATION

- Identifies the page as an HF Control Page.
- Color: White.

2 - PRESET HF TRANSMISSION FREQUENCY

- Identifies the page as an HF Control Page.
- Color: White.
- Pressing the Upper Line Select Button positions the cursor around the preset frequency.
- If in Split Mode, pressing the Upper Line Select Button positions the cursor around the Receive Frequency. It also toggles between the preset Receive and Transmission frequency.
- If in Emergency or ITU mode, holding the Upper Line Select Button displays the corresponding frequency and emission mode, and releasing it returns the display to the preset channel.
- Pressing the Lower Line Select Button positions the cursor around the preset frequency.
- If the cursor is already positioned in the preset frequency, the Lower Line Select Button toggles through the different emission modes (UV, LV, UD, LD, AM and CW).
- If in Split Mode, pressing the Lower Line Select Button positions the cursor around the Transmission Frequency. It also toggles between the preset Receive and Transmission frequency.
- If in Emergency or ITU mode, holding the Lower Line Select Button displays the corresponding frequency and emission mode, and releasing it returns the display to the preset channel.

3 - TRANSMIT POWER

- Identifies the Transmit Power level. Available levels are MIN, MED and MAX.
- Pressing the associated Line Select Button changes the Transmit Power level.

4 - MEMORY STORAGE BUTTON

- Stores the information in the preset channel into the selected memory location.

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5 - SQUELCH LEVEL

- Identifies the Squelch Level. Available levels are MIN, MED and MAX.
- Pressing the associated Line Select Button changes the Squelch Level.

6 - ACT MODE (ACTIVE MODE)

- Pressing the associated Line Select Button changes the active mode of operation (Simple, Split, Emergency and ITU).

7 - TRANSFER FUNCTION

- Pressing the associated Line Select Button switches the information in the preset and active windows. The STO key must be pushed in order to save the information in the memory location.

8 - ACTIVE HF TRANSMISSION FREQUENCY

- Identifies the Active HF Transmission Frequency.
- Color: Green.
- Pressing the Upper Line Select Button positions the cursor around the active frequency.
- If in Split Mode, pressing the Upper Line Select Button positions the cursor around the Receive Frequency. It also toggles between the active Receive and Transmission frequency.
- If in Emergency or ITU mode, holding the Upper Line Select Button displays the corresponding frequency and emission mode, and releasing it returns the display to the active channel.
- Pressing The Lower Line Select Button positions the cursor around the active frequency.
- If the cursor is already positioned in the active frequency, the Lower Line Select Button toggles through the different emission modes (UV, LV, UD, LD, AM and CW).
- If in Split Mode, the Lower Line Select Button positions the cursor around the Transmission Frequency. It also toggles between the active Receive and Transmission frequency.
- If in Emergency or ITU mode, holding the Lower Line Select Button displays the corresponding frequency and emission mode, and releasing it returns the display to the active channel.
- After setting the frequency, pushing the PPT button momentarily initiates the antenna tuning.

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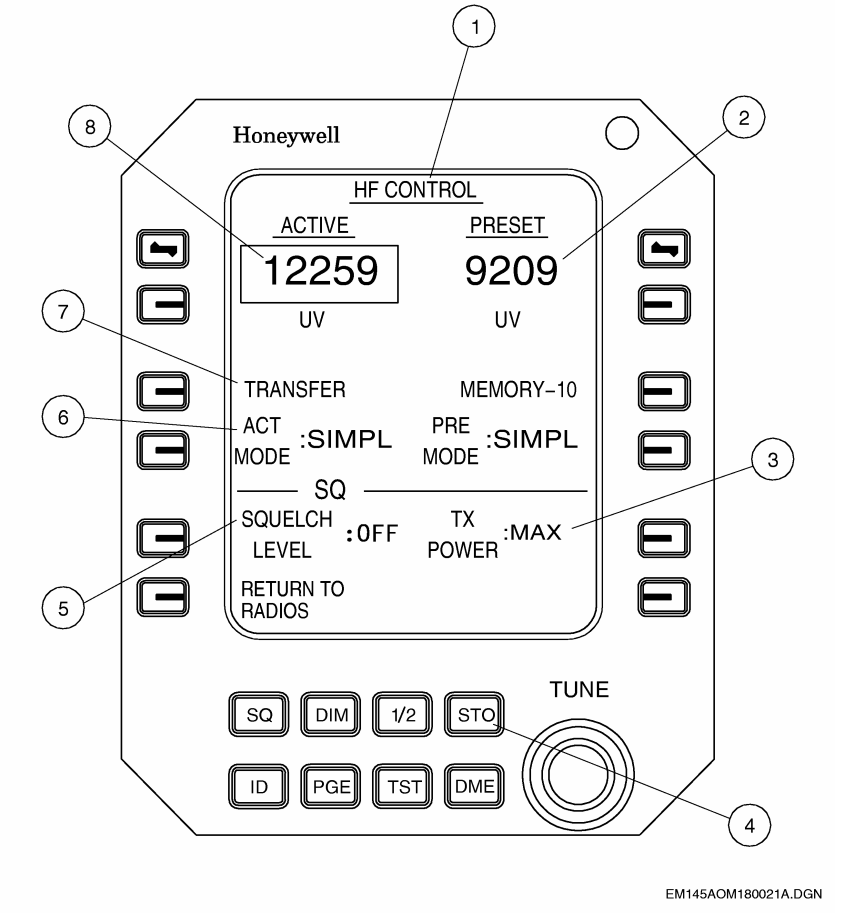

HF CONTROL PAGE (only for KHF-1050)

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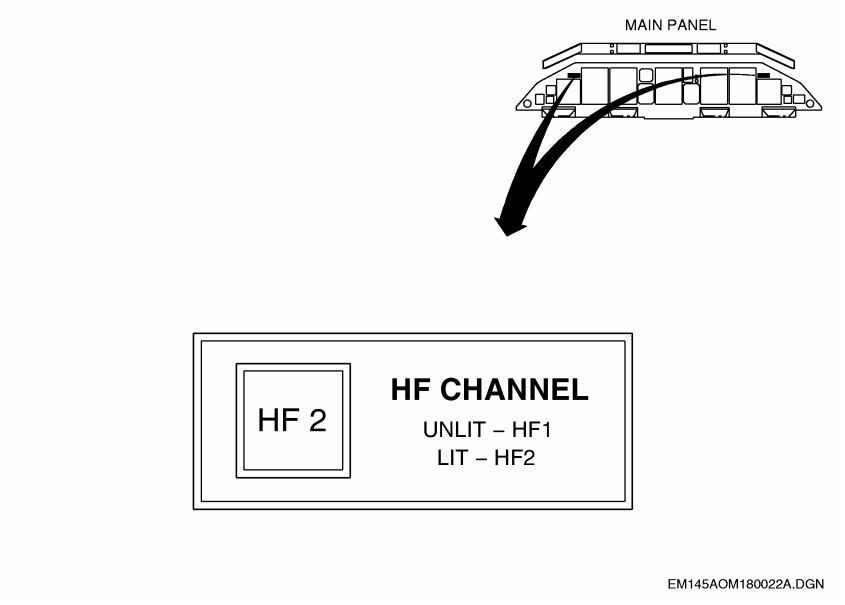
HF SELECTOR PANEL (only for KHF-1050)

The airplane may be equipped with one (Single installation) or two (Dual installation) HF systems.

In case of Dual installation, press the HF2 button (on the Pilot or Copilot position) to toggle between HF1 and HF2 radio system. The HF1 radio system is selected when the button is unlit, and the HF2 is selected when the button is lit. The HF2 buttons always assume the same state (both unlit or both lit).

To toggle between HF1 and HF2 Tuning pages, press the Cross-side Transfer Button (1/2).



HF SELECTOR PANEL WITH DUAL INSTALLATION

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ATC/TCAS CONTROL PAGE

1 - INTRUDER ALTITUDE DISPLAY

- REL (green): Target's altitude displayed relative to one's own airplane (default).
- FL (cyan): Target's altitude displayed as flight level (reverts to REL after 20 sec).

2 - TA DISPLAY

- AUTO (green): Traffic targets displayed only when TA or RA target condition exists.
- MANUAL (cyan): All traffic targets displayed within the viewing airspace.

3 - FLIGHT ID

- Allows Mode S coding to reflect the current flight's call sign. The outer tuning knob moves the character position designator and the inner tuning knob selects the desired alphanumeric character.
- Color: White.

4 - ADS-B STATUS (only for airplanes Post-Mod. SB 145-34-0118 or equipped with an equivalent modification factory incorporated)

- NORMAL (white): GPS data is received on the active transponder.
- FAIL (yellow): No GPS data is received on the active transponder.
- DEGRADED (yellow): GPS navigation integrity or accuracy parameters do not meet ADS-B standards, as recognized by the active transponder.

5 - FLIGHT LEVEL 1/2

- Display of the transponder's encoded altitude and the air data source for that altitude.
- Color: Green.

6 - RADIO PAGE RETURN PROMPT

- Pressing the associated Line Select Button will return the RMU display to the RADIO Page.
- Color: Green.

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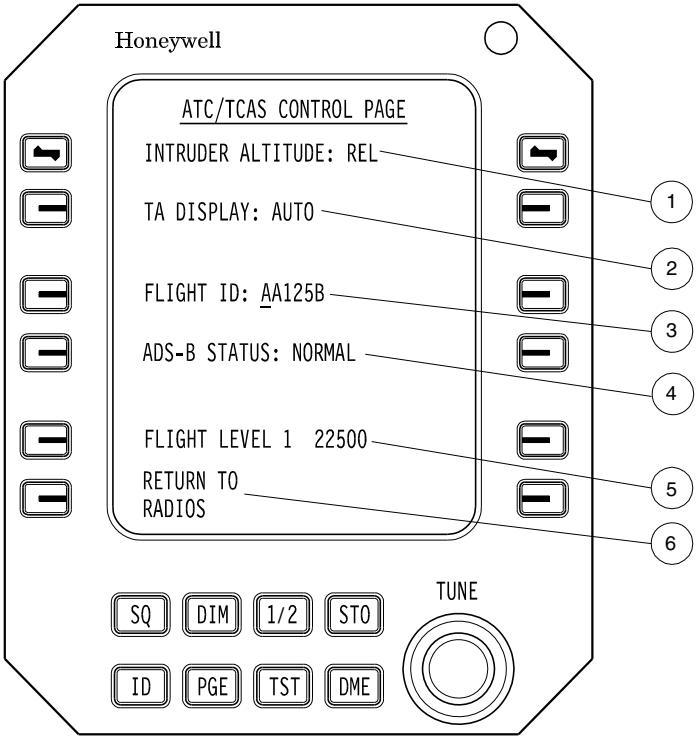

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RMU ATC/TCAS CONTROL PAGE

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NAVIGATION BACKUP PAGE

NOTE: - Navigation information presented on the Navigation Backup Page is operationally identical to that normally presented on the PFD.

- The compass card is presented only in arc partial format.
- The selected course and the DME distance to station are boxed.
- NAV and ADF active frequencies are also presented.

1 - ACTIVE NAV FREQUENCY

2 - BEARING 1 POINTER

3 - BEARING 2 POINTER

4 - ACTIVE ADF FREQUENCY

5 - COURSE DEVIATION BAR

6 - COURSE DEVIATION SCALE

7 - DME DISTANCE TO STATION

8 - MARKER BEACON DISPLAY

9 - SELECTED COURSE

10 - BEARING 2 SOURCE ANNUNCIATION

11 - BEARING 1 SOURCE ANNUNCIATION

12 - COMPASS CARD DISPLAY

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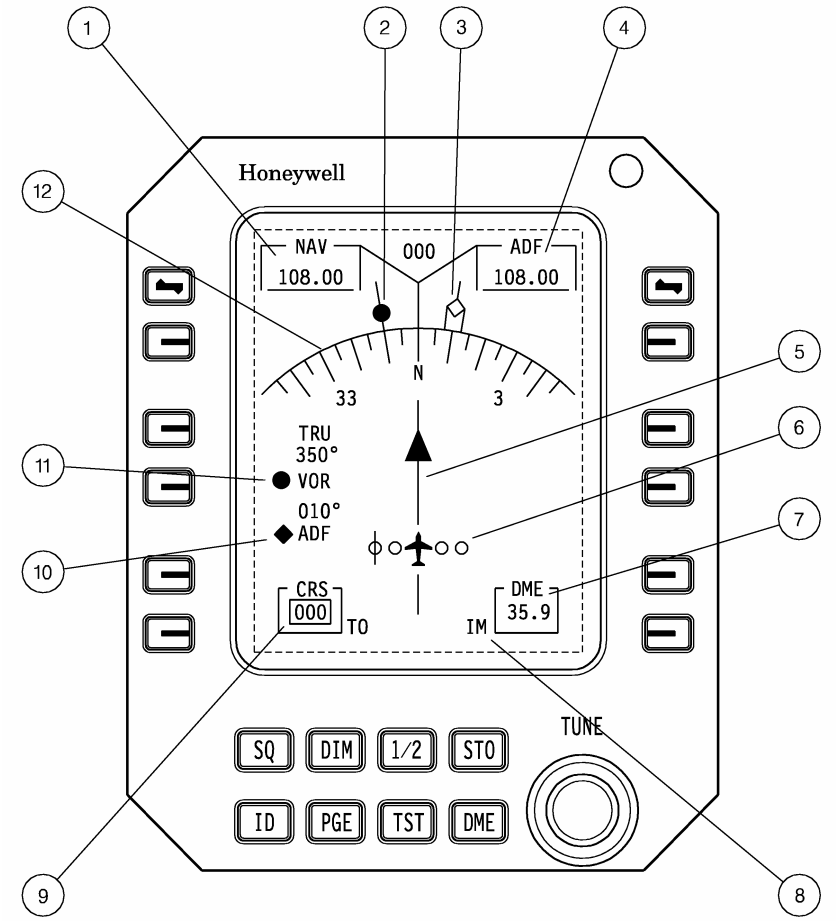

RMU NAV BACKUP PAGE

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RMU ENGINE BACKUP PAGES

1 - THRUST MODES

- This is the thrust mode when both engines are operating in the same mode. If the engines are operating in different modes, it is displayed above each N1 indication with its respective thrust mode.
- Labels: T/O-1 or ALT T/O-1 (A, A1, A1/1, A3 engines);
  T/O or ALT T/O-1 (A1P or A1/3 engines);
  E T/O, T/O or ALT T/O-1 (A1E engine);
  CON, CLB or CRZ.

2 - N1 INDICATION (FAN SPEED)

- Displays N1 speed in RPM percentage both digitally and on an analog scale.

3 - INTERSTAGE TURBINE TEMPERATURE (ITT)

- Indicates the temperature in degrees Celsius.

4 - N2 INDICATION (CORE SPEED)

- Displays N2 speed in RPM percentage.

5 - FUEL FLOW INDICATION (FF)

- Indicates fuel flow in PPH or KPH.

6 - OIL PRESSURE

- Indicates engine oil pressure in psi. Refer to section 2-10 Powerplant for further information.

7 - OIL TEMPERATURE

- Oil temperature indication ranges from 0° to 180°C.

8 - FUEL QUANTITY (FQ)

- Indicates the fuel quantity for each tank in lb or kg.

9 - FLAPS

- Flaps indication ranges from 0° to 45°, with discrete indications on 0°, 9°, 18°, 22°, 45°.
- In-transit, flap position is replaced by the actual flap position.

10 - LANDING GEAR DOWN LOCKED

- Landing gear down locked is presented on the RMU through the green indication LG DOWN LOCKED.

11 - SPOILER OPEN

- Displays SPOILER OPEN when any of the surfaces are open.

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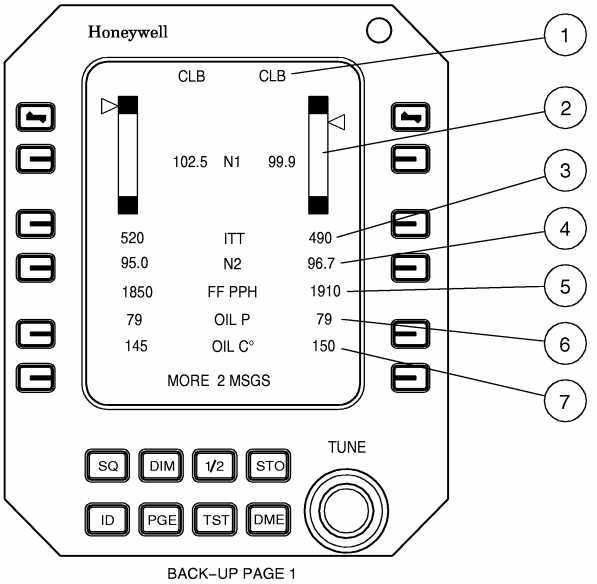
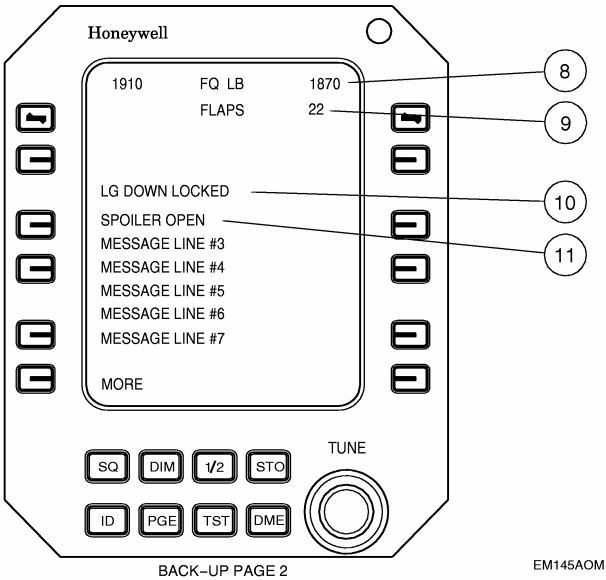


BACK–UP PAGE 1



BACK–UP PAGE 2

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RMU ENGINE BACKUP PAGES

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SYSTEM SELECT PAGE

1 - SYSTEM SELECT PAGE IDENTIFICATION

- Identifies the SYS SELECT Page.
- Color: White.

2 - COM 1 AND COM 2 BANDWIDTH SELECTION FIELD

- Indicates the current COM 1 and COM 2 status regarding bandwidth selection. Pressing the Line Select Button beside the COM 1/COM 2 line field will toggle the receiver bandwidth from WIDE (2 digits at the right of the decimal point) to NARROW (3 digits at the right of the decimal point) or vice-versa.
- Color:
  - Cyan for COM 1 (2) BNDWD label.
  - Green for WIDE/NARROW indication.

3 - RADIO PAGE RETURN PROMPT

- Pressing the associated Line Select Button will return the RMU display to the RADIO Page.
- Color: Green.

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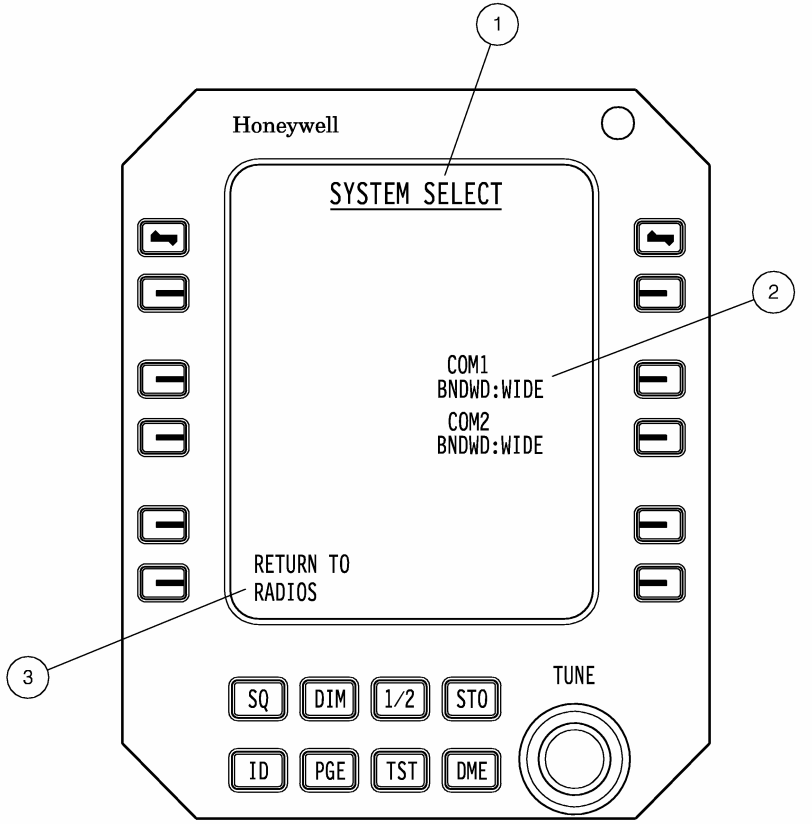

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RMU SYSTEM SELECT PAGE

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MAINTENANCE PAGE (POWER ON SELF-TEST)

1 - TEST PAGE IDENTIFICATION

- Indicates where a failure has been detected.
- Color: White.

2 - FAILURE SIDE IDENTIFICATION

- Indicates the side of the detected failure.
- Color: Green.

3 - FAILURE IDENTIFICATION

- Identifies the detected failure according to the table below.
- Color: Red.

ERROR MESSAGE	MEANING	ACTION	DECISION
RMU ERR	One or more internal parameters were measured and found to be outside their self-test limit.	1. Check that CDH is not in EMERG Mode. 2. On main tuning page, perform tuning test on all radios by setting frequency and determining that radio is operating.	If tuning test fails, the RMU is not fully operable.
PRI BUS	Full RMU communications with all COMs, NAVs, and cross-side RMU cannot be established on the primary bus.	1. Check that all radio circuit breakers are on. 2. Check RMU ON/OFF Page for all functions ON. 3. Check that CDH is not in EMERG Mode. 4. If 1 or 2 (or 3 if installed) are sources, correct and turn RMU power off for 10 seconds. Reapply power to start new POST. 5. If error persists, perform on-side and cross-side tuning off all radios and activate auxiliary tuning sources to determine which functions are still available.	Any of these messages indicate that system redundancy has been reduced.
SEC BUS	Full RMU communications with the on-side COM and NAV cannot be established using the secondary bus.		
NAV UNIT/ COM UNIT	The NAV units and/or COM units cannot fully communicate with both RMUs over primary bus and/or the on-side RMU over secondary bus.		

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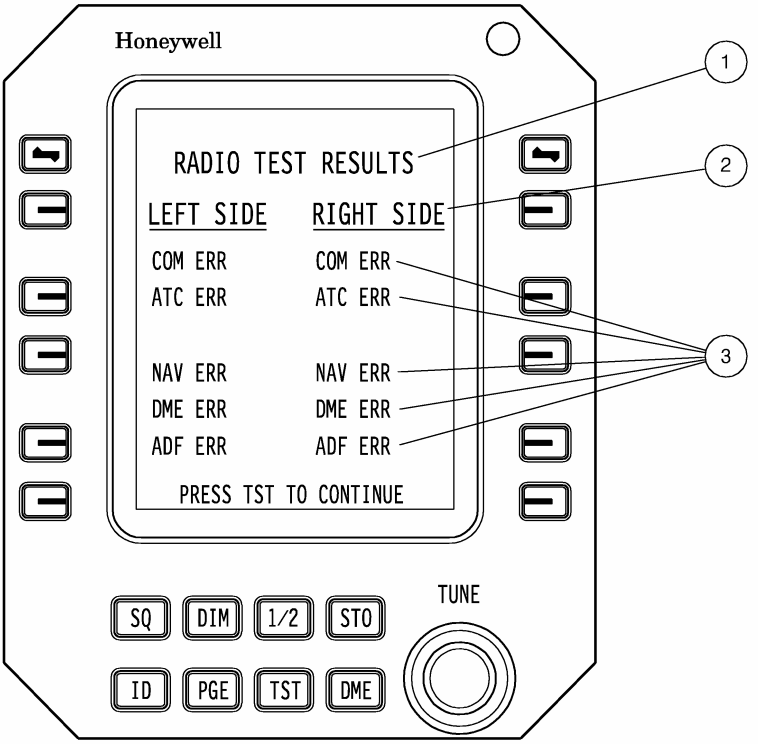

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RMU MAINTENANCE PAGE (POWER ON SELF TEST)

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MAINTENANCE PAGE (PILOT-ACTIVATED SELF TEST)

1 - SYSTEM TEST IDENTIFICATION

- Indicates which unit is being tested.
- Color: Amber.

2 - TEST RESULT INDICATION

- Indicates whether the tested system is operating normally or not.
- Color:
  - Green for successful tests.
  - Red for unsuccessful tests.

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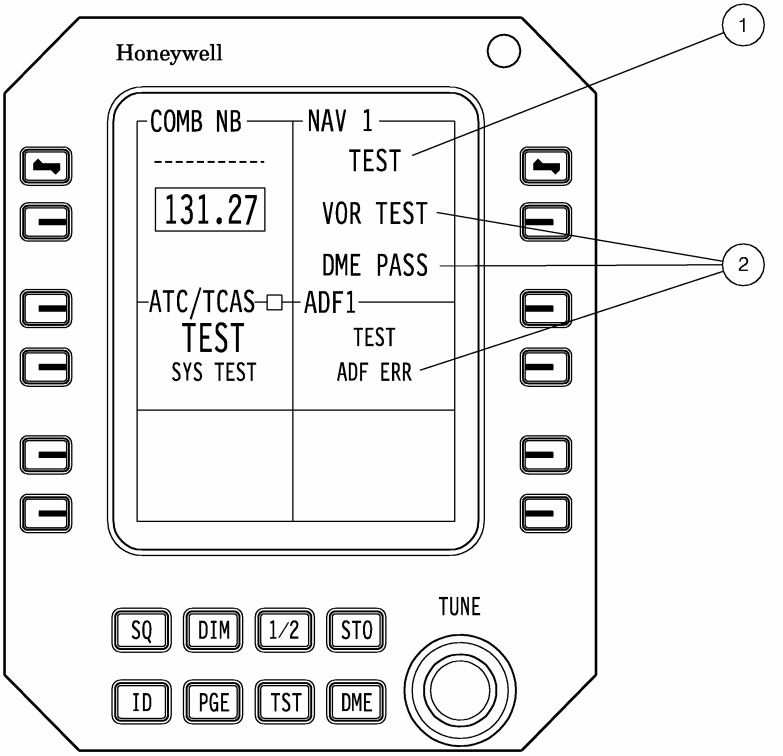

RMU MAINTENANCE PAGE (PILOT-ACTIVATED SELF TEST)

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TUNING BACKUP CONTROL HEAD

The Tuning Backup Control Head is a unit that provides an alternative means of tuning the NAV 2 and COM 2.

The TBCH is energized only when the AVIONICS MASTER is switched ON, and in normal operation it displays the RMU 2 NAV and COM active frequencies (NAV 2 and COM 2).

NORMAL MODE

In the Normal Mode, the TBCH displays the RMU 2 NAV and COM active frequencies. Each time these frequencies are tuned via RMU, the TBCH display is updated automatically. The same occurs when these frequencies are tuned via TBCH, the RMU 2 NAV and COM active frequencies being also updated automatically.

It is also possible to tune the RMU 1 NAV and COM active frequencies using the RMU cross-side operational mode (see 2-18-11, page 4).

EMERGENCY MODE

When the TBCH is set to the Emergency Mode, the Radio Management System will accept only the NAV and COM tuning via TBCH, ignoring the RMUs control.

The RMUs will recover their capability of tuning the radio frequencies only when the TBCH is set to the Normal Mode again.

SELF TEST

After power up, the Tuning Backup Control Head performs a self-test. This test consists of saving the frequencies that the COM and NAV units are tuned to as indicated by the Radio System Bus (RSB), and then changing the frequency outputs to the COM and NAV and verifying that they have changed on the RSB. Failures are announced in the display line associated with the function as an error message followed by an error code “ERXX”, with the “XX” showing a two-digit error code.
This test is performed only on the ground, when the unit is turned on.

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TBCH CONTROLS AND INDICATORS

1 - SYSTEM INSTALLATION ANNUNCIATION

- Indicates to which Radio System the Tuning Backup Control Head is connected.

2 - REMOTE TUNE ANNUNCIATION

- Indicates that radio is tuned from a source other than the Tuning Backup Control Head.
- Presented only when the unit is strapped for NAV only or COM only tuning.

3 - TUNING CURSOR

- Indicates which frequency may be changed by the Tuning Knobs.

4 - NAV AUDIO ON ANNUNCIATION

- Indicates that the NAV audio is selected on.

5 - EMERGENCY MODE ANNUNCIATION

- Indicates when the unit has been selected to the Emergency Mode, which inhibits RMU tuning capability.

NOTE: - This annunciation is not related to the emergency COM frequency of 121.5 MHz.

6 - SQUELCH ANNUNCIATION

- Indicates that the squelch is opened by the SQ Switch.

7 - TRANSMIT ANNUNCIATION

- Indicates that the COM transmitter is ON.

8 - NAV AUDIO BUTTON

- Toggles NAV audio on and off.

9 - SQUELCH BUTTON

- Toggles the COM squelch on and off.

10 - TUNING KNOBS

- Change the frequency indicated by the tuning cursor.
- Inner knob changes the frequency decimal digits in steps of 0.025 MHz for VHF and 0.050 MHz for VOR/LOC.

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On airplanes Post-Mod. SB 145-23-0003 or with an equivalent modification factory incorporated, it also changes the frequencies in the VHF sub-band that contains the 8.33 kHz spaced channels according to appropriate selection on the RMU. These frequencies are identified in voice communications by the channel names as exemplified below:

Frequency (MHz)	Spacing	Channel Name
132,0000	**25**	**132,000**
132,0000	8.33	132,005
132,0083	8.33	132,010
132,0166	8.33	132,015
132,0250	**25**	**132,025**
132,0250	8.33	132,030
132,0333	8.33	132,035
132,0416	8.33	132,040
132,0500	**25**	**132,050**
132,0...	8....	132,...

- Outer knob changes the frequency non-decimal digits in steps of 1 MHz for both VHF and VOR/LOC.

11 - NORMAL/EMERGENCY MODE SELECTOR KNOB/BUTTON

- When knob rotated clockwise selects normal Mode.
- When knob rotated counterclockwise selects Emergency Mode.
- On airplanes Post-Mod. SB 145-23-0003 or with an equivalent modification factory incorporated, the EMRG button toggles the Emergency mode on and off.

12 - TRANSFER BUTTON

- Alternately selects between the COM frequency (top) or the NAV frequency (bottom) to be connected to the Tuning Knobs.
- In the NAV only or COM only configurations, toggles the active (top) frequency with the preset (bottom) frequency. In addition, holding the button down for two seconds will remove the preset frequency and place the unit in the Direct Tuning Mode. To return to the Active/Preset Tuning Mode, hold down the transfer key for two seconds.

13 - RADIO TUNING ANNUNCIATION

- Identifies the frequency at the top and bottom lines.

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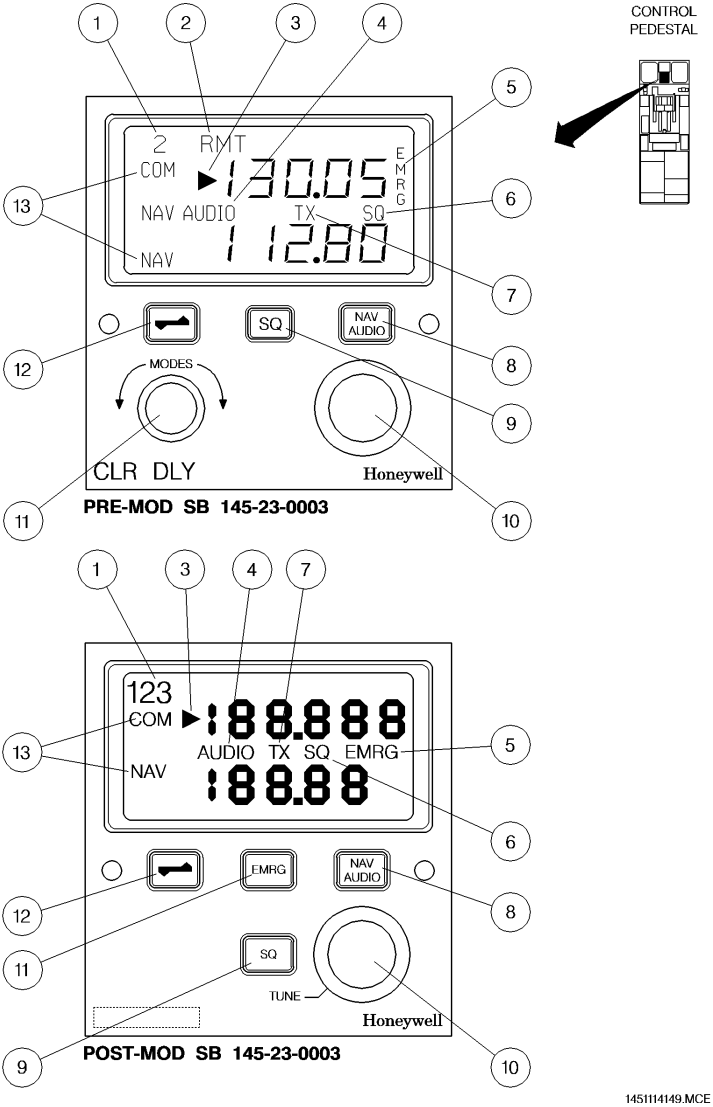

TUNING BACKUP CONTROL HEAD

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DIGITAL AUDIO PANEL

The EMB-145 is equipped with three individual Digital Audio Panels (DAP), one each for the captain, copilot and observer.

This unit allows each flight crew member to select an individual transceiver, the intercommunication function further permitting individual selection and audio level adjustment of the following communications equipment:

- VHF communication;
- Crew/ramp station intercommunication;
- Passenger address;
- Reception and amplification of the NAV/COM audio signals.

NORMAL MODE

In the normal mode, each flight crew member may select one COM transceiver (VHF COM 1, VHF COM 2, VHF COM 3 or HF), the interphone function and, simultaneously, several audio receivers (COM 1, 2 and 3, HF, NAV 1 and 2, ADF 1 and 2, and DME 1 and 2).

Also, the unit may provide volume control for each radio equipment, microphone selection between Boom and Mask (Oxygen Masks), and audio output selection between Speakers and Headphones.

Other features are the capability to filter the NDB/VOR audio signals, attenuating morse code or voice signals. Finally, Normal Mode allows marker beacon audio sensitivity control, which also may silence temporarily that type of signal.

EMERGENCY MODE

The pilot's, copilot's and observer's digital audio panels are supplied by ESS BUS 1, ESS BUS 2 and DC BUS, respectively. The emergency mode must be selected in case power supply fails to come to pilot's or copilot's digital audio panel, which does not mean that there is a fault of the supplying bus. Selecting the pilot's DAP EMER button automatically causes the pilot to be connected to COM 1 and NAV 1 and selecting the pilot's DAP EMER button automatically causes the copilot to be connected to COM 2 and NAV 2. The others buttons of the DAP that is in emergency mode will be disabled. These configurations are emergency modes that assure communication continuance. Only for the observer's DAP there is no alternative means to keep communication capability once its normal power supply is interrupted.
The interphone function will also be lost.

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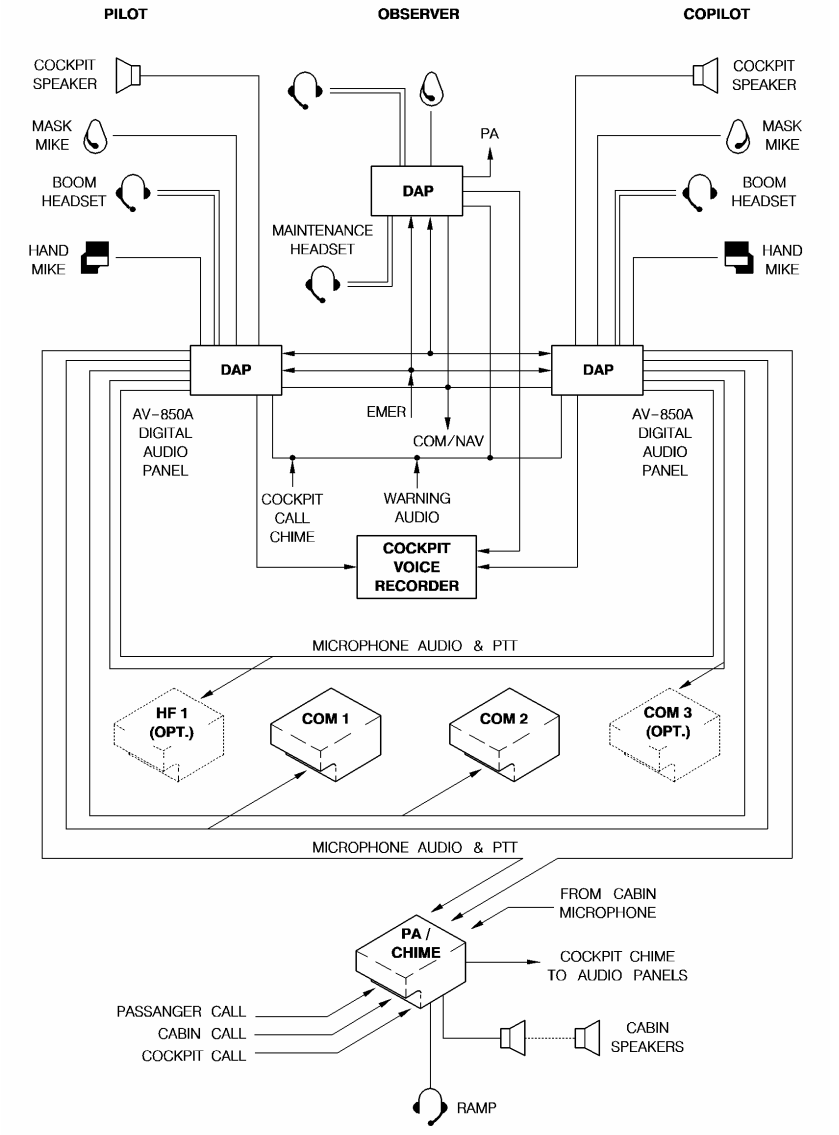
When power supply to the digital audio panel is resumed, the normal mode of operation may be reestablished by selecting any other MICROPHONE button (COM 1, 2, 3 or HF).



COMMUNICATION SYSTEM SCHEMATIC

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DIGITAL AUDIO PANEL CONTROLS AND INDICATORS

1 - MICROPHONE SELECTOR BUTTONS

- When pressed enables transmission and reception of radio signals through the respective COM unit (COM 1, COM 2, COM 3, HF).
- Simultaneous selection of more than one microphone selector button is not possible. Pressing a different microphone selector button will cause the previously selected button to be deselected.
- A bar illuminates inside the button to indicate that it is pressed.

2 - AUDIO CONTROL KNOBS

- When depressed, turns on the associated COM/NAV audio.
- When rotated, provides volume control for the associated COM/NAV audio.

3 - PASSENGER BUTTON

- When pressed enables the crew to make the speech to the passenger cabin while simultaneously deselecting the previously selected COM transmitter.

4 - EMERGENCY BUTTON

- When pressed in case of interruption of power supply to the Digital Audio Panel, it automatically connects the microphone to the emergency COM mic outputs and headphone unit to COM and NAV audio.
- The captain is connected to COM 1 and NAV 1 and the copilot to COM 2 and NAV 2. Observer radio communications capability is lost.

5 - BOOM/MASK BUTTON

- Alternates selection between the boom (pressed) and the mask (released) microphones.

6 - ID/VOICE BUTTON

- When pressed (ID position), NDB and VOR audio signals are filtered in order to enhance morse code identification.
- When depressed (VOICE position), VOR/ILS audio signals are filtered in order to reduce morse code signal, enhancing the VOR/ILS voice associated messages (e.g., ATIS messages).

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7 - HEADPHONE MASTER VOLUME CONTROL KNOB

- Allows adjustment of headphone amplifier volume.

8 - INTERPHONE SELECTOR KNOB

- When depressed, enables communications between captain, copilot, observer, and ramp station via airplane interphone.
- When rotated, provides interphone volume control.

NOTE: To enable the interphone function the respective control wheel and observer communications switch must also be set at the HOT position.

9 - MARKER BEACON SENSITIVITY/MUTE KNOB

- The mute function is enabled by pressing the marker beacon sensitivity/mute knob and it is used to temporarily silence the marker beacon audio signal. The audio signal will be automatically re-enabled according the following schedule:
  - If the mute function was selected when the marker beacon audio level was above a certain threshold setting, the audio will be re-enabled 5 seconds after the audio level descends below that threshold setting.
  - If the mute function was selected when the marker beacon audio level was below that threshold setting, the audio signal will be mute during 20 seconds, and then it will be re-enabled.
- The marker beacon sensitivity/mute knob, when rotated, also controls the sensitivity of the Marker Beacon receiver.

10 - MARKER BEACON VOLUME KNOB

- When rotated, allows to control the marker beacon audio volume.

NOTE: Does not allow volume settings below a certain level in order to prevent the marker beacon audio from being adjusted too low to be heard, that the marker signal could be missed.

11 - SIDETONE KNOB

- This knob selects the speaker ON (depressed) or OFF (pressed). It must be pressed when the headphones are used.
- The sidetone control is made by rotating the sidetone knob, which prevents undesirable feedback of speaker sidetone audio into the transmitting microphone.

12 - SPEAKER MASTER VOLUME CONTROL KNOB

- When rotated, allows adjustment of speaker volume.

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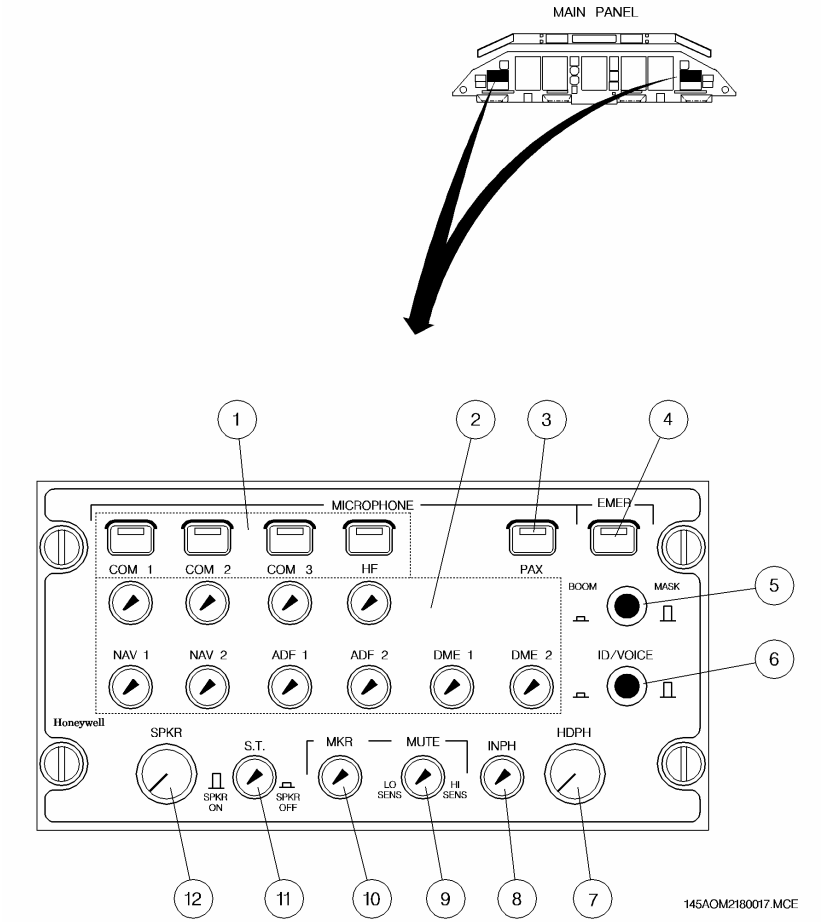

DIGITAL AUDIO PANEL

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	CHECK XPDR	The transponder is not operational.

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COMMUNICATION CONTROLS AND INDICATORS

COCKPIT

CONTROL WHEEL COMMUNICATIONS SWITCH (PTT)

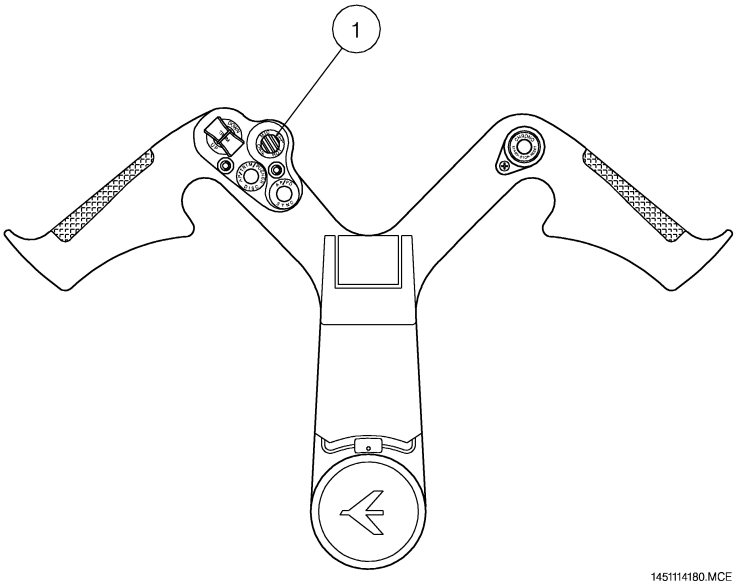
1 - CONTROL WHEEL COMMUNICATIONS SWITCH

PTT POSITION - Momentary position. When pressed allows VHF and HF transmissions and speech to the passengers through Passenger Address System. Releasing this button, it returns to the HOT position and VHF, HF or passenger cabin transmissions will be interrupted.

NOTE: For VHF transmissions, a continuous command of PTT switch is limited to 2 minutes. If the PTT switch is pressed longer than 2 minutes, the message MIC STK will be displayed on RMU, and the microphone will be disabled.

HOT POSITION - Allows communication between crew members and between crew members and ramp station.

OFF POSITION - Allows only audio reception.



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CONTROL WHEEL

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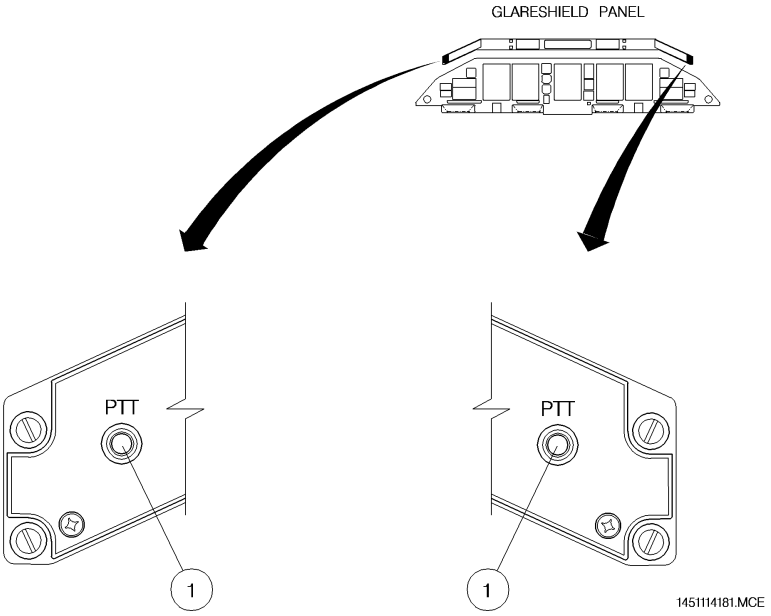
GLARESHIELD COMMUNICATION SWITCH (PTT)

1 - GLARESHIELD MIC PTT BUTTON

– When pressed allows VHF and HF transmission and speech to passengers through the Passenger Address System. Releasing this button will interrupt transmission.



GLARESHIELD PANEL

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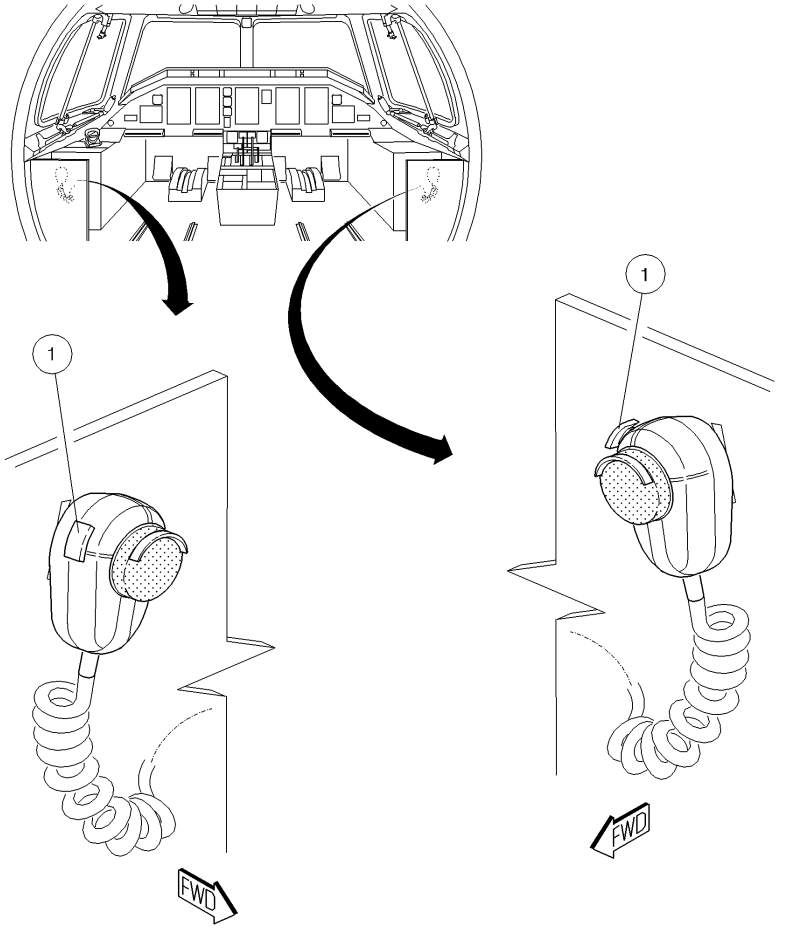
CAPTAIN AND COPILOT HAND MICROPHONE

1 - HAND MIC PTT BUTTON

- When pressed allows VHF and HF transmission and speech to passengers through the Passenger Address System. Releasing this button will interrupt transmission.

PILOT AND COPILOT CONSOLES



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PILOT AND COPILOT CONSOLE

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CAPTAIN AND COPILOT JACK PANELS

1 - CAPTAIN AND COPILOT JACKS

– Allows plugging-in the headphone, the boom microphone, and the hand microphone.

2 - HEADSET ANR

– Allows plugging-in the headphone with the Active Noise Reduction feature.

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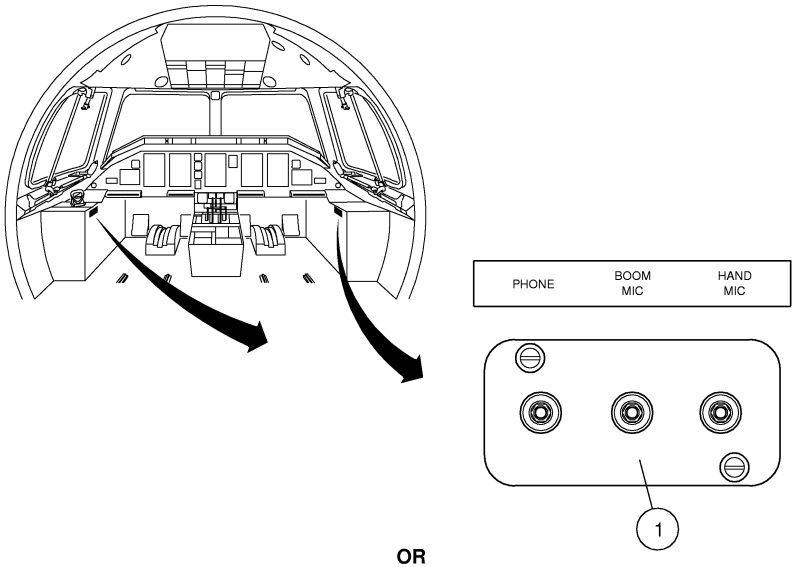

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CAPTAIN AND COPILOT JACK PANELS

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OBSERVER JACK PANEL AND COMMUNICATION SWITCH (PTT)

1 - BOOM JACK

- Allows plugging-in the boom microphone.

2 - HEADPHONE JACK

- Allows plugging-in in the headphone.

3 - OBSERVER MICROPHONE SWITCH

HOT POSITION - Allows communication with crew members and ramp station.

OFF POSITION - Allows only audio reception.

PTT POSITION - Momentary position. When pressed allows VHF and HF transmissions and speech to passengers through the passenger address system. Releasing this button, it returns to the OFF position and transmissions will be interrupted, remaining only in audio reception.

4 - HEADSET ANR

- Allows plugging-in in the headphone with the Active Noise Reduction (ANR) feature. The Sennheiser headset model HMEC25-CAP is certified for ANR function. A switch in the headset cord activates or deactivates the active noise reduction feature. If the noise reduction feature malfunctions the headset must be used with this feature disabled.

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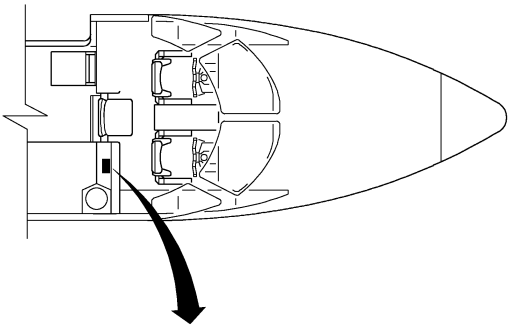
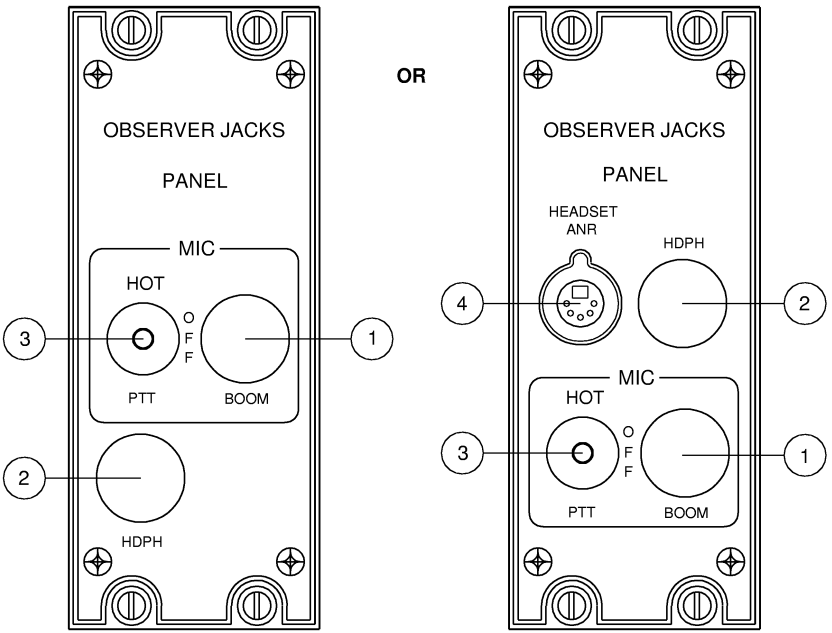
RIGHT AFT CONSOLE





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OBSERVER JACK PANEL

RAMP STATION

FRONT AND REAR RAMP PANELS

1 - COCKPIT CALL BUTTON (momentary action)

- When pressed, generates a tone in the headphones and cockpit speakers.

2 - MICROPHONE/HEADPHONE JACK

- Allows ramp crew to plug in a headphone and a microphone equipped with a PTT Button.

NOTE: Ground crew panel is linked to the Hot Mic.

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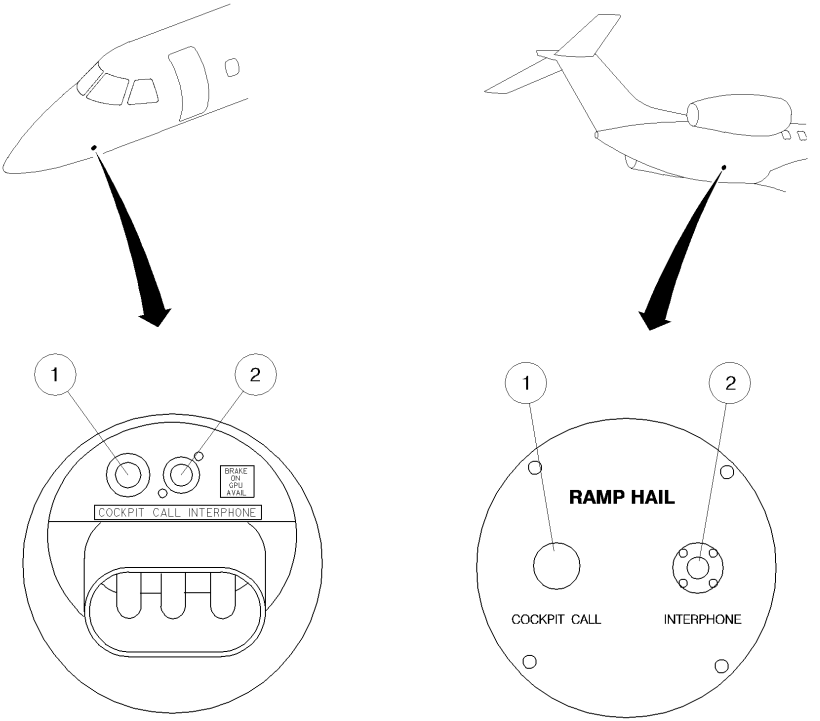

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FRONT AND REAR RAMP PANELS

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HF COMMUNICATION SYSTEM - HF-230

The airplane may be equipped with a HF-230 High-Frequency Communication System. All functions of the HF-230 System are controlled by the CTL-230 Control Panel located at the control pedestal.

HF OPERATING MODES

The HF-230 High-Frequency Communications System provides the following operating modes:

AMPLITUDE MODULATION

Amplitude modulation (AM) is a transmission process in which a selected frequency (called carrier frequency) and two sidebands (frequencies above and below the carrier) are generated and transmitted. The upper sideband (USB) is the sum of the carrier frequency and the voice, while the lower sideband (LSB) is the difference between the two. The disadvantages of AM are that it occupies a wide spectrum and is inefficient in the sense that a great deal of unneeded carrier is generated, as well as redundant information in the unused sideband.

SINGLE SIDEBAND

Single sideband operation achieves the same function as AM with considerably greater efficiency. The SSB transmitter electronically eliminates most or all of the carrier wave and one of the sidebands. The major advantages of SSB (either USB or LSB) as opposed to AM are greater talking power (about eight times that of AM for a given power input), reduced power drain, longer range and conservation of the spectrum (since only one sideband is required to transmit the message).

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SUPPRESSED CARRIER AND REDUCED CARRIER

The SSB operation with the carrier frequency eliminated is referred to as single sideband suppressed carrier and is designated as the TEL SUP CAR mode in the HF-230.
If a small portion of the carrier frequency is transmitted along with the sideband, then the operation is referred to as single sideband reduced carrier. and is designated as the TEL PLT CAR mode in the HF-230.

SIMPLEX AND HALF-DUPLEX OPERATION

Simplex operation means that the transmission and reception frequencies are the same. An example of simplex operation would be communications with a control tower using a VHF COMM transceiver. Half-duplex means transmit on one frequency and reception on another frequency. All 176 of the ITU channels provided the HF-230 are permanently programmed for half-duplex operation and will normally be worked in the TEL SUP CAR mode. The 40 user programmed channels can be programmed for either simplex or half-duplex operation, and can operate in any of the available modes (AM, USB, LSB, TEL SUP CAR, or TEL PLT CAR).

NOTE: The use of LSB is legal for some international and off-shore communications, but is not authorized for use in the United States and most European countries.

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HF NORMAL OPERATION

There are two types of operation:

- Discrete frequency tuning.

- Programmable channel.

DISCRETE FREQUENCY TUNING OPERATION

In the discrete frequency mode of operation, the user may directly tune any one of 280,000 frequencies over the range of 2.0 to 29.9999 MHz.

1 - Access discrete frequency operation.

Apply power to the system by rotating the volume (V) knob clockwise from the OFF position.
With power applied to the system, ensure that the CHAN/FREQ switch is in the FREQ position.
This can be confirmed by noting that four dashes appear in the CHAN display.

2 - Enter the frequency.

Use the four frequency select knobs to enter the desired frequency in the FREQ kHz display.

3 - Select the transmission mode.

Pull out and rotate the left inner (PULL MODE) knob in either direction, to assign one of the available operating modes (USB, LSB, AM, TEL SUP CAR, or TEL PLT CAR).

4 - Tune the antenna.

Momentarily key the PTT to initiate the antenna coupler tuning cycle. A steady 1000-Hz tone will be heard in the headset or speaker while the antenna coupler is been tuned. Approximately 1 second after antenna coupler tuning cycle is completed (tuning cycle may require from 5 to 30 seconds), the 1000-Hz tone will cease, indicating that the system is ready for use on the selected frequency. Adjust volume (V) and squelch (S) controls as desired.

NOTE: - The discrete frequency mode always provides simplex operation (transmit and receive frequencies are the same).

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- Always key the PTT after selecting a new frequency to initiate the antenna coupler tuning cycle. If this is not done, you may experience poor reception or miss important calls.
- During operation, if the receive (R) or transmit (T) annunciators on the CTL-230 flash, this indicates that the receive or transmit (as applicable) frequency data does not match that being sent by the CTL-230. An equipment malfunction is probable and the system should be checked by maintenance personnel.

PROGRAMMABLE CHANNEL OPERATION

In the channel mode operation, the user may select ITU and user programmed channels by their channel numbers. For user programmed channels:

1 - Access channelized operation.
Apply power to system (rotate the V knob from the OFF position), and position the CHAN/FREQ switch to the CHAN position.

2 - Rotate the left outer channel select knob until user channel 1 or 40 appears on the right side of the CHAN display. Use the right outer channel select knob to select the desired channel number within the user programmed channels.

3 - Tune the antenna.
Momentarily key the PTT to initiate antenna coupler tuning cycle. Adjust volume and squelch controls, as desired.

THE 40 USER CHANNELS PROGRAMMING PROCEDURE

The 40 user programmable channels available in the HF-230 system can be programmed on the ground or in flight. All programmed information is stored in a nonvolatile memory and can be recalled by selecting the desired user channel number.

There are three types of channels that can be programmed:

1 - Half-duplex
The user programs two different frequencies, one for receive and one for transmit. The user also assigns one of the available operating modes (USB, LSB, AM, TEL SUP CAR, or TEL PLT CAR) to the selected channel. Half-duplex operation is available only when the HF-230 is being operated in the CHAN mode.

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2 - Simplex

The user programs the same frequency for receive and for transmit. The user also assigns one of the available operating modes (USB, LSB, AM, TEL SUP CAR, or TEL PLT CAR) to the selected channel. Simplex operation is used by ARINC, ATC (Air Traffic Control), and others.

3 - Receive-only

The user programs a frequency for reception and assigns one of the available operating modes (USB, LSB, AM, TEL SUP CAR, or TEL PLT CAR), but does not program a transmit frequency.
The transmitter and power amplifier are locked out and cannot be used when a channel has been programmed for receive-only operation.

Receive-only channels are used to listen to frequency standards (WWV) for example, time, weather, Omega status, and geophysical alert broadcasts

HALF-DUPLEX CHANNEL PROGRAMMING PROCEDURE

1 - Access channelized operation.
Apply power to the system by rotating the volume (V) knob clockwise from the OFF position. With power applied to the system, ensure that the CHAN/FREQ switch is in the CHAN position.

2 - Select the desired user channel.

Rotate the left outer channel select knob in either direction until user channel 1 or 40 appears at the right side of the CHAN display. Then use the right outer channel select knob to select the desired channel number (from 1 to 40) that you wish to program.

3 - Initiate program mode.

Press the program (PGM) button once to initiate the programming sequence. At this point, the entire display on the CTL-230 will slowly begin to blink.

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4 - Enter the receive frequency and mode of operation.

Set the desired receive frequency using the four frequency select knobs. This procedure is identical to tuning a discrete frequency which has been previously described. The receive frequency will appear in the FREQ kHz display. Next, select the desired operating mode (USB, LSB, AM, TEL SUP CAR, or TEL PLT CAR) by pulling out on the PULL MODE knob and rotating it until the appropriate mode appears in the MODE display.

5 - Store the receive frequency and mode of operation.

With the desired receive frequency and mode being displayed, press the PGM button once again to store the data. The CTL-230 display will blank for a short period of time to confirm storage.

6 - Enter and store the transmit frequency.

When the display returns, it will be blinking faster with the transmit frequency displayed (initially this is the same as the already programmed receive frequency). At this point, you have approximately 20 seconds to begin entering the desired transmit frequency. If no changes are made during the next 20 seconds, the currently displayed transmit frequency will become invalid and you will have created a receive-only channel. Set the desired transmit frequency using the four frequency select knobs. This procedure is identical to entering the receive described above. With the desired transmit frequency shown in the FREQ kHz display, press the PGM button once again to store the data.

As before, the CTL-230 display will blank for a short period of time to confirm storage. The display will then return to normal with the new channel data (channel number, mode, and receive frequency) showing.

7 - Tune the antenna.

Momentarily key the PTT to initiate the antenna coupler tuning cycle. Adjust the volume (V) and squelch (S) controls, as desired.

NOTE: If additional user channels are to be programmed, repeat steps 2 through 6 at this time. Ensure that you make and keep for reference a list of channel numbers, and the receive and transmit frequencies, as well as the mode of operation that are programmed on the individual channels.

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SIMPLEX CHANNEL PROGRAMMING PROCEDURE

When you program a channel for simplex operation, both the receive and the transmit frequencies will be the same. Programming a simplex channel is similar to programming a half-duplex channel, except the PGM button is pressed twice after the receive frequency and mode of operation are entered to store the frequency in both the receive and the transmit positions.

RECEIVE-ONLY CHANNEL PROGRAMMING PROCEDURE

When you program a channel for receive-only operation, only a receive frequency is entered and stored. Programming a receive-only channel is similar to programming a simplex channel except the PGM button is pressed only once after the receive frequency and mode of operation are entered. The programming sequence is then terminated without entering a transmit frequency.

Program sequence can be terminated in any one of the three ways:
- By momentarily keying the PTT.
- By positioning the CHAN/FREQ switch to FREQ and then back to CHAN.
- By waiting for the 20-second timer to run out (this is the preferred method).

THE 176 ITU CORRESPONDENCE CHANNELS OPERATION

The 176 ITU (International Telecommunication Union) public correspondence channels (and their receive and transmit frequencies) in the maritime radiotelephone network are permanently programmed in the nonvolatile memory of the CTL-230 Control. The 176 ITU channels all operate half-duplex in TEL SUP CAR (preferred) or TEL PLT CAR modes only.

Perform the following steps to operate on the ITU channels:

1 - Access channelized operation.

Apply power to the system by rotating the volume (V) knob clockwise from the OFF position.
With power applied to the system, ensure that the CHAN/FREQ switch is in the CHAN position.

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2 - Select the desired ITU channel.

Rotate the left outer channel select knob in either direction until the desired ITU band appears in the one or two left-hand digits in the CHAN display. Next use the right outer channel select knob to select the individual channel number within the ITU band (the two right-hand digits in the CHAN display.
When the ITU channel numbers have been entered, the airplane receive frequency will appear in the FREQ kHz display and the R annunciator will be illuminated.

NOTE: Refer to a list of the ITU maritime radiotelephone channels to see that the above incrementing and decrementing changes are consistent with the actual ITU channel numbers.

3 - Select the operating mode.

Pull out and rotate the left inner (PULL MODE) knob in either direction to select between TEL SUP CAR or TEL PLT CAR mode.
When the mode has been selected, push the knob back in.

4 - Tune the antenna.

Momentarily key the PTT to initiate the antenna coupler tuning cycle. A steady 1000-Hz tone will be heard in the headset or speaker while the antenna coupler is tuning. Approximately 1-second after completion of the antenna coupler tuning cycle (tuning cycle may require from 5 to 30 seconds), the 1000-Hz tone will cease, indicating that the system is ready for use on the selected ITU channel. Adjust volume (V) and squelch (S) controls as desired.
When transmitting, the receive frequency and R annunciator in the FREQ kHz display are replaced with the aircraft transmit frequency and a T annunciator.

FAULT INDICATION

If the antenna coupler does not tune after approximately 35 to 40 seconds, the steady 1000-Hz tone will begin to beep, indicating a fault has occurred. To clear the fault, simply rotate one of the Frequency/Channel Select Knobs away from and then back to the desired frequency or channel and initiate another tuning cycle by momentarily pressing the PTT button. The 1000-Hz tone should again be heard and then disappear at the end of the tuning cycle. If the beeping recurs, try the clearing procedure a second time. If a fault is still indicated, there is probably an equipment malfunction.

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HF CONTROLS AND INDICATORS

CTL-230 CONTROL PANEL

1 - GAS DISCHARGE DISPLAY

- Shows channel number (CHAN), mode of operation (MODE), transmit and receive frequency in kilohertz, and separate R (receive) and T (transmit) annunciators.

2 - CHANNEL FREQUENCY SELECT KNOBS

- Knob functions when selecting a discrete frequency

FREQUENCY SELECT KNOB	KNOB FUNCTION
Left outer	Selects the MHz digits (2 through 29) in the FREQ kHz display.
Left inner (pushed in)	Selects the 100-kHz digit (0 through 9) in the FREQ kHz display.
Left inner (pulled out)	Rotate to select USB, AM, LSB modes.
Right outer	Selects the 10-kHz digit (0 through 9) in the FREQ kHz display.
Right inner (pushed in)	Selects the 1-kHz digit (0 through 9) in the FREQ kHz display.
Right inner (pulled out)	Selects the 100-Hz digit (0 through 9) in the FREQ kHz display.

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– Knob functions when selecting a user programmed channel.

CHANNEL SELECT KNOB	KNOB FUNCTION
Left outer	Rotate until brings up user channel number 1 or 40. If user channel 1 is being displayed, the next clockwise increment of the knob will cause ITU channel 401 to be displayed, then 601, 801, and on. User channels are designated by 1-or 2-digit channel numbers appearing at the right side of the CHAN display (the left two or three digits are blanked).
Left inner (pushed in or pulled out)	No effect on user channels.
Right outer	With user channel 1 displayed, clockwise rotation of this knob will increment through the 40 user channels one channel at a time. The next increment past user channel 40 will cause the lowest ITU channel number (401) to be called up. With user channel 40 displayed, counterclockwise rotation of the right outer knob will decrement through the user channels, 1 channel at a time. The next decrement past user channel 1 will cause the highest ITU channel number (2510) to be called up.
Right inner (pushed in or pulled out)	No effect on user channels.

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– Knob functions when selecting an ITU telephone channel

CHANNEL SELECT KNOB	KNOB FUNCTION
Left outer	This knob is used to select the ITU band (the one or two left-hand digits in the CHAN display). Clockwise rotation of the knob increments the CHAN display to the next higher ITU band and counterclockwise rotation decrements to the next lower ITU band. If ITU channel 401 is being displayed, the next clockwise increment of the knob will cause ITU channel 601 to be displayed, then 801, 1201, 1601, and 2201. Rollover occurs between the top ITU band (22 MHz) and user programmed channel number 1, and between the lowest ITU band (4 MHz) and user programmed channel number 40.
Left inner (pushed in)	No effect on ITU channels.
Left inner (pulled out)	Rotate to select between TEL SUP CAR and TEL PLT CAR models.
Right outer	This knob selects the individual channel number within the ITU band (the two right-hand digits in the CHAN display). If the channel number is incremented beyond the highest channel for that band, the lowest channel for the next higher band will appear. For example, if ITU channel 427 is being displayed, the next clockwise increment of the knob will cause ITU channel 601 to be displayed. Likewise, decrementing below the lowest channel in a band will select the highest channel in the next lower band.
Right inner (pushed in or pulled out)	No effect on ITU channels

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3 - PROGRAM BUTTON

- Allows the user to store frequencies in the 40 user programmed channels (refer to Programmable Channel Operation section for proper operation).

4 - CHANNEL/FREQUENCY SWITCH

- The channel/frequency select knobs are used to select the desired user channel or ITU telephone channel number (CHAN/FREQ switch positioned to CHAN) or the proper transmit and receive frequencies when operating in the discrete frequency mode number (CHAN/FREQ switch positioned to FREQ). The knobs are also used to enter frequencies when programming the user channels number (CHAN/FREQ switch positioned to CHAN).

5 - SQUELCH/TEST CONTROL

- This knob is adjusted to mute undesired background noise. The noise proper setting is made by rotating the S (squelch) knob clockwise from TST (test) position until background noise can be heard and by turning it counterclockwise until the background noise disappears or is just barely audible.
- When the S knob is in the TST position, the squelch circuit is, in effect, removed from the receiver audio circuit in the TST, maximum background noise (depending on the volume control setting) will be heard.
- Setting the squelch control too far clockwise can result in blocking out weak signals. There are times when it will be necessary to leave the squelch control in the TST position to maintain satisfactory reception. This is because of conditions relating to propagation and the ionosphere that causes the HF receiver to operate with a signal that is subject to considerable fading and which is marginally strong.

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6 - OFF/ CLARIFIER CONTROL

- Concentric with the volume knob, and sharing the same OFF position, the CLAR knob is used when receiving SSB signals that may be slightly off frequency.
- The CLAR knob can help eliminate unnatural sounds when receiving USB, LSB, or either of the telephone modes.
- The clarifier function does not affect AM reception, and is disabled during transmit or when the CLAR knob is set to OFF position.
- To operate the clarifier, rotate the CLAR knob clockwise from off until the centering dot is visible on the knob skirt at the mid rotation point. This is the neutral or zero shift position. From this position, the CLAR knob is adjusted clockwise or counterclockwise for the best clarity or the most natural sound of the signal being received.

NOTE: When the audio quality of the received SSB signal is good and natural sounding, the CLAR knob should remain in the OFF position.

7. OFF/VOLUME CONTROL

- Turns system off and on and controls volume. Rotating the V knob clockwise from the OFF position turns the system on. Continued clockwise rotation increases audio level. When the system is turned OFF, the discrete frequency or channel, and mode of operation displayed on the CTL-230 will be stored in nonvolatile memory and will be restored to the display the next time the system is turned on.

NOTE: It is recommended that the HF-230 system be turned on at least 15 minutes before use, to ensure frequency stability under varying environmental conditions.

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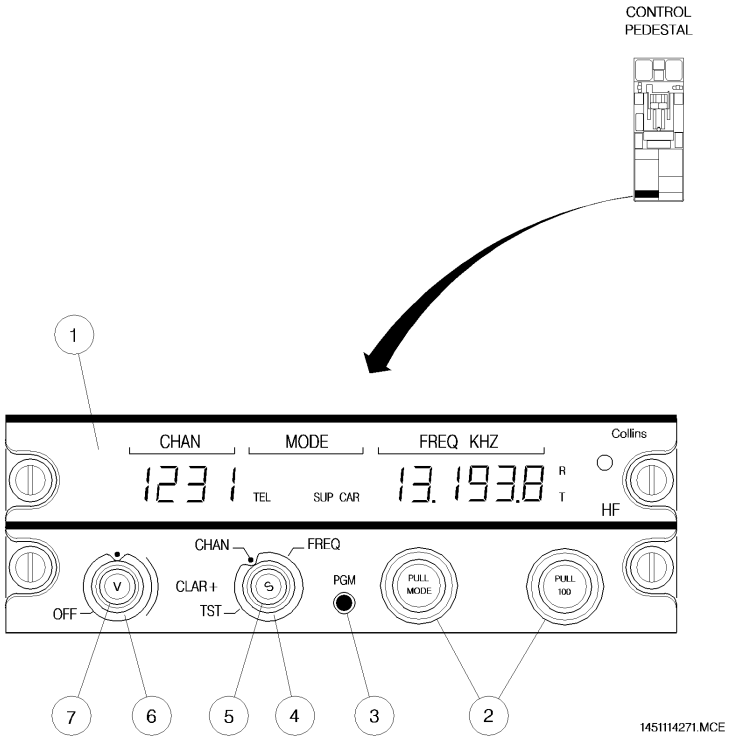

CTL-230 HF CONTROL PANEL

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HF COMMUNICATION SYSTEM - KHF-950

The airplane may be equipped with a KHF-950 or KHF-1050 High-Frequency Communication System. All functions of the KHF-950 System are controlled by the KCU-951 or KFS-954 Control Panel located at the control pedestal. For airplanes equipped with KHF-1050, refer to section 2-18-11.

HF OPERATING MODES

The KHF-950 High-Frequency Communications System provides the following operating modes:

AMPLITUDE MODULATION

Amplitude modulation (AM) is a transmission process in which a selected frequency (called carrier frequency) and two sidebands (frequencies above and below the carrier) are generated and transmitted. The upper sideband (USB) is the sum of the carrier frequency and the voice, while the lower sideband (LSB) is the difference between the two. The disadvantages of AM are that it occupies a wide spectrum and is inefficient in the sense that a great deal of unneeded carrier is generated, as well as redundant information in the unused sideband.

SINGLE SIDEBAND

Single sideband operation achieves the same function as AM with considerably greater efficiency. The SSB transmitter electronically eliminates most or all of the carrier wave and one of the sidebands. The major advantages of SSB (either USB or LSB) as opposed to AM are greater talking power (about eight times that of AM for a given power input), reduced power drain, longer range and conservation of the spectrum (since only one sideband is required to transmit the message).

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SUPPRESSED CARRIER AND REDUCED CARRIER (OPTIONAL)

The SSB operation with the carrier frequency eliminated is referred to as single sideband suppressed carrier and is designated as the A3J mode in the KHF-950.
If a small portion of the carrier frequency is transmitted along with the sideband, then the operation is referred to as single sideband reduced carrier, and is designated as the A3A mode in the KHF-950.

SIMPLEX, SEMI-DUPLEX AND RECEIVE-ONLY OPERATION

Simplex operation means that the transmission and reception frequencies are the same. An example of simplex operation would be communications with a control tower using a VHF COMM transceiver. Semi-duplex means transmit on one frequency and reception on another frequency.
Receive-only operation allows the system to operate as a receptor only.
The 99 user programmed channels can be programmed for either simplex, semi-duplex or receive only operation, and can operate in any of the available modes (AM, USB or LSB).

NOTE: The use of LSB is legal for some international and off-shore communications, but is not authorized for use in the United States and most European countries.

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HF NORMAL OPERATION

There are two types of operation:

- Discrete frequency tuning.
- Programmable channel.

DISCRETE FREQUENCY TUNING OPERATION

In the discrete frequency mode of operation, the user may directly tune any one of 280,000 frequencies over the range of 2.0 to 29.9999 MHz.

1 - Access discrete frequency operation.

Apply power to the system by rotating the volume (V) knob clockwise from the OFF position. Wait for about two minutes, until the system has warmed up. Until then, no frequency is displayed. Make sure that the FREQ/CHAN button is depressed, in the FREQ position. Confirm this by seeing that no channel number is annunciated in the frequency display. If the button is pressed, a momentary press unlatches it and engages FREQ (direct tune) operation.

2 - Select the transmission mode.

Press the mode button to select the transmission mode (USB, LSB or AM).

3 - Enter the frequency.

Each digit in a frequency is selected individually. The large concentric knob on the lower right of the control unit may be rotated in either direction and causes one of the displayed frequency digits to flash. This flashing “cursor” indicates which frequency digit will be changed by rotating the smaller concentric knob. Rotate the larger knob until the digit you wish to change flashes, and then select the desired number into view by rotating the smaller knob.

4 - Tune the antenna.

Momentarily key the PTT to initiate the antenna coupler tuning cycle. During the tuning process the TX annunciator will flash and the frequency numbers will blank. When the TX stops flashing and the frequency reappears , the antenna tuning cycle is complete and you are ready to transmit on the selected frequency.

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NOTE: - The discrete frequency mode always provides simplex operation (transmit and receive frequencies are the same).

- Always key the PTT after selecting a new frequency to initiate antenna tunning, otherwise you may experience poor reception or miss an important call.

PROGRAMMABLE CHANNEL OPERATION

In the channel mode operation, the user may select user programmed channels by their channel numbers. For user programmed channels:

1 - Access channelized operation.
Apply power to system (rotate the VOLUME knob from the OFF position). Wait for about two minutes, until the system has warmed up. Until then, no frequency is displayed. Make sure that the FREQ/CHAN button is pressed, in the CHAN position.

2 - Select the channel.
Rotate the small inner concentric knob to select the desired channel number.

3 - Tune the antenna.
Momentarily key the PTT to initiate antenna coupler tuning cycle. Adjust volume and squelch controls, as desired.

THE 99 USER CHANNELS PROGRAMMING PROCEDURE

The 99 user programmable channels available in the KHF-950 system can be programmed on the ground or in flight. All programmed information is stored in a nonvolatile memory and can be recalled by selecting the desired user channel number.

There are three types of channels that can be programmed:

1 - Semi-duplex
The user programs two different frequencies, one for receive and one for transmit. The user also assigns one of the available operating modes (USB, LSB or AM) to the selected channel. Semi-duplex operation is available only when the KHF-950 is being operated in the CHAN mode.

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2 - Simplex

The user programs the same frequency for receive and for transmit. The user also assigns one of the available operating modes (USB, LSB or AM) to the selected channel. Simplex operation is used by ARINC, ATC (Air Traffic Control), and others.

3 - Receive-only

The user programs a frequency for reception and assigns one of the available operating modes (USB, LSB or AM), but leaves the transmit portion of the preset channel blank.
The transmitter and power amplifier are locked out and cannot be used when a channel has been programmed for receive-only operation.

Receive-only channels are used to listen to frequency standards (WWV) for example, time, weather, Omega status, and geophysical alert broadcasts.

SEMI-DUPLEX CHANNEL PROGRAMMING PROCEDURE

1 - Access channelized and program mode.

Apply power to the system by rotating the VOLUME (V) knob clockwise from the OFF position. Make sure that the FREQ/CHAN button is pressed, in the CHAN position. Activate the program mode by pressing the PGM switch with a pointed object.

2 - Select the desired user channel.

Rotate the inner concentric knob to select the channel number to be programmed.

3 - Select emission mode.

Use the MODE button to select emission mode (USB, LSB or AM). Press the MODE button until the desired mode appears.

4 - Enter the receive frequency.

Use the outer larger concentric knob to position the flashing “cursor” on each digit of the receive frequency and use the smaller inner knob to select the desired number in each position.

5 - Store the receive frequency and mode of operation.

Push the STO button once and the receive frequency is entered in the electronic memory. The TX annunciator will begin to flash in the display window indicating the receive frequency is stored and you are ready to program the transmit frequency.

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6 - Enter and store the transmit frequency.

Use the outer larger concentric knob to position the flashing “cursor” on each digit of the transmit frequency and use the smaller inner knob to select the desired number in each position.

7 - Store the transmit frequency.

Push the STO button again and the transmit frequency is now stored. If additional user channels are to be programmed, repeat steps 2 through 7 at this time.

8 - Exit the program mode

Press the PGM switched with pointed object.

9 - Tune the antenna.

Momentarily key the PTT to initiate the antenna coupler tuning cycle. Adjust the volume (V) and squelch (S) controls, as desired.

SIMPLEX CHANNEL PROGRAMMING PROCEDURE

When you program a channel for simplex operation, both the receive and the transmit frequencies will be the same. Programming a simplex channel is similar to programming a semi-duplex channel, except the STO button is pressed twice after the receive frequency and mode of operation are entered to store the frequency in both the receive and the transmit positions.

RECEIVE-ONLY CHANNEL PROGRAMMING PROCEDURE

1 - Access channelized and program mode.

Apply power to the system by rotating the VOLUME (V) knob clockwise from the OFF position. Make sure that the FREQ/CHAN button is pressed, in the CHAN position. Activate the program mode by pressing the PGM switch with a pointed object.

2 - Stow the cursor.

Stow the “cursor” if a frequency digit is flashing. The cursor is stowed by rotating the larger concentric knob until no frequency digit is flashing. With the cursor stowed in the program mode, the smaller inner knob is now used to select a channel number to be programmed.

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3 - Select channel number.

Use the smaller inner concentric knob to select the channel number you wish to program. Simply rotate the smaller knob until the desired channel appears on the right side of the display.

4 - Select operating mode.

Push the MODE button until the appropriate mode (USB, LSB or AM) appears in the lower part of the display window.

5 - Set the frequency.

Move the “cursor” into position by rotating the larger concentric knob, and then use the smaller concentric knob to set the desired number under each “cursor” position.

6 - Store the information.

Push the STO (store) switch with a pointed object. The information you have entered will be stored in the electronic memory. After you push the STO button, the TX annunciator will flash indicating that the frequency you have just entered is stored in the receive position, but nothing is entered in transmit. Since a receive-only is being set, ignore the flashing TX.

7 - Exit the program mode.

Press the PGM switched with pointed object. All information you have stored is locked into CHANNEL memory.

FAULT INDICATION

If the system detects a fault during transmission or during the tuning of the antenna coupler, the frequency digits on the display begin to flash. Simply key the PTT button and the automatic antenna coupler begins a new tunning cycle to clear the fault.

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HF CONTROLS AND INDICATORS

KCU-951 CONTROL PANEL

1 - FREQUENCY DISPLAY

- Displays the operation frequency, in either FREQ or CHAN mode.

2 - MODE DISPLAY

- Displays emission mode, transmit indicator and program mode indication.

3 - CHANNEL DISPLAY

- Displays the set channel. If in FREQ mode, the channel display will not show numbers.

4 - PHOTOCELL

- Automatically adjusts the display brightness.

5 - MODE SWITCH

- Selects transmission and reception mode. Momentary depression cycles the KHF-950 from upper sideband (USB) to lower sideband (LSB) to AM.

6 - FREQ/CHAN SWITCH

- Allows the user to select between the two methods of frequency selection. In the FREQ mode (depressed switch) the user may direct tune any of the 280,000 available frequencies, simplex operation only. In the CHAN mode (pressed switch), the user presets the transmit and receive frequencies in up to 99 available channels.

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7 - PROGRAM SWITCH

- Used on the 99 user-programmed channels programming.

8 - LARGER CONCENTRIC KNOB

- Moves the “cursor” which selects the digit of the frequency to be changed.

9 - SMALLER CONCENTRIC KNOB

- Increments or decrements the frequency digit under the “cursor” (flashing digit).

10 - STORE SWITCH

- Used to store data when programming the user programmable channels.

11 - POWER AND VOLUME KNOB

- Turns the system on and off and controls volume. Clockwise rotation past the first click turns the system on. Further rotation increases audio level. After turning on, the system takes about two minutes to warm up. Until then, no frequencies are displayed.

12 - SQUELCH KNOB

- Reduces background noises when rotated counterclockwise. Must be set by rotating the knob clockwise until background noise can be heard and then turning it counterclockwise until background noise is eliminated or barely audible.

13 - CLARIFIER KNOB

- Clarifier is used only in SSB communications, and is not applicable to AM mode;
- It must be used when due to off frequency ground station transmissions the audio voice quality from KHF-950 may sound unnatural;

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– To operate the clarifier, pull the knob out and rotate the knob in either direction until the audio quality is optimized. When the knob is pushed in, the clarifier has no effect. When voice quality is good and natural, the carifier knob should remain pushed in.

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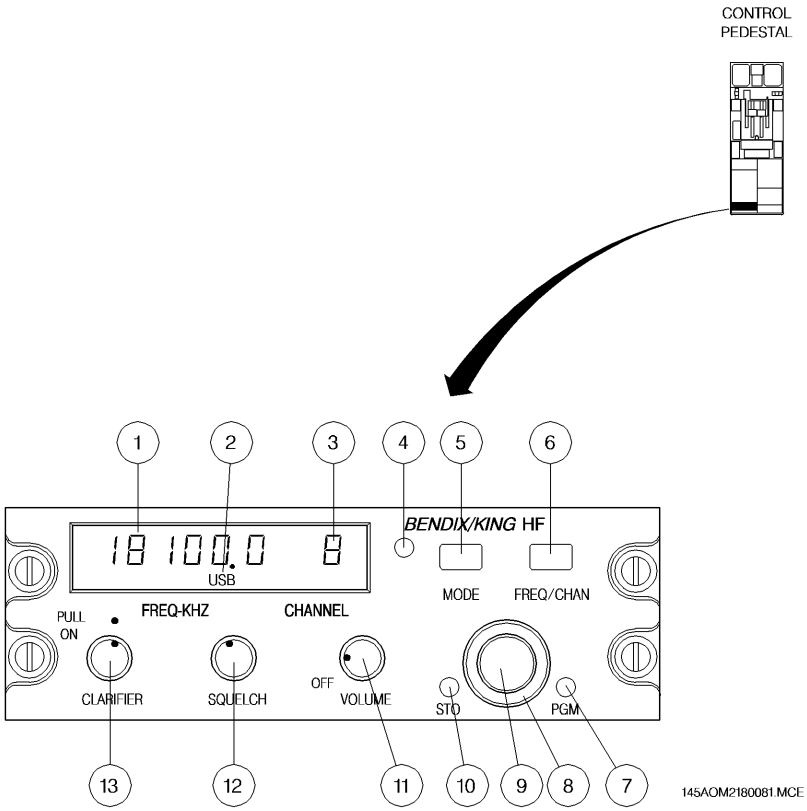

KCU-951 CONTROL PANEL

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HF COMMUNICATION SYSTEM - KHF-1050

The airplane is equipped with a single or DUAL KHF-1050 HF Communication System configuration.

Please refer to HF OPERATION, RMU DISPLAYS, RADIO PAGE, HF Memory Page and HF Control Page in the section 2-18-11, to get instructions regarding the KHF-1050 System Operation.

For DUAL KHF-1050 HF System Configuration, please refer to the following item in the Section: HF SELECTOR PANEL.

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THIRD VHF COMMUNICATIONS SYSTEM

The airplane may be equipped with a third VHF Communications System. All functions of the Collins VHF-22A System are controlled by the CTL-22 VHF Control Panel located at the main panel.

The Avionics Master DC Bus 1 supplies the third VHF Communications System with a protective 5A circuit breaker.

THIRD VHF COM CONTROLS AND INDICATORS

1 - ACTIVE FREQUENCY DISPLAY

- Displays the active frequency (frequency to which the equipment is tuned) and diagnostics messages.

2 - XFR/MEM SWITCH

- This is a 3-position, spring-loaded toggle switch.
- When held to the XFR position, the preset frequency is transferred up to the active display and the equipment retunes. The previously active frequency becomes the new preset frequency and is displayed in the lower window.
- When held to the MEM position, one of the six stacked memory frequencies is loaded into the preset display.
- Successive pushes cycle the six memory frequencies through the display.

3 - FREQUENCY SELECT KNOBS

- Two concentric knobs control the preset or active frequency displays.
- The large knob changes the digits to the left of the decimal point in 1 MHz steps.
- The smaller knob changes the digits to the right of the decimal point in 0.005 MHz steps.
- Numbers roll over at the upper and lower frequency limits.

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4 - ACTIVE BUTTON

- Push the ACT button for about 2 seconds to enable the frequency select knobs to directly retune the VHF-22A (active frequency).
- The bottom window will display dashes and the upper window will continue to display the active frequency.
- Push the ACT button a second time to return the control to the normal 2-display mode.

5 - TEST BUTTON

- The self-test diagnostic routine is initiated in the transceiver by pushing the TEST button.
- The active and preset display intensity will flash, modulating its brightness from minimum to maximum indicating self-test in progress.
- The active frequency display will show four dashes and the preset frequency display will show “00”.
- An audio tone will be heard from the audio system.
- At the completion of the self-test program, the display will return to its normal operation if no problem occurs.
- In case of a detected failure, “diAG” (diagnostic) letters will be displayed in the active and a 2-digit diagnostic code will be displayed in the preset display.
- Record any diagnostic codes displayed to help maintenance personnel in locating the problem.

6 - STORE BUTTON

- The STO button allows up to six preset frequencies to be selected and entered into the controls non-volatile memory.
- After presetting the frequency to be stored, push the STO button. The upper window displays the channel number of available memory (CH1 through CH6); the lower window continues to display the frequency to be stored. For approximately 5 seconds, the MEM switch may be used to advance through channel numbers without changing the preset display. Push the STO button a second time to commit the preset frequency to memory in the selected location. After approximately 5 seconds, the control will return to normal operation.

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7 - POWER AND MODE KNOB

OFF - Turns off the system.
ON - Turns on the system.
SQ OFF - Disables the receiver squelch circuits. Use this position to set volume control or, if necessary, to try to receive a very weak signal that cannot operate the squelch circuits.

8 - ANNUNCIATORS

- The COM control contains MEM (memory) and TX (transmit) annunciators.
- The MEM annunciator illuminates whenever a preset frequency is being displayed in the lower window.
- The TX annunciator illuminates whenever the VHF-22A is transmitting.

9 - PRESET FREQUENCY DISPLAY

- Displays the preset (inactive) frequency and diagnostics messages.
- The frequencies displayed on the COM control show only five of the six digits.

10 - COMPARE ANNUNCIATOR

- ACT momentarily illuminates when active and preset frequencies are being switched.
- ACT flashes if the actual radio frequency is not identical to the frequency shown in the active frequency display.

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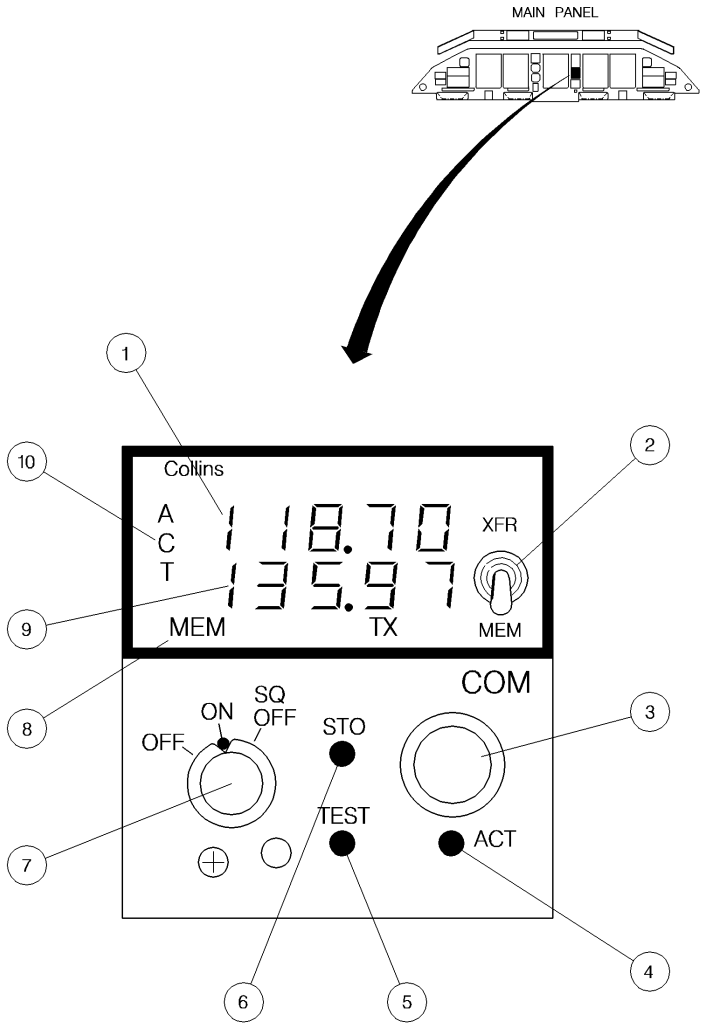

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CTL-22 VHF CONTROL PANEL

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THIRD VHF NAVIGATION/COMMUNICATIONS SYSTEM

The airplane may be equipped with a third VHF Navigation/Communications System.

The third Navigation receiver is required to perform CAT-IIIa operations. It feeds the HGS with high reliability ILS data, which are compared with those received from Navigation receiver #1. In case of a miscomparison between both signals, the HGS will not be able to engage CAT-IIIa mode.

All functions of the Collins VIR-433 System are controlled by the CTL-23C VHF Control Panel located at the main panel.

The Avionics Master DC Bus 1 supplies the third VHF Navigation/Communications System with a protective 5A circuit breaker.

THIRD VHF NAV/COM CONTROLS AND INDICATORS

1 - COM/NAV SWITCH

- This is a 2-position, spring-loaded toggle switch.
- In the UP position, the Frequency Select Knob will affect the COM display.
- In the DOWN position, the Frequency Select Knob will affect the NAV display.

2 - FREQUENCY SELECT KNOBS

- Two concentric knobs control the COM or NAV frequency displays.
- The large knob changes the three digits to the left of the decimal point in 1 MHz steps.
- The smaller knob changes the two digits to the right of the decimal point.
- Numbers roll over at the upper and lower frequency limits.

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3 - POWER AND MODE KNOB

OFF - Turns off the system.

STBY - For approximately 5 seconds COM and NAV frequency displays show the number 1 followed by eights and “TX” is annunciated.
- A short audio tone will be heard.
- A dimming self-test of the frequency displays is performed.
- The last COM/NAV frequencies are displayed

ON - Turns on the system.
- After turning ON, the equipment performs a test. In a few seconds a code is displayed. If the system is OK, “00” will be displayed. In case of any detected failure, a different code will be displayed. In this case, record the code displayed to help the maintenance personnel to locate the problem.

SQ OFF - Disables the VHF COM receiver squelch circuits. Use this position to set volume control or, if necessary, to try to receive a very weak signal that cannot operate the squelch circuits.

4 - ANNUNCIATOR

– The TX annunciator illuminates whenever the VIR-433 is transmitting.

5 - ACTIVE NAV FREQUENCY DISPLAY

– Displays the active Navigation (NAV) frequency (frequency to which the equipment is tuned) and diagnostics messages.

6 - ACTIVE COM FREQUENCY DISPLAY

– Displays the active VHF Communication (COM) frequency (frequency to which the equipment is tuned) and diagnostics messages.

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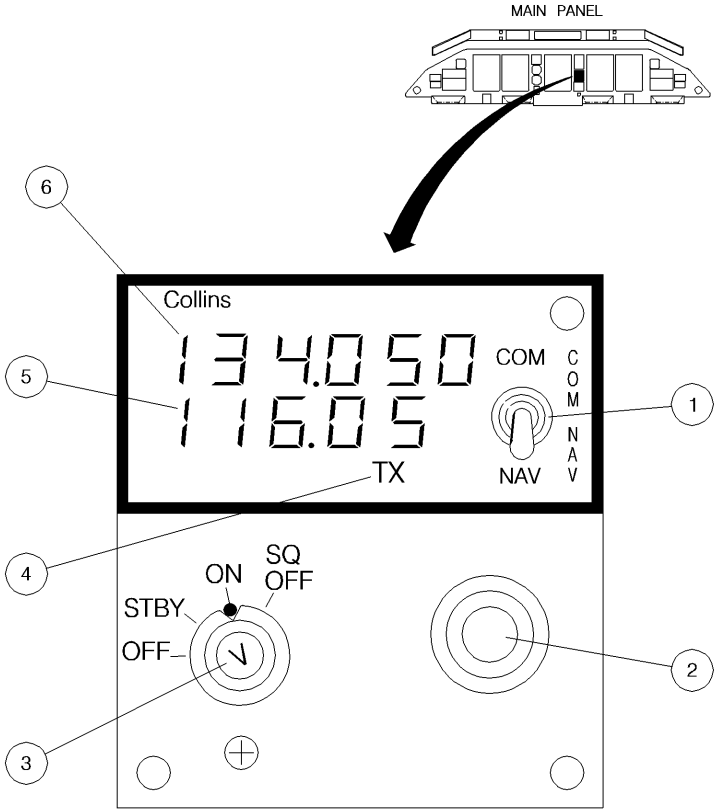

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CTL-23C VHF CONTROL PANEL

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THIRD VHF NAVIGATION SYSTEM

The airplane may be equipped with a third VHF Navigation System.

The third Navigation receiver is required to perform CAT-IIIa operations. It feeds the HGS with high reliability ILS data, which are compared with those received from Navigation receiver #1. In case of a miscomparison between both signals, the HGS will not be able to engage CAT-IIIa mode.

All functions of the Collins VIR-433 System are controlled by the CTL-32 VHF Control Panel located at the pedestal.

The Avionics Master DC Bus 1 supplies the third VHF Navigation System with a protective 5A circuit breaker.

THIRD VHF NAV CONTROLS AND INDICATORS

1 - ACTIVE FREQUENCY DISPLAY

- Displays the active frequency (frequency to which the equipment is tuned) and diagnostics messages.

2 - XFR/MEM SWITCH

- This is a 3-position, spring-loaded toggle switch.
- When held to the XFR position, the preset frequency is transferred up to the active display and the equipment retunes. The previously active frequency becomes the new preset frequency and is displayed in the lower window.
- When held to the MEM position, one of the four stacked memory frequencies is loaded into the preset display.
- Successive pushes cycle the four memory frequencies through the display.

3 - FREQUENCY SELECT KNOBS

- Two concentric knobs control the preset or active frequency displays.
- The large knob changes the digits to the left of the decimal point in 1 MHz steps.
- The smaller knob changes the digits to the right of the decimal point in 0.05 MHz steps.
- Numbers roll over at the upper and lower frequency limits.

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4 - ACTIVE BUTTON

- Push the ACT button for about 2 seconds to enable the Frequency Select Knobs to directly retune the VIR-433 (active frequency).
- The bottom window will display dashes and the upper window will continue to display the active frequency.
- Push the ACT button a second time to return the control to the normal 2-display mode.

5 - TEST BUTTON

- The self-test diagnostic routine is initiated in the transceiver by pushing the TEST button.

NOTE: For the first 2 or 3 seconds immediately after the TEST button is pushed, a 2-digit diagnostic code may be displayed in the lower window, based on the conditions existing immediately before the test button was pushed. In case of any problem detected, the 2-digit diagnostic code will remain displayed in the lower window.

- The active and preset display intensity will flash modulating its brightness from minimum to maximum indicating self-test in progress.
- If no problem was found, the active frequency display will show four dashes and the preset frequency display will show “00”.
- At the completion of the self-test program, the display will return to its normal operation if no problem occurs.
- Record any diagnostic codes displayed to help maintenance personnel in locating the problem.

6 - STORE BUTTON

- The STO button allows up to four preset frequencies to be selected and entered into the controls non-volatile memory.
- To store a frequency, toggle the MEM switch until the upper window displays the desired channel number (CH1 through CH4); rotate de Frequency Select Knobs until the lower window displays the frequency to be stored; push the STO button twice within 5 seconds. After approximately 5 seconds, the control panel will return to the normal 2-display mode of operation.

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7 - LIGHT SENSOR

- The built-in light sensor automatically controls the display brightness.

8 - POWER AND MODE KNOB

OFF - Turns off the system.
ON - Turns on the system.

9 - ANNUNCIATOR

- The NAV control contains MEM (memory) annunciator.
- The MEM annunciator illuminates whenever a preset frequency is being displayed in the lower window.

10 - PRESET FREQUENCY DISPLAY

- Displays the preset (inactive) frequency and diagnostics messages.

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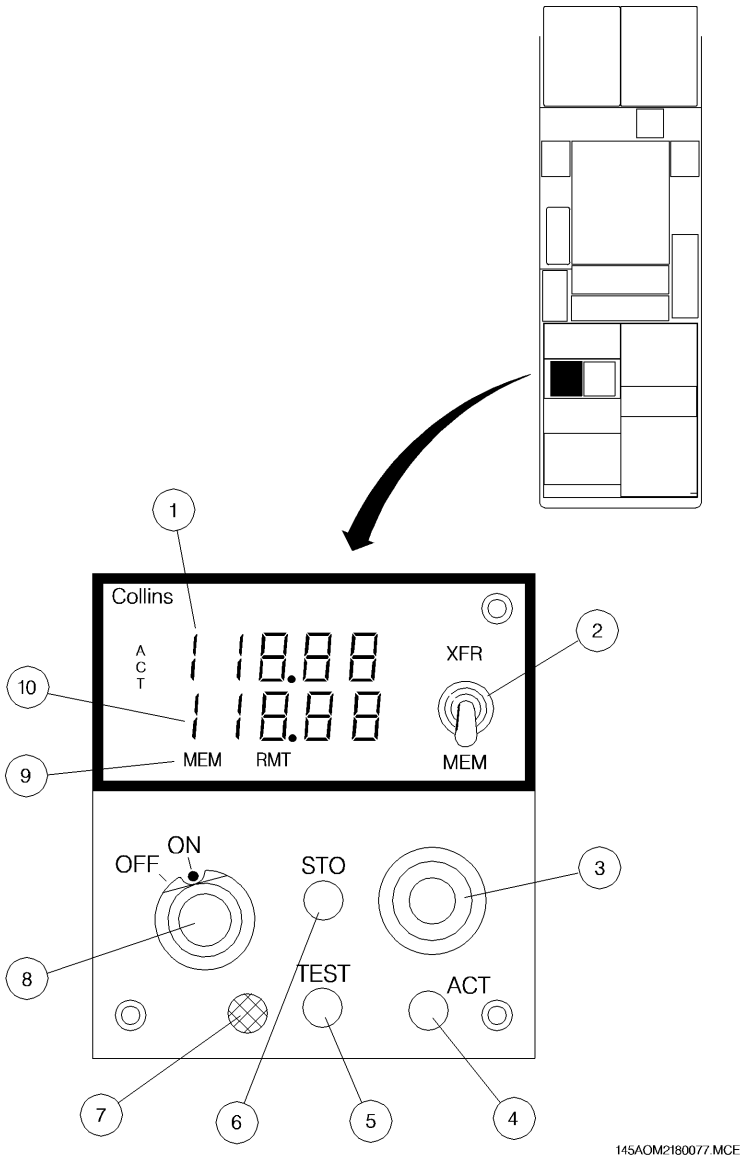

CTL-32 VHF CONTROL PANEL

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THIRD VHF COMMUNICATIONS SYSTEM

The airplane may be equipped with a third VHF communications system. All functions of the Honeywell RC-833/853 System are controlled by the RMU and by the CMU, if installed.

The active frequency will appear in the third COM window of the RMU display when operating in voice mode. The desired frequency should be selected by the pilot using the RMU select knob. Communication can be established pressing the third COM button on the audio panel and the PTT button.

When in data mode, the third VHF transmits the data on the frequency selected by the CMU unit, while on the RMU's third COM window the active frequency will display "DATA".

The third VHF has a pilot-activated self-test that performs a check of individual parts. A self-test is initiated when power is supplied to the RMU.

The Avionics Master DC Bus 1A supplies the third VHF Communications System.

THIRD VHF COM NORMAL OPERATION

In order to operate the third COM unit for voice communications, it is necessary to properly set the RMU. By pressing the PGE bezel button on the RMU, the page menu will be displayed. On the page menu the "SYS SELECT" option should be chosen. Once selected, the System Select page will be displayed containing the available COM pairs (1/2, 1/3 and 2/3), bandwidth of each COM unit and the COM3 operating mode.

After selecting the COM pair to the corresponding RMU, the change between each COM mode of the selected pair is achieved by pressing the "1/2" bezel button.

The switch between data and voice modes can be accomplished by means of the "SYS SELECT" page. The voice mode can also be entered selecting the COM3 window and turning the RMU knob. The data mode cannot be entered during a voice transmission. If a CMU is installed and connected to the third VHF, it will enter the data mode and "DATA" will be displayed in active frequency window when the third VHF starts a data transmission.

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It is possible to enter a frequency, store it, and perform a self-test using the same procedures applicable to regular COM units. The announcements also will be the same.

Should any radio component fail or a disagreement occur between the frequency selection and the subsequent transmission, the frequency or operating command will be removed from the RMU and replaced by dashes. This is an indication that the operation of that radio system is not normal.

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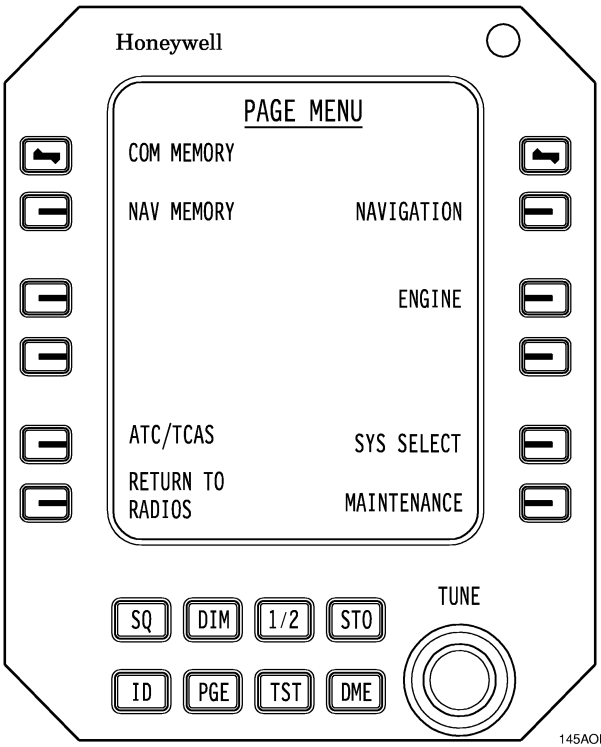

RMU PAGE MENU

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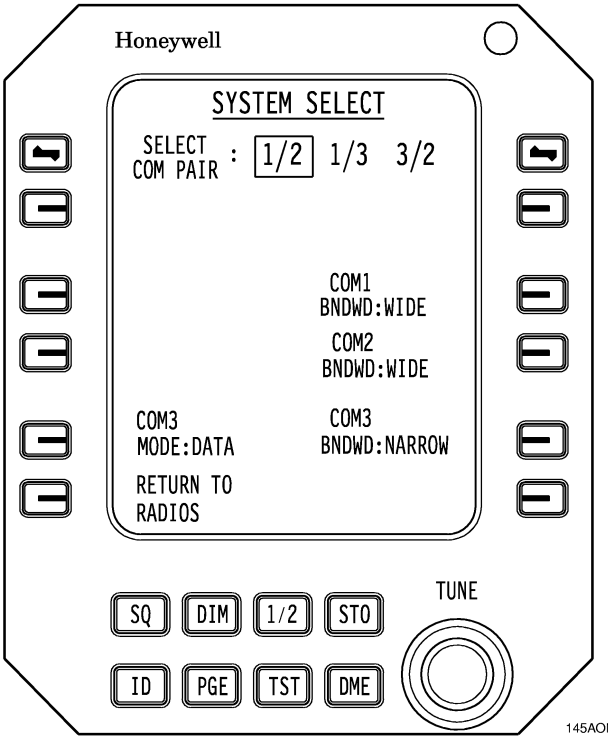

RMU SYSTEM SELECT PAGE

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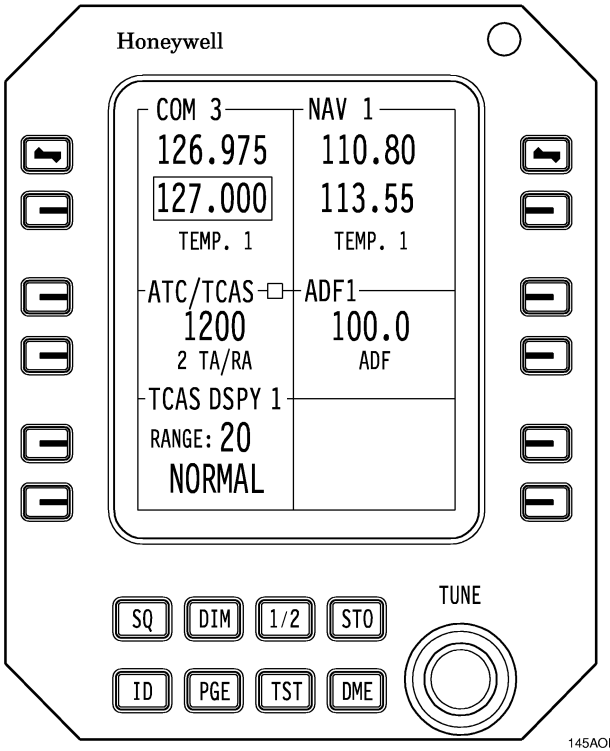

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RMU RADIO PAGE WITH THIRD VHF IN VOICE MODE

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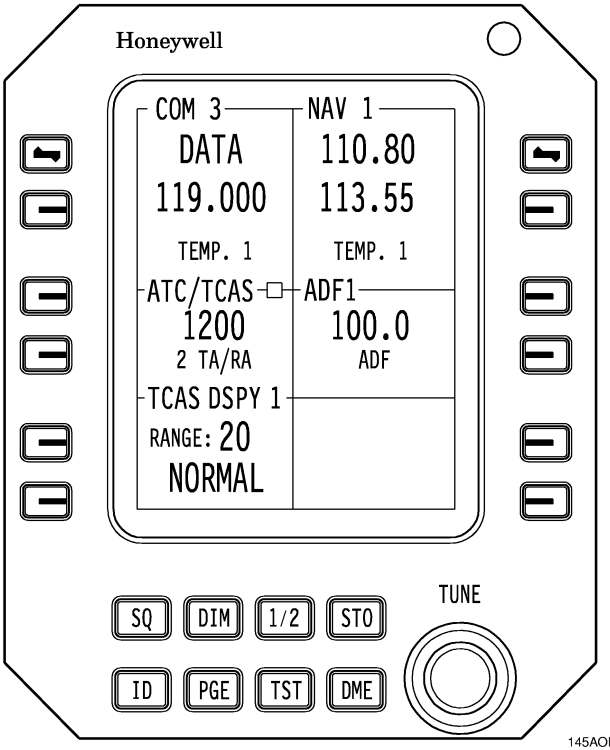

RMU RADIO PAGE WITH THIRD VHF IN DATA MODE

SELCAL SYSTEM

The Ground-to-Air Selective Calling (SELCAL) System operates in conjunction with the communication radios. The SELCAL provides continuous monitoring of a pre-set frequency, eliminating the need to continuously monitor the communication frequencies by the flight crew.

The SELCAL permits ground stations, equipped with encoding equipment, to call individual airplane by transmitting a coded signal. This coded signal will activate only one SELCAL unit to respond to that particular coded signal. In this case, a SELCAL voice message is activated through the Aural Warning Unit. Once activated, the system is reset for further monitoring by pressing the SELCAL Button, located on the Main Panel, or actuating the PTT function (on Control Wheel or glareshield panel).

NOTE: - For some airplanes the SELCAL enables only the VHF 2 operation or only the HF operation.

- SELCAL will recognize the coded signal from ground stations only if the associated system (HF or VHF2) is powered on and its frequency is adjusted to the ground station frequency.

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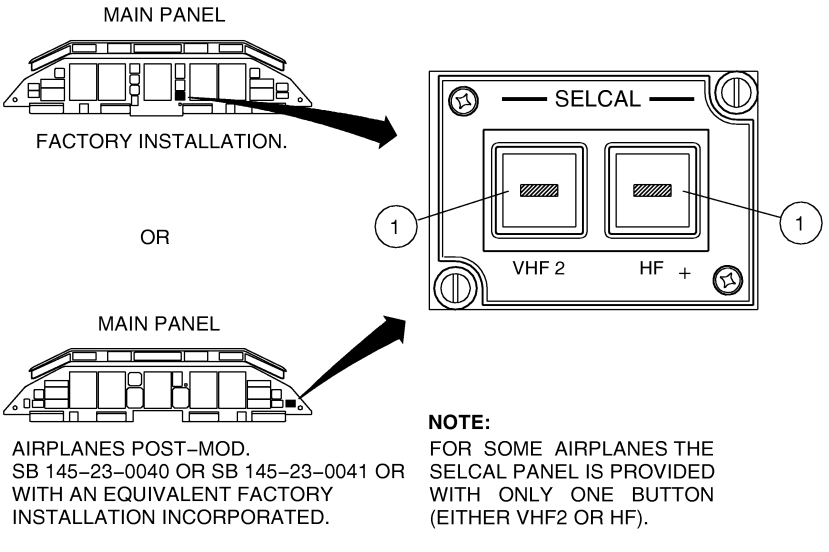
SELCAL CONTROLS AND INDICATORS

1 - SELCAL BUTTON

- A striped bar illuminates inside the associated button to alert the crew that communication is desired on VHF 2 or HF. A SELCAL voice message sounds simultaneously.
- When pressed, after a system activation, the striped bar extinguishes and the system is reset.



SELCAL PANEL

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AIRCRAFT COMMUNICATIONS ADDRESSING AND REPORTING SYSTEM (ACARS)

The airplane may be optionally equipped with an Aircraft Communications Addressing And Reporting System (ACARS), a UniLink UL-600. For additional information on functions and operations, refer to the manufacturer's manual.

The ACARS is an air to ground digital communication system that exchanges data with ground based service providers. The ACARS allows the flight crew to request and receive clearances, weather reports and messages, eliminating the need to transmit routine information through voice transmission. The system uses an assigned airborne VHF frequency to transmit and receive data from a ground station.

The ACARS is powered by 28 V DC from one of the Avionics Switched DC buses. Should a power supply failure occur, the ACARS will be inoperative, as there is no backup power supply to it.

The ACARS interfaces with other airplane systems and equipment as follows:

- FMS - The pilot - ACARS interface is accomplished through the FMS Control and Display Units (CDU).
- VHF - The VHF transmit and receive data with ground bases.
- Printer - provides a hard copy data printout.
- CMC - Sends maintenance information to the ACARS.
- Main Door - Automatically sends the inputs of door open/close to the ACARS.
- Parking Brake - Automatically sends the inputs of parking brake on/off to the ACARS.

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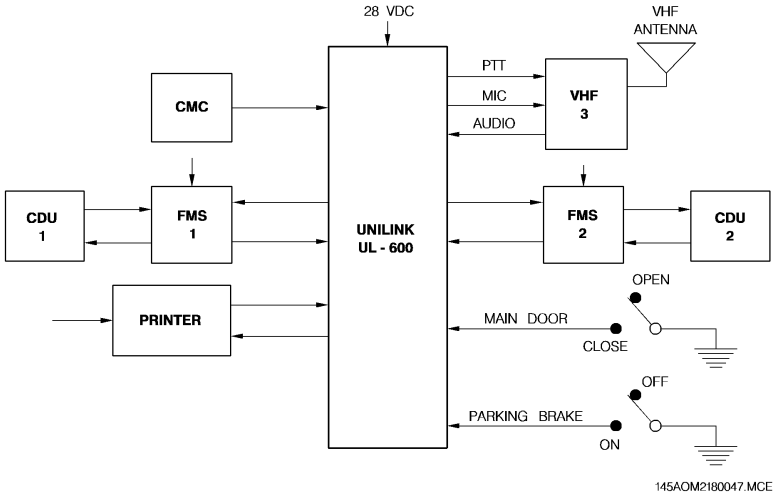

ACARS SCHEMATIC

ACARS OPERATION

The Aircraft Communications Addressing and Reporting System (ACARS) is controlled through the FMS Control and Display Units (CDU) located on the control pedestal aft panel. The CDU provides control functions and operating modes management for proper ACARS operation. The FMS provides default data to the ACARS. Many messages and requests have fields that are filled with FMS flight progress data, but the flight crew can modify data by overriding that value with a manual entry.

There are two types of ACARS data communications: ground to air via uplink messages and air to ground via downlink messages. Once a message is generated, it goes into transmission queue and when a clear channel is obtained, the message is transmitted.

Uplink messages are generated by Airline Operations Centers (AOC), ATC facilities or Data Link Service Providers (DSP). The message is processed by the ACARS or, when the message is addressed for a peripheral unit, is passed on. When an error free message has been received, the ACARS generates a positive transmission acknowledgment to the ground station, otherwise, a negative acknowledgment is transmitted and the ground system should retransmit the uplink message. The ACARS is capable of storing 25 blocks of uplink messages. When the message log is full the ACARS will delete the oldest read message. If the message log contains 24 unread messages, the ACARS will announce a full message log to the flight crew.

Downlink messages are generated by an occurred event or by the flight crew. The messages are sent to a DSP, which then addresses the messages to a designated AOC or ATC. ACARS transmits the message having the highest priority. The ground system also generates a positive acknowledgment for the message and transmits a confirmation to the airplane. Upon receiving positive acknowledgment, the ACARS deletes the message from the downlink queue. The ACARS is capable of queuing 70 blocks of downlink messages.

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ACARS CONTROLS AND INDICATORS

CONTROL DISPLAY UNIT (CDU)

1 - STATUS AND ERROR MESSAGES

MSG PRINTING - The printer has started printing an uplinked message.

UNABLE TO PRINT - The printer is unable to print an uplinked message.

DATA REQD - The message selected cannot be sent because the required data for downlink is not available.

QUEUE FULL - The message cannot be sent because the downlink buffer is full.

UNABLE TO SEND - The transmission of a message has been manually initiated but the UniLink unit has determined that the message cannot be delivered to a ground system.

2 - LINE SELECT BUTTONS

– There are five line selection buttons on each side of the Control Display Unit (CDU) that provide selection of submodes within major modes when in an indexed display.

3 - SEND PROMPT

– When the Send prompt is pressed, the message goes into queue for transmission and the status of the message appears above the SEND prompt. The message status are:

  – QUEUED - when the message is in the log.
  – SENDING - when the message is being sent.
  – SENT - when the message has been sent.

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4 - ENTER

– The ENTER Button places the cursor over the first data entrance field when the cursor is parked off the page and stores input data.

5 - UNILINK ADVISORIES

– The bottom left line select button on each ACARS page is reserved for ACARS advisories. ACARS advisories notify the crew of ACARS activity that may require user action and simplify procedures. Only one advisory will be displayed at a time in order of priority. Activation, when required, is accomplished by pressing the line selecting button. The ACARS Advisories, in the order of priority are:

FAIL - A new failure has been detected or has been reported to ACARS and has not yet been displayed on the status page.

ACKNOWLEDGE - The uplinked message being displayed requires crew acknowledgment. Activation will send an acknowledgment message to the ground.

SELCAL - A SELCAL request has been made. Activation will display the SELCAL page.

NEW MSG - A new message has been uplinked. Activation will access the latest unread message.

6 - PREV/NEXT BUTTONS

– PREV - Changes the current page to the previous page.
– NEXT - Changes the current page to the next page.

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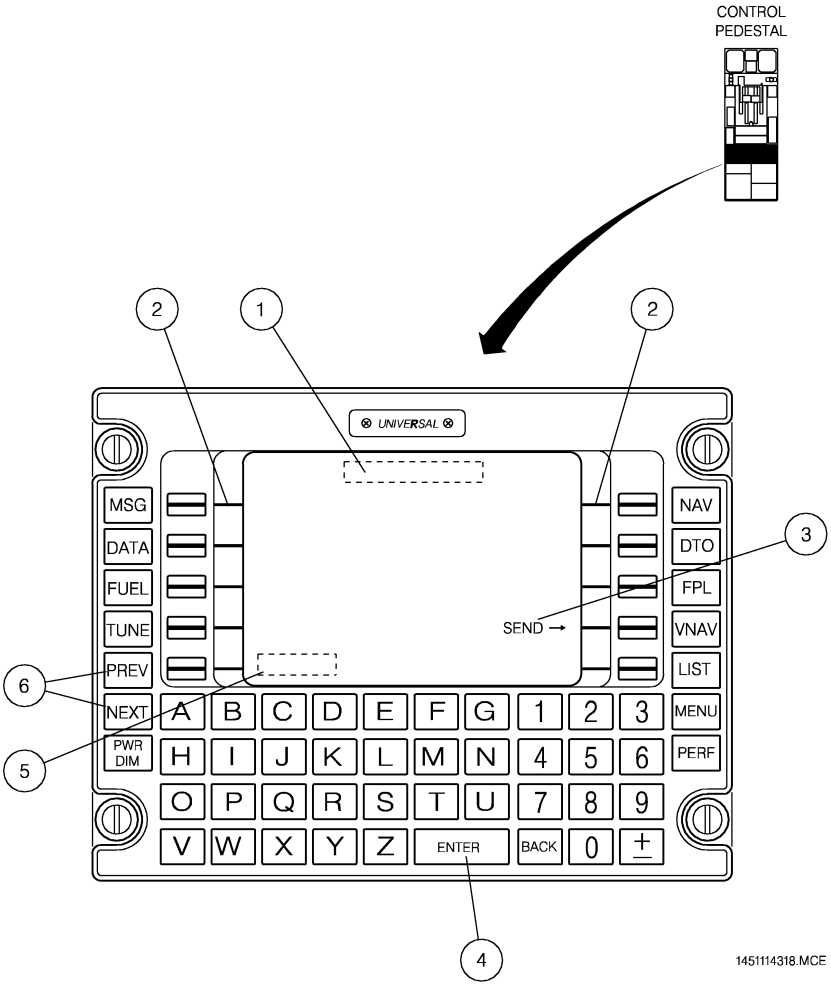

ACARS FMS CONTROL PANEL

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ACARS PRINTER CONTROLS AND INDICATORS

The ACARS may be optionally equipped with a Printer. The Printer will provide a hard copy printout of data collected by the ACARS including uplinked printer messages. For additional information on functions and operations, refer to the manufacturer's manual.

1 - PAPER ADVANCE

- When pressed, advances paper.

2 - SELF-TEST

- When pressed, produces a test pattern, comprising full character complement of printer, and activates both external aural/visual alert functions. If button is pressed and held, printer will successively print 40-, 60-, 80-column test patterns. Otherwise, each time button is pressed printer will print next test pattern in sequence.

3 - POWER ON

- A green light indicator illuminates when power is on.

4 - ALERT RESET

- Will reset the aural/visual alert function and causes Printer Busy indicator to go out.

5 - PRINTER BUSY

- An amber indicator illuminates upon receipt of first text character and will remain on until the paper has advanced three lines beyond tear-off edge. The indicator will flash continuously after paper advance until the reset button is depressed.

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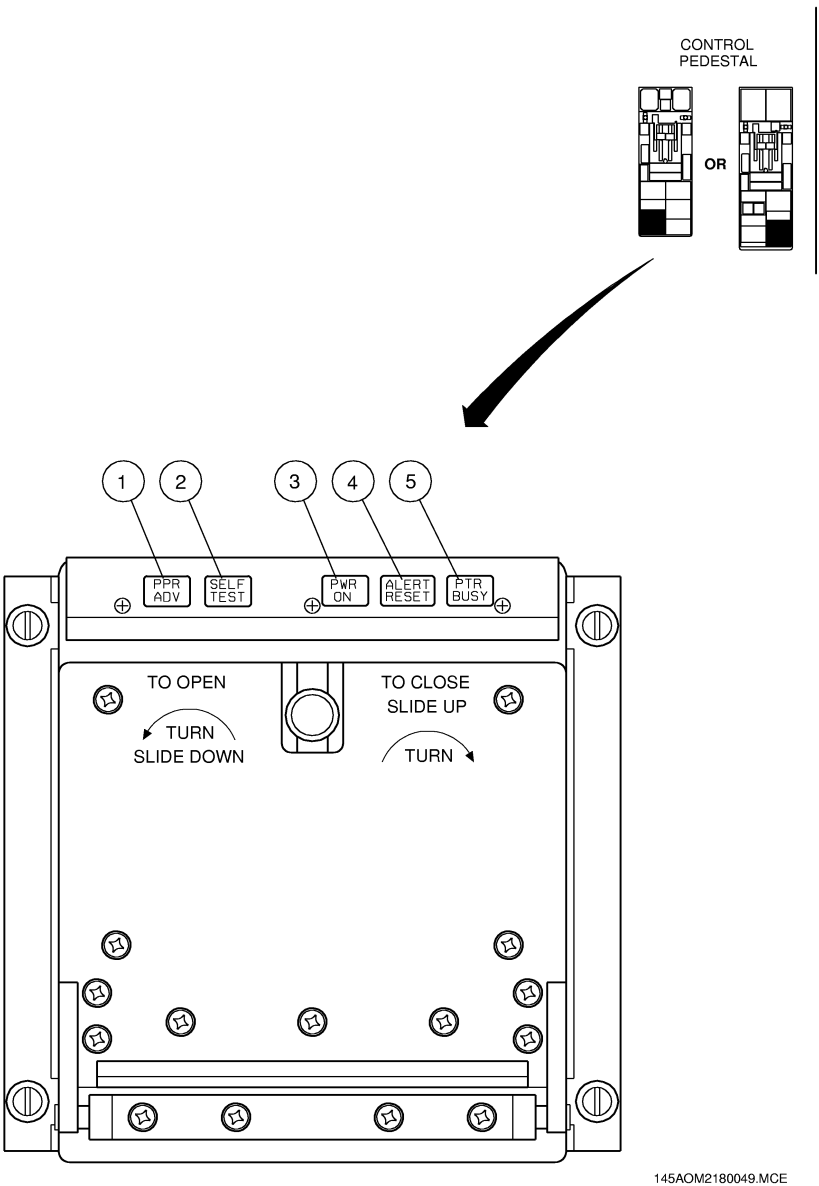

PRINTER PANEL

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HONEYWELL MARK III COMMUNICATIONS MANAGEMENT UNIT (CMU)

The airplane may optionally be equipped with Honeywell's Mark III Communications Management Unit (CMU). Additional information on functions and operations can be obtained in the manufacturer's manual.

The Mark III Communications Management Unit (CMU) is an airborne communications router that supports data link service access between the following aircraft data link applications and their corresponding ground service providers:

- Aeronautical Operational Communication (AOC)/Airborne Flight Information System (AFIS).
- Controller Pilot Data Link Communication (CPDLC).
- Automatic Dependent Surveillance (ADS).

The CMU is based on ARINC Characteristic 758 and can be upgraded, by software download, to an Aeronautical Telecommunications Network (ATN) router when protocols and application infrastructure are available to support Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM) data link applications. The CMU provides an Aeronautical Radio, Inc. (ARINC) 724B compatible data link router through which all character-oriented data are transmitted to and from the ground Aircraft Communications Addressing and Reporting System (ACARS) network.

There are several levels of user interfacing. The CMU´s operational crew interface is provided through a Control Display Unit (CDU), printer, and data loaders.

Access to the ground network is provided via several ACARS air-ground sub-networks listed below:

- Satellite Communications (SATCOM).
- Very High Frequency (VHF).
- High Frequency (HF).
- Mode-S (future).
- Ultrahigh Frequency (UHF) (future).

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The CMU functions as a router, with growth capacity as a gateway and an end system for hosting data link applications. As a gateway, the CMU can implement future protocols and provide the appropriate protocol conversions to support airborne systems whose architectures do not allow updates to future communication protocols but host the data link applications.

Currently, the CMU is compliant with ARINC 758 level 0, which means that the CMU is able to perform ACARS functions. The other ARINC 758 levels will be available in the equipment as soon as the software upgrades are released by the manufacturer.

The CMU is powered by the Avionic Switched DC Bus 1B.

The CMU interfaces with other airplane systems and equipment through the following equipments:

– FMS	The pilot → CMU interface is accomplished through the Honeywell FMS (NZ-2000) Control and Display Units (CDU). It may be utilized with single or dual FMS installation.
– VHF #3	Transmit and receive data with ground bases.
– Printer	Provides a hard copy data printout.
– Portable Data Loader	Used to upload and to download information, customized configurations and messages.
– CMC	Sends maintenance information to the ACARS.
– OOOI	Used to inform if the airplane is in one of the following situations: OUT - parking brake released and doors closed; OFF - airplane lift-off (Weight Off Wheels); ON - airplane has landed (Weight On Wheels); IN - parking brake applied and doors opened.

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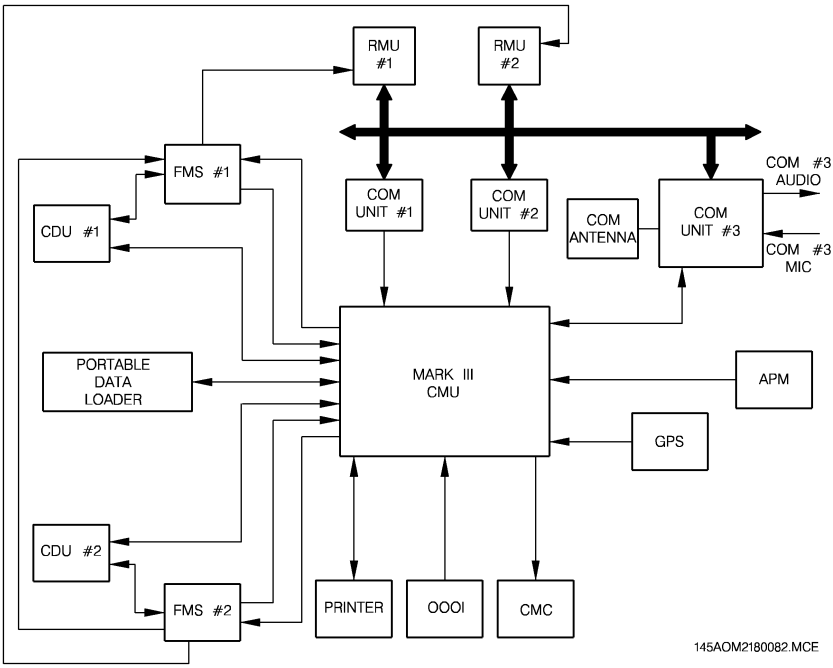

CMU ARCHITETURE

CMU NORMAL OPERATION

Pilot interface is accomplished through the FMS Control and Display Unit (CDU). Data is entered in any field highlighted by a cursor. Generally, when accessing a FMS page, the cursor will park off the page. Selecting the ENTER key will place the cursor over the first enterable field on the page. Data is then entered into the field with the alphanumeric keys.

In some situations, flight progress and related data from the FMS will prefill into the field but it is possible to change that data by overriding that value with a manual data entry.

When SEND is pressed, the message goes into a queue for transmission. If the aircraft is flying over a region or is grounded at an airport not covered by a DSP (Data Link Service Provider) reception or transmission of messages to or from a ground station will not be successful.

Communications are eased by the use of the Main Menu page and several submenus to quickly access each function or service available.

CMU ABNORMAL OPERATION

The CMU has a Built-In Test (BIT) function that contains a continuous monitor and self-test monitor. The continuous monitor function monitors critical system parameters and record faults found during normal operation.

The self-test monitor function is activated upon command from the system controller, external discrete input, front test panel switch, maintenance computer or a power-up event. The self-test monitor will exercise various system functions, record faults found, and annunciate the results of the test.

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CMU CONTROLS AND INDICATORS

CONTROL DISPLAY UNIT (CDU)

1 - LINE SELECT BUTTONS

– There are four line selection buttons on each side of the Control Display Unit (CDU) that provide selection of submodes within major modes when in an indexed display.

2 - PREV/NEXT BUTTONS

- PREV - Changes the current page to the previous page.
- NEXT - Changes the current page to the next page.

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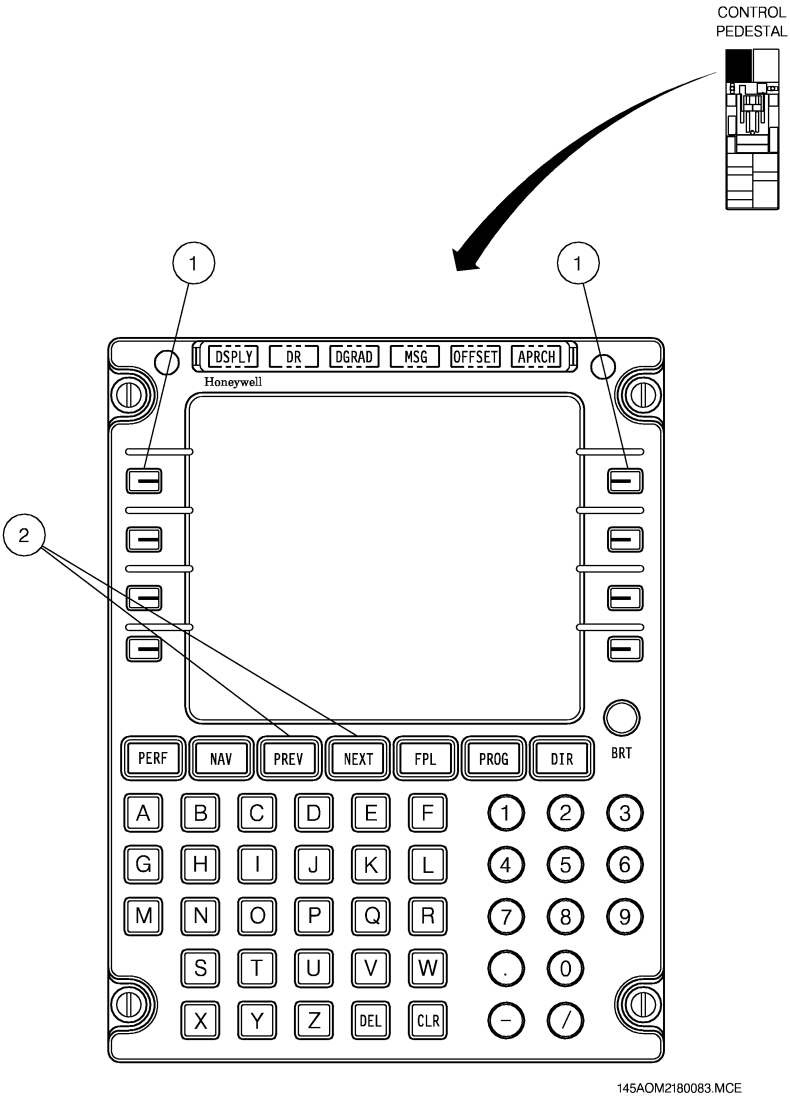

CMU FMS CONTROL PANEL

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PRINTER CONTROLS AND INDICATORS

The CMU may be optionally equipped with a Printer. The Printer will provide a hard copy printout of data collected by the CMU including uplinked printer messages. For additional information on functions and operations, refer to the manufacturer's manual.

1 - PAPER ADVANCE

- When pressed, advances paper.

2 - SELF-TEST

- When pressed, it produces a test pattern, comprising full character complement of printer, and activates both external aural/visual alert functions. If button is pressed and held, printer will successively print 40-, 60-, 80-column test patterns. Otherwise, each time the button is pressed, printer will print the
- next test pattern in sequence.

3 - POWER ON

- A green light indicator illuminates when power is on.

4 - ALERT RESET

- Will reset the aural/visual alert function and causes Printer Busy indicator to go out.

5 - PRINTER BUSY

- An amber indicator illuminates upon receipt of first text character and will remain on until the paper has advanced three lines beyond tear-off edge. The indicator will flash continuously after paper advance until the reset button is depressed.

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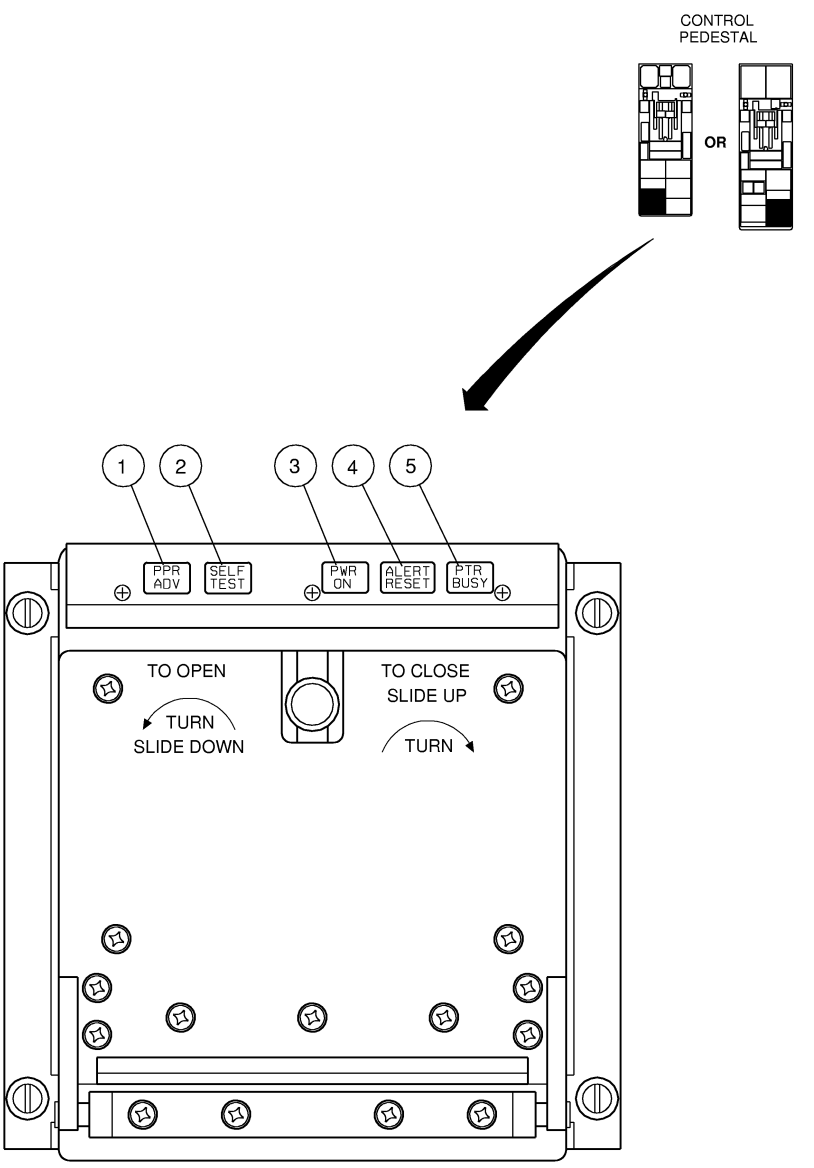

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COCKPIT VOICE RECORDER

The Solid State Cockpit Voice Recorder System records all audio signals transmitted and received by the crew members via the Digital Audio Panels, and any audible noise in the cockpit, through an area microphone installed below the standby compass.

The CVR is in operation whenever the essential DC Bus 2 is energized, storing the last 2 hours of recorded information in a solid state crash survivable memory unit. Any data older than 2 hours is automatically overwritten by the most recent audio inputs.

A crash impact switch cuts off power to the CVR immediately after experiencing a 5 G impact in order to preserve the recorded data.

The CVR also incorporates an Underwater Locator Beacon (ULB). Powered by a dedicated battery, the ULB starts transmitting an acoustic signal in the 37.5 kHz frequency once it senses contact with water, thus easing wreckage site location of a submerged airplane. The signal is transmitted during approximately 30 days.

A signal from the captain's clock allows timing correlation between CVR and FDRS.

SELF TEST

When the TEST button is pressed the unit performs a functional self-test to verify the integrity of the system. A successful self-test results in a one-second activation of the status LED on the control panel and a two-second tone (800 Hz for Honeywell equipment and 620 to 660 Hz for L3 equipment) that may be heard from a headphone plugged to the CVR control panel jack. If a failure is detected during the test, the status LED will not be activated and the aural tone will not be heard.

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ERASE FUNCTION

Previously recorded CVR data may be made unavailable if the ERASE button on the CVR control panel is pressed, provided the airplane is on the ground and with the parking brake applied. In this case, only the CVR manufacturer (for Honeywell equipment) will be able to recover the “erased” data.

When the ERASE button is pressed (for 2 seconds for L3 equipment), a two-second 400 Hz tone may be heard from a headphone plugged to the CVR control panel jack, confirming that the erase command was successful.

COCKPIT VOICE RECORDER CONTROLS AND INDICATORS

1 - ERASE BUTTON

- Erases previously recorded data from the crash survivable memory.
- Function is available only on the ground, with the parking brake applied.

2 - TEST BUTTON

- Tests system integrity.
- A successful self-test results in a one second activation of the status LED.
- In case of failure, the status LED on the control panel is not activated.

3 - HEADPHONE JACK

- Allows plugging a headphone to monitor the test tone, the erase tone and recorded audio signals.

4 - STATUS LED

- Illuminates during one second to indicate a successful test.

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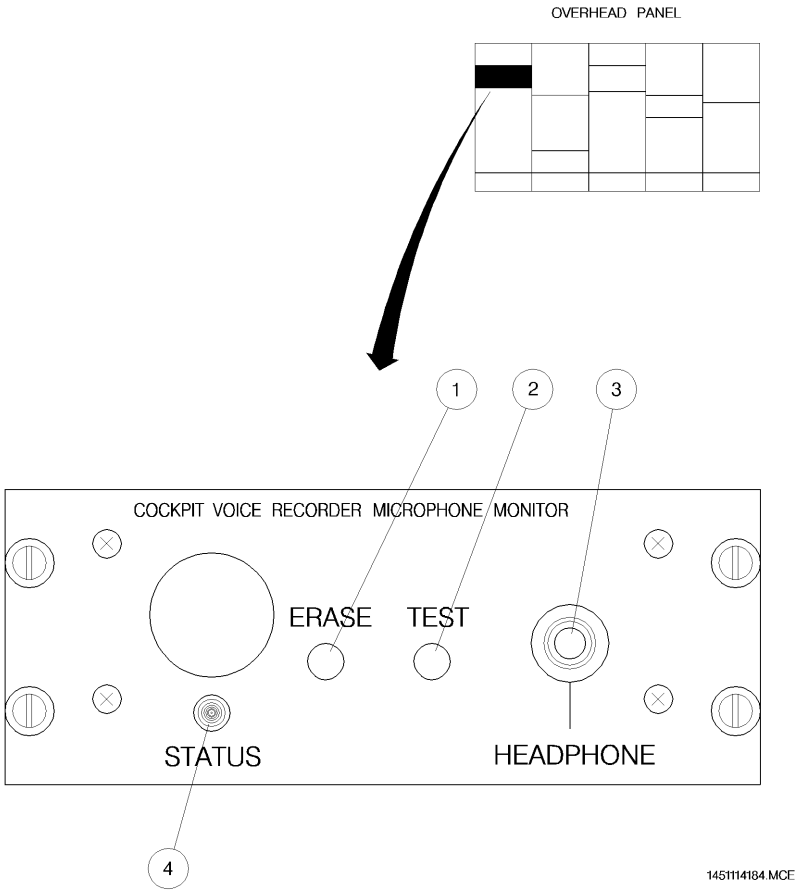

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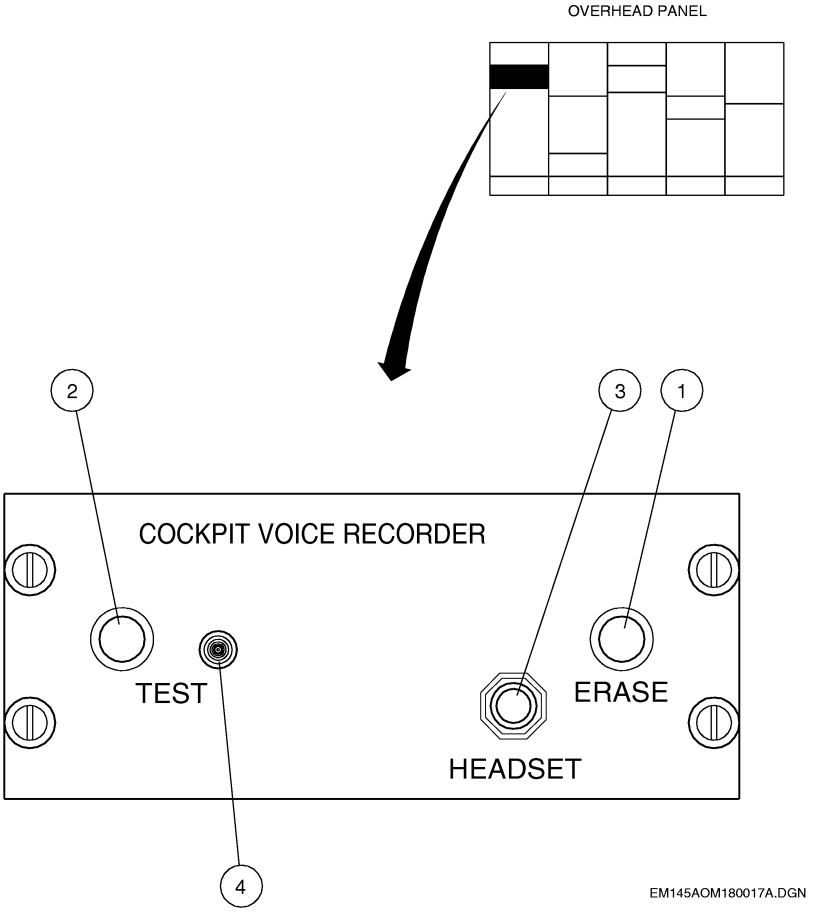
HONEYWELL COCKPIT VOICE RECORDER PANEL



L3 COCKPIT VOICE RECORDER PANEL

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PASSENGER ADDRESS SYSTEM

The Passenger Address System (PAS) provides communication between cockpit and flight attendants, and announcements from cockpit or flight attendants to the passenger cabin.

The PAS also interfaces with the audio entertainment and prerecorded announcement systems to provide music and safety briefing/flight information through the passenger loudspeakers.

The following functions are available through the PAS:

- Voice announcement transmission (speech) to the PAX cabin.
- Call function from captain, copilot and observer to flight attendant and vice-versa through chime tone.
- Call function from passenger to attendant, through chime tone.
- Chime tone for NO SMOKING and FASTEN SEAT BELTS signals.
- Interface to boarding music and passenger briefing.

The PAS component responsible for sending/receiving signals to/from cockpit, attendant handsets, and for passenger entertainment and prerecorded announcement systems is the Passenger Address Amplifier (PAA), located in the airplane electronic compartment.

The PAA establishes the priority among the input signals from the several sources and then drives these signals to the proper cabin loudspeakers. The PAA also provides the logic for generation of the aural and visual annunciators, chimes for attendant, passenger and cockpit calls, and for NO SMOKING and FASTEN SEAT BELTS signals.

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PASSENGER ADDRESS OPERATING MODES

MUTED MODE

The Muted Mode is automatically selected during power up and when no other mode is selected. In this mode there will be no chimes, no lights and no microphones enabled during power up or power supply transients.

PILOT-TO-PASSENGER MODE

The Pilot-to-Passenger Mode is enabled by momentarily pressing the Passenger Button, labeled PAX, on the Digital Audio Panel. When this mode is enabled the captain, copilot or observer may transmit announcements to the passengers, by pressing the respective PTT/HOT-MIC switches. The priority of the transmission through the system is the following: captain, copilot, observer. There are no chimes in this mode.

ATTENDANT-TO-PASSENGER MODE

The Attendant-to-Passenger Mode is enabled by pressing the PA Button in the Attendant Handset. When this mode is enabled the flight attendant may transmit announcements to the passengers, by pressing the Attendant Handset PTT. If the PAX Button is selected on the Digital Audio Panel in the cockpit, besides listening the attendant announcements in the cockpit speaker or headphones, the pilots and observer take priority over the attendant announcements.

Some airplanes have a knob installed in the main panel or in the control pedestal which allows to adjust the volume of the PA announcements in the flight deck.

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PASSENGER ADDRESS CONTROLS AND INDICATORS

INTERPHONE CONTROL UNIT

1 - CABIN BUTTON

- Allows interphone communication between pilots and flight attendant.
- Generates a “ding-dong” chime through the Passenger Address Amplifier and illuminates the PILOT light on the Attendant’s Call Panel.
- A striped bar illuminates inside the button to indicate that it is pressed.

2 - CABIN EMERGENCY BUTTON

- Provides the same functions as the Cabin Button, except that it illuminates the Pilot Emergency Light, labeled EMER PILOT, on the Attendant’s Call Panel.
- A striped bar illuminates inside the button to indicate that it is pressed.

3 - BACKUP INTERPHONE BUTTON

- Allows interphone communication between pilots and attendant, in case of normal mode failure.
- Illuminates CABIN and CAB EMERG buttons on the ICU, and PILOT and EMERG PILOT annunciators on the Attendant’s Call Panel.
- A striped bar illuminates inside the button to indicate that is pressed.

4 - FLIGHT ATTENDANT CALL BUTTON

- Generates a chime in the passenger address, to call a flight attendant.
- During backup operation generates a tone in the chime located in the passenger cabin ceiling, near the emergency exits.

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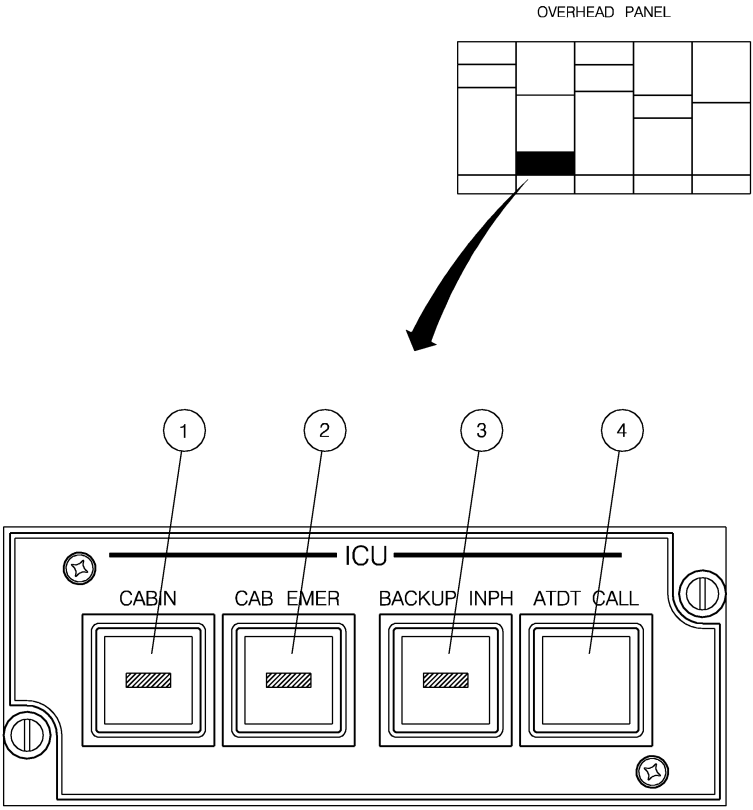

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INTERPHONE CONTROL UNIT

ATTENDANT HANDSET

1 - PRESS TO TALK BUTTON

- When pressed allows flight attendant to address the passengers, or communicate with the other flight attendant station or pilots, depending on the channel selected.

2 - BUTTONS AND ANNUNCIATORS

- When pressed and according to the selected channel it allows the flight attendant to address the passengers (PA), or to communicate with the other attendant station (ATTD) or pilots (PILOT and EMER PILOT). The associated annunciator illuminates to indicate which button is pressed.
- Annunciator colors:
  - ATTD, PILOT and PA: green.
  - EMER PILOT: red.

3 - BACKUP INTERPHONE BUTTON

- When pressed, establishes a permanent communication between pilots and flight attendant, in case of normal mode failure.
- When pressed, BKUP INPH, EMER PILOT, and PILOT annunciators of the station which commanded the backup mode remains illuminated.
- BKUP INPH annunciator is amber.

ATTENDANT'S CALL PANEL

Refer to Section 2-2 – Equipment and Furnishings.

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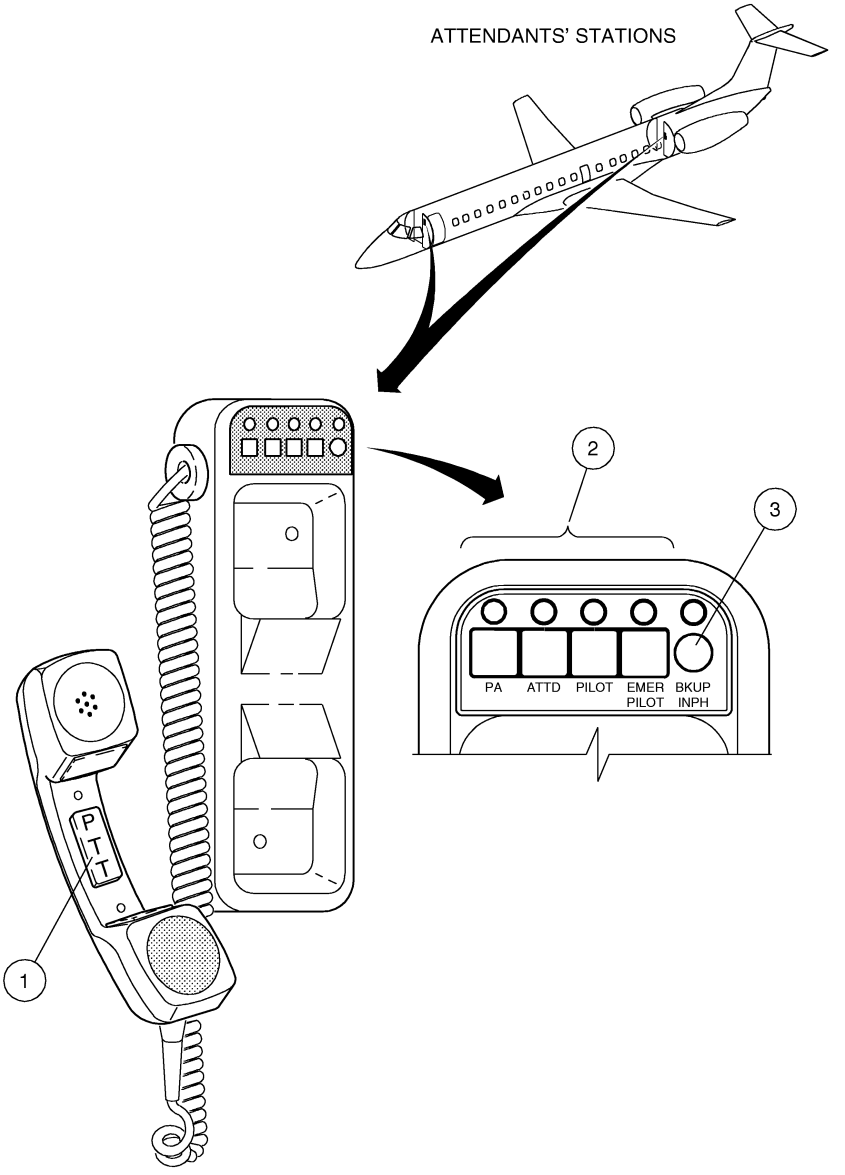

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ATTENDANT HANDSET

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SATCOM SYSTEM

INTRODUCTION

The airplane may be equipped with a TT-3000 Series Aero-M SATCOM, that is capable of performing global communication through the INMARSAT satellite network. The system provides one channel voice 4800 BPS AMBE coding, fax 2400 BPS on 2 wire RJ-11 type interface, circuit mode data 2400 BPS, and can be interfaced with a PC via a RS-232 serial port for data communication.

NOTE: The information presented in this manual has the purpose of assisting the user to perform basic operations on the SATCOM system. For advanced operation refer to the manufacturer's user manual.

SATCOM OPERATION

When the Aero-M system is powered-up, after a short pause the handset will display the initialization page.

Once that has ocurred, the display will shift to the Wait for GPS page. This means that the system is acquiring GPS (Global Positioning System) satellite signals and determining the systems position.

The display will then shift to the Wait for NCS (Network Coordinating Station) page, indicating that the system is attempting to logon to a satellite network and acquire a bulletin board.

Finally, the display will then shift to the Logon Display and the user is now ready to proceed with Pre-Operational Requirements.

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PRE-OPERATIONAL REQUIREMENTS

Before attempting to initiate or receive a call, the user must verify that the Aero-M System has logged on to the satellite network. There are two indications that the system has power applied and the system has logged onto the satellite network:

- Both the left and green handset LED indicators will be illuminated and the signal strength indicator will display a measurement;
- The Aero-M logon display will appear in the handset display.

The top line of the display will indicate which Ocean Region Satellite is in use followed by a colon. This will be:

- AORW : Atlantic Ocean Region West Satellite;
- AORE : Atlantic Ocean Region East Satellite;
- POR : Pacific Ocean Region Satellite;
- IOR : Indian Ocean Region Satellite.

NOTE: The Aero-M system requires the user to determine the ocean region in which the aircraft is currently located. The user must enter the user menu and setup the system for that ocean region.

SELECTION OF OCEAN REGION SATELLITE

From Logon display, or Wait for NCS display, enter Area Menu, by pressing "2nd" and "3" keys. The "∗" indicates the current ocean region selected. Scroll through menu to the correct region, using the "↓" key. Select correct ocean region pressing the "OK" key.

The display will revert to Wait to NCS page and when NCS is acquired the display will return to Logon Display with the new ocean region used.

After the colon, the display will indicate what Land Earth Station (LES) is in use for routing your calls. If the LCD display is on another display, you can always return to the Logon display by pressing the "Exit" key repeatedly to step back from MENU operation. Many functions require starting from the Logon display.

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OPERATION

This section contains information on types of calls and procedures for dialing and completing calls.

GROUND CALLS

All ground-to-air calls must be placed as international calls. Each INMARSAT Satellite has an assigned three digit code that is, for all practical purposes, the country code for the satellite. It is necessary to first dial the international access code that is used in your country, followed by the satellite country code and the number issued by the Ground Service Provider for the Airborne Earth Station (AES). In some countries, call routing by the Public Switched Telephone Network can be routed to the “870” country code. “870” is the Single Network Access Code (SNAC). SNAC is a special country code that contacts the Network Coordinating Station for INMARSAT Aero-M services and automatically routes the call to the satellite that Airborne Earth Station is logged on to.

In countries where calls do not route to 870, it is necessary to manually include the appropriate country code for the INMARSAT Satellite that is serving the Airborne Earth Station. If the incorrect satellite/country code is dialed, an automatic response will inform that the station you are calling is not currently logged onto this ocean region. If you are sure the AES is logged on to a satellite, you can redial the number using another satellite country code in order to contact the AES.

Country codes for the INMARSAT Satellites:

AREA / OCEAN REGION		INTERNATIONAL ACCESS CODE
Single Network Access Code	SNAC	870
Atlantic Ocean Region East	AORE	871
Pacific Ocean Region	POR	872
Indian Ocean Region	IOR	873
Atlantic Ocean Region West	AORW	874

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VOICE CALLS

- Receiving calls

  If a handset is receiving a call, the handset will ring and the Yellow Ring LED will flash. To establish a connection the user can either press the Toggle Hook key (key 5 on HANDSET KEY FUNCTIONS figure) or lift handset from cradle. When a connection has been established the Yellow Ring Led will be illuminated.

- Standard telephone calls

  Dial a telephone number by entering call prefixes, country and area codes and number, then press the “#” key or the Toggle Hook key (key # 5 on HANDSET KEY FUNCTIONS figure) in the handset keypad. To finish the call press the the Toggle Hook key (key # 5 on HANDSET KEY FUNCTIONS figure).

- Calls from handset #2 (2-wire auxiliary handset)

  Handset #2 can initiate short code, service code , handset to handset, as well as standard telephone calls. Follow the procedures described for handset #1 to initiate these types of calls from handset #2.

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SATCOM CONTROLS AND INDICATORS

The TT-3000 Series Aero-M SATCOM System uses the TT-5621A Handset as the main user interface. The handset contains a keypad with 21 separate function keys, a 2X12 character Liquid Crystal Display (LCD), four indicator LEDs, and a volume control.

The handset allows the user to:

- Navigate the user menu;
- Place and receive calls;
- Save and recall phonebook entries;
- Configure system parameters;
- View phone log;
- Monitor system operations;
- View system errors as they occur.

HANDSET KEYS FUNCTIONS

The handset keypad consists of 21 keys (12 numeric and nine function keys). These keys are designed to perform multiple functions, that are dependent on the selected mode.

The handset has three modes that determine the function of the keys:

- Normal mode: keys perform their primary functions;
- Alpha mode: keys perform alphanumeric functions;
- 2nd mode: keys perform their alternate functions.

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The following table lists all the keys and defines their functions:

	MODE		
Figure Number	NORMAL	ALPHA	2nd
1	Accept selection		
2	Toggles handset audio mode		
3	Enable alpha mode	Disable alpha mode	Delete entry
4	Move one selection up		Edit entry
5	Toggle hook		
6	Move one selection down		Mute
7	3		
8	2		
9	6		
10	5		
11	9		
12	8		
13	#		
14	0		
15	*		
16	7		
17	4		
18	1	- ? ! , . : " ' $ ( ) + / 1	Access user menu
19	Enable 2nd mode	Enable 2nd mode	Disable 2nd mode
20	Delete/Back space one character / Delete display (hold 2 seconds)		Insert entry
21	Exit menu / Cancel selection		

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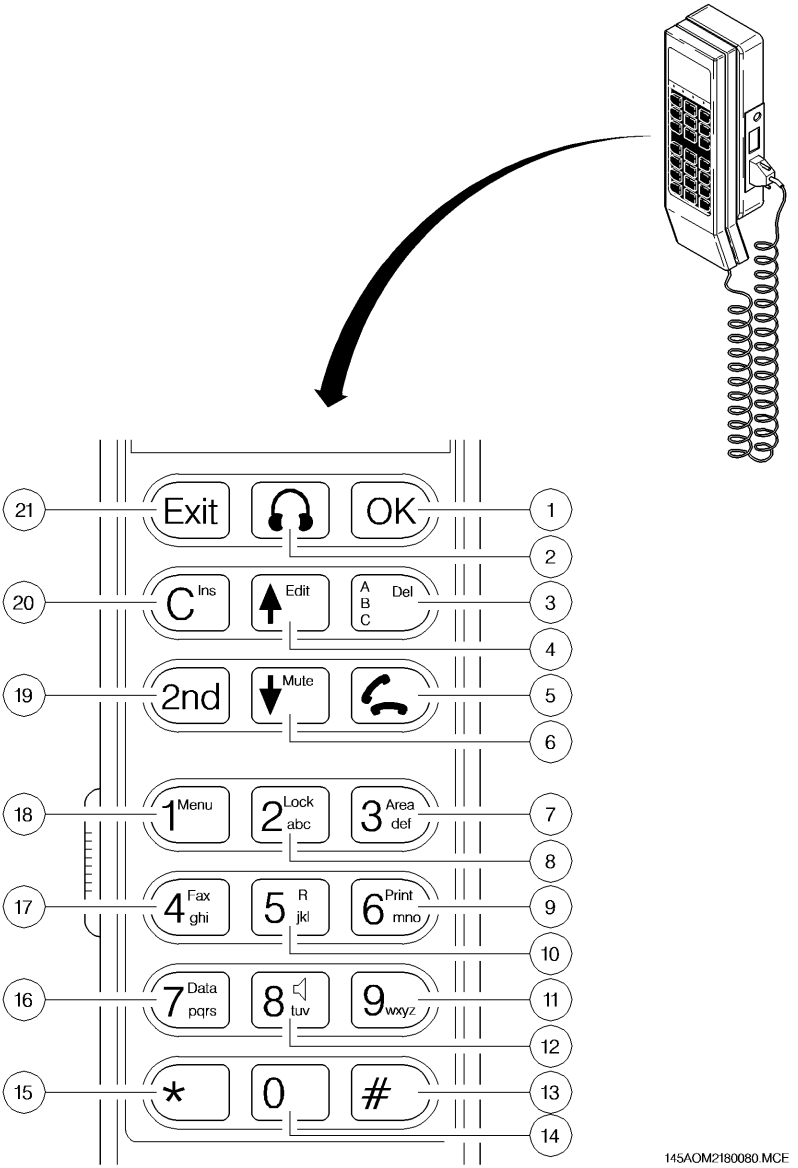

HANDSET KEYS

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HANDSET LCD DISPLAY

The handset uses a LCD to display all data. The LCD is a 2X12 character alphanumeric display. Aditionally, the LCD will display ten symbols to indicate operating status and alert the user of any errors that may occur. The following table lists all display symbols, referring to the figure in the next page, and defines their meaning.

FIGURE NUMBER	NAME	DESCRIPTION
1	More entries above flag	Indicates that additional entries are available above and can be displayed by pressing the “Edit” key
2	New AES messages flag	A recorded MES message for the SDU/SIM is waiting at the LES
3	Signal strength indicator	Indicates the strength of the signal being received by the system.
4	Hook off flag	Indicates that a call is in progress
5	Speaker active flag	The speaker in the cradle is active
6	Toggle field flag	Indicates that pressing “↑” or “↓” keys can change the current selection
7	Alpha mode flag	Indicates that the “Del” key was pressed and the alpha mode is active. The next key pressed will perform its alpha mode function

Continued

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FIGURE NUMBER	NAME	DESCRIPTION
8	Security enabled flag	Indicates that the handset has been locked and can only be accessed by entering a valid PIN code.
9	2nd mode flag	Indicates the “2nd” key was pressed and the 2nd mode is active. The next key pressed will perform its alternate function.
10	More entries below flag	Indicates that additional entries are available below and can be displayed by pressing the “↓” key .

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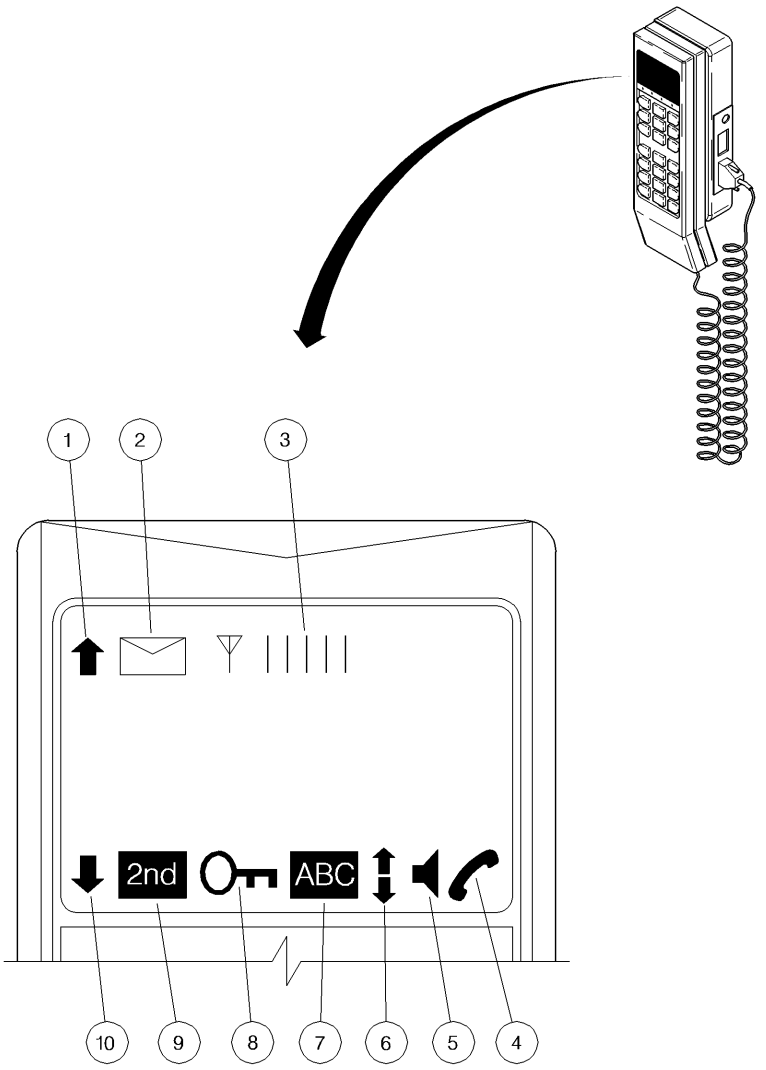
The figure below shows all the symbols found on the handset display.



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HANDSET DISPLAY

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HANDSET LED INDICATORS

The handset user four colored LEDs as indicators. These LEDs alert the user of the following indications:

FIGURE NUMBER	LED	DESCRIPTION
1	Left Green	Indicates power to handset
2	Right Green	System is logged or is logging into the satellite network. When on, the antenna strength indicator will show a measurement
3	Yellow	When on, indicates call in progress, the LED will flash when a call is received
4	Red	Illuminates when an error has occurred in the system

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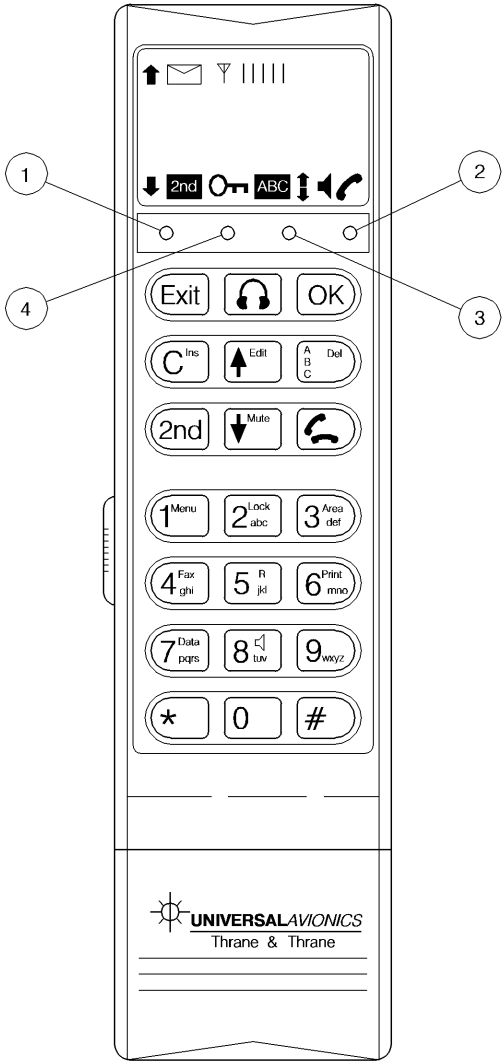

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HANDSET LED INDICATORS

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ATTITUDE AND HEADING REFERENCE SYSTEM (AHRS)

On EMB-145/135 airplanes, the equipment responsible for generating attitude and heading data is the Attitude and Heading Reference System (AHRS). Optionally the AHRS may be replaced by the Inertial Reference System (IRS) that, aside generating attitude and heading data, may still provide position information to the Flight Management System (FMS).

There are two types of AHRS installed on EMB-145/135 airplanes: the AH-800 and the AH-900.

Regardless of version, the airplane is equipped with two identical and independent units, identified as AHRS 1 and AHRS 2.

The interface of the AHRS with other systems and equipment of the airplane is the following:

- Air Data Computers (ADC 1 and ADC 2): The AHRS 1 and AHRS 2 receive true airspeed information from the ADC 1 and ADC 2 respectively, to improve the precision of the computed navigation data.
- Integrated Computers (IC1 and IC2): The AHRS 1 and AHRS 2 provide pitch, roll and heading information to the respective PFD, and heading information to the respective MFD, through the IC-600s. Data is transmitted separately to both sides, to ensure that single IC failure does not compromise the data path.
- Radio Management Units (RMU 1 and RMU 2): The AHRS 1 provides heading information to both RMUs via DAU 2.
- Autopilot System: The AHRS 1 provides pitch, roll and acceleration information to the Autopilot System via IC-600-1.
- Weather Radar: The AHRS 2 provides attitude information to the Weather Radar for antenna stabilization.
- Flight Management System (FMS): The AHRS provides attitude and heading information to the FMS.
- EGPWS/GPWS: The AHRS 1 provides attitude and heading information to the EGPWS/GPWS.

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- Stall Protection System (SPS): The AHRS provides attitude rate variation and vertical acceleration information to the SPS.
- Integrated Standby Instrument System (ISIS): the AHRS 1 provides heading information to the ISIS.
- Windshear Detection And Escape Guidance System: The AHRS 1 provides attitude rate variation and vertical acceleration information to the windshear computer.
- Flight Data Recorder (FDR): The AHRS 1 provides attitude and heading information to the FDR via DAU 2 and IC-600.

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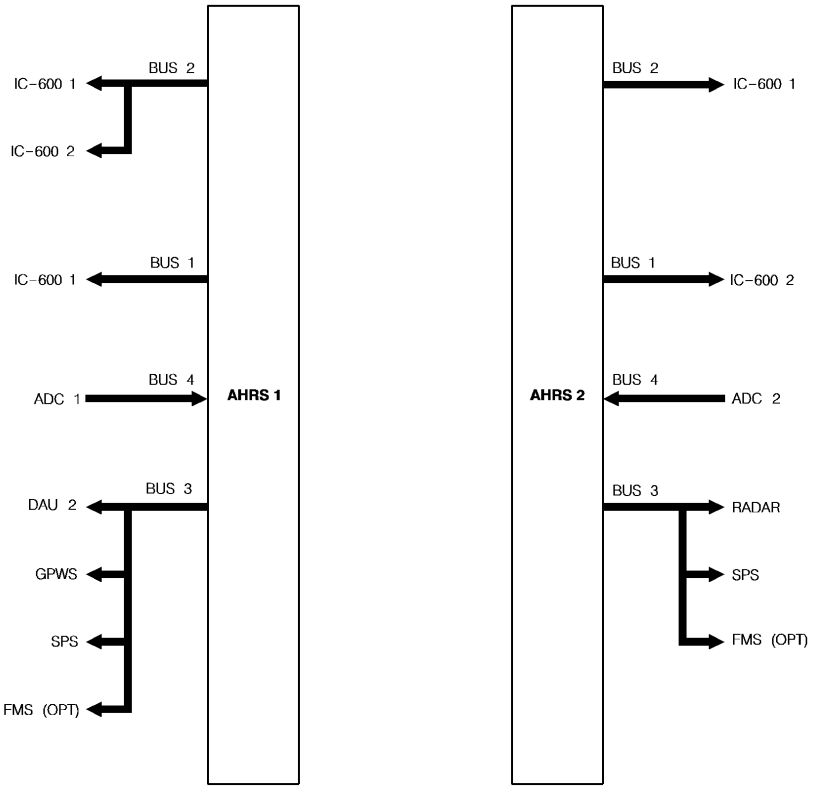

AHRS SCHEMATIC

AH-800 AHRS VERSION

Each AH-800 AHRS consists of an Attitude and Heading Computer (AHC), a Magnetic Flux Detector Unit (MFDU), a Memory Module and an AHRS Control Panel.

Each AHC uses two 28 VDC power inputs, one for normal power (primary source) and other for backup power (airplane batteries). The AHC 1 primary power source is the Essential DC Bus 1 and its backup power source is the Backup Essential Bus. The AHC 2 primary power source is the DC Bus 2 and its backup power source is the Backup Bus 2. If the AHC loses the primary power, it automatically transfers to backup power.

When the AHC operates solely on backup power, it will operate for 40 minutes.

ATTITUDE AND HEADING COMPUTER (AHC)

The major component of the AHRS is the AHC. The AHC contains three single axis interferometer fiber optic gyros (IFOG) mounted along the principal axis of the unit to measure the airplane angular motion. The signals processed and generated by the IFOGs as well as the information of attitude, heading and airplane axis accelerations are transmitted by the AHC in digital format to the airplane systems and equipment interfaced with the AHRS. In addition, the AHC provides excitation, current feedback control and signal demodulation interfaces to the flux detector.

MAGNETIC FLUX DETECTOR UNIT (MFDU)

The AHRS uses the wing tip mounted MFDU as long term magnetic reference. The flux detector senses the horizontal component of the earth magnetic field and provides continuous magnetic heading reference to the AHC. The heading reference is processed by the AHC to compute an inertial stabilized magnetic heading output.

MEMORY MODULE

The memory module is used to store the AHC mounting tray alignment coefficients, flux valve compensation coefficients and discrete data (orientation, source/destination identifier and interface digital buses).

AHRS CONTROL PANEL

The AHRS control panel allows canceling the magnetic field distortion as well as selecting the Directional Gyro (DG) or Slaved (SLVD) Modes.

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AH-800 OPERATING MODES

The AHRS has six fundamental operating modes, which are described below.

– **Initialization mode:** The Initialization Mode is entered upon power up of the system. During the operation in this mode the AHRS performs self-tests to determine the condition of its components (sensors, AHC, power supply, etc). Furthermore the AHRS performs a first order leveling process to determine pitch and roll, and further slaves the magnetic heading to the flux valve. At the end of the Initialization Mode the system enters the Full Performance Mode, unless the crew selects the DG Mode or the system detects a lack of input, in this case reverting automatically to the Basic Mode.

– **Full Performance Mode:** The Full Performance Mode (slaved) is the standard system operating configuration. When operating in this mode, the TAS input from the ADC is used in the vertical channel (pitch and roll) to produce a Schuler tuned erection loop for pitch and roll attitude, and the flux valve is used as a continuous heading reference.

NOTE: When switched from DG to SLVD (Full Performance Mode) the system performs automatic synchronization to the flux valve.

– **DG Mode:** The DG Mode, which causes the heading channel to operate as a free non-slaved gyro, is selected by the flight crew and is used when operating in charted areas of unreliable magnetic heading or in case of a failure in the flux valve.

– **Basic Mode:** The Basic Mode is entered automatically by the system if the TAS becomes invalid. AHRS attitude output in this mode is corrected by a simple first-order erection loop similar to that of a conventional vertical gyro.

– **Test Mode:** The Test Mode is to be operated mainly by the ground personnel during maintenance procedures. This mode is activated through a switch located in the maintenance panel behind the pilot seat when the airplane is on the ground. During the test, the system verifies the outputs for proper operation of the data channels, interconnections and indications.

– **Maintenance Mode:** The Maintenance Mode is used for maintenance purposes only.

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AH-800 EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	AHRS 1 (2) OVERHEAT	The associated AHRS computer is overheated.
ADVISORY	AHRS 1 (2) BASIC MODE	The TAS input signal from the ADC has been lost in the associated AHRS.

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AH-800 CONTROLS AND INDICATORS

AHRS CONTROL PANEL

1 - AHRS MODE SELECTOR SWITCH

DG - Selects the Directional Gyro Mode. In this condition the AHRS heading channel operates as a free non-slaved gyro.

SLVD - The AHRS operates slaved to the flux valve, which will provide a continuous heading reference.

2 - SLEWING SWITCH

CW - Allows selection, in the clockwise direction, of the desired heading to which the gyro will be slaved when the AHRS is not slaved to the magnetic heading of the flux valve (DG Mode selected).

CCW - Allows selection, in the counter-clockwise direction, of the desired heading to which the gyro will be slaved when the AHRS is not slaved to the magnetic heading of the flux valve (DG Mode selected).

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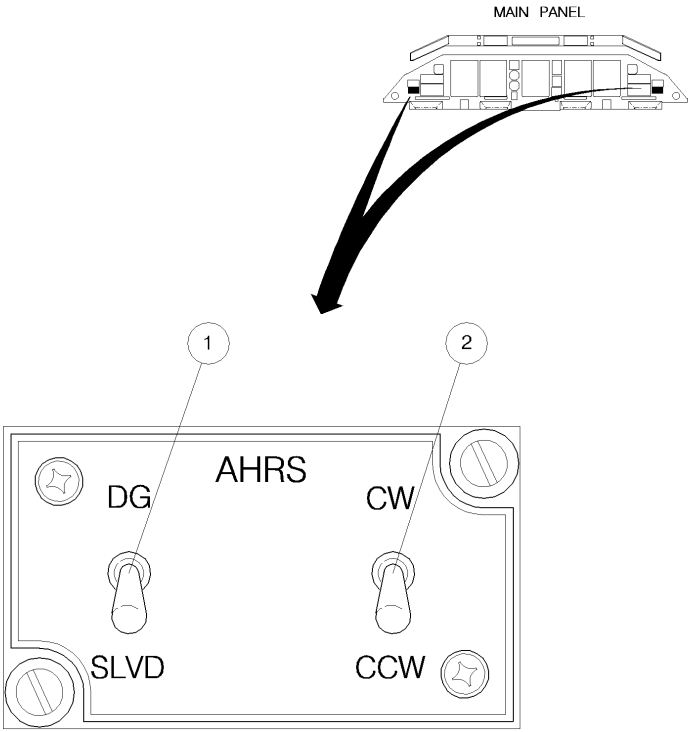

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AHRS CONTROL PANEL (AH-800 VERSION ONLY)

AH-900 AHRS VERSION

The AH-900 AHRS version is basically an attitude and heading reference system that senses linear motion and angular rates through inertial sensors. Heading orientation is also obtained through the inertial sensors, dispensing the magnetic flux detectors.

Each AHRS consists of one Attitude and Heading Reference Unit, the AHRU 1 and AHRU 2, located in the forward electronics compartment.

There are no cockpit control panels.

ATTITUDE AND HEADING REFERENCE UNIT (AHRU)

The Attitude and Heading Reference Unit contains three laser gyros and three accelerometers that are mounted on each of the three axis inside of the AHRU, which it uses to measure inertial motion.

The AHRU requires initialization data from the Flight Management System (FMS) and Air Data Computer (ADC). From inertial measurements, initialization data, and air data inputs, the AHRU performs the calculations necessary to provide heading and attitude data to the airplane.

Each AHRU uses two 28 VDC power inputs, one for normal power (primary source) and the other for backup power (airplane batteries). The AHRU 1 primary power source is the Essential DC Bus 1 and its backup power source is the Backup Essential Bus. The AHRU 2 primary power source is the DC Bus 2 and its backup power source is the Backup Bus 2. If the AHRU loses primary power, it automatically transfers to backup power.

When the AHRU operates solely on backup power, it will operate for 40 minutes and the AHRS 1 (2) ON BATT advisory message will be presented on the EICAS.

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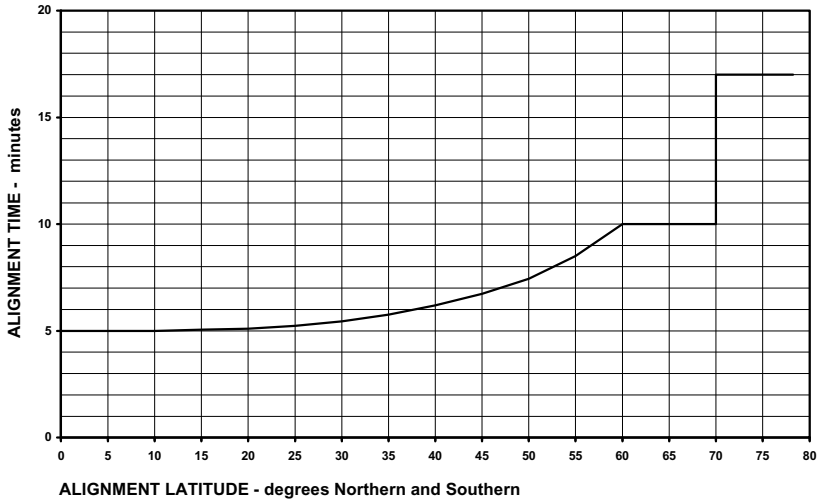
AH-900 OPERATING MODES

ALIGNMENT MODE

The alignment mode initiates when the airplane is energized. The AHRU aligns its reference axis to the local vertical and true north, and estimates the horizontal earth rate components to compute latitude. The latitude at which the AHRU is aligned affects the alignment time. The relationship between alignment time and latitude is shown in the chart below.



The airplane must remain stationary during alignment (AHRS 1 (2) ALN advisory message presented on the EICAS). If the AHRU detects excessive airplane motion (AHRS 1 (2) EXC MOTION advisory message is presented on the EICAS), it starts an automatic full realignment 30±1 seconds after the motion stops. Normal passenger-loading or cargo-loading activities should not cause excessive airplane motion condition.

NOTE: To complete the alignment, the AHRU requires a valid input of the airplane's present position (latitude and longitude) from the FMS or optionally through the MFD 1. The present position input through MFD 1 bezel is possible only in airplanes equipped with EICAS 18.5 and on.

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If the present position is not entered during the normal alignment time, the AHRS 1 (2) ALN FAULT caution message will be displayed on the EICAS. For airplanes equipped with EICAS 18.5 and on, the AHRS 1 (2) NO PPOS or ARHS 1-2 NO PPOS advisory messages will be displayed on it. The AHRU will not enter the NAV mode until it receives a valid position input.

The AHRU accepts multiple entries of latitude and longitude, which means that various positions may be stored. This feature allows the pilot to select the current position previously stored, instead of enter it again.

A new position entry writes over the previous entry. More than one entry may be necessary to confirm, update or correct the position. This occurs because the AHRU does not accept new position inputs until 2 seconds after the previous input or new position input that has more than 1 degree of disagreement from the stored latitude/longitude from the last power down from the NAV mode.

The AHRU conducts a position-compare test on latitude and longitude immediately after each data has been entered. The AHRU uses only the latest entry for its test calculations. To pass the test, the entered data must compare within 1 degree of the stored latitude/longitude from the last power down from the NAV mode. If the test fails, the AHRS 1 (2) ALN FAULT caution message is presented on the EICAS.

For airplanes equipped with EICAS 18.5 and on, whenever the airplane is on the ground and the AH-900 is in align mode, the MAP/PLAN label on MFD 1 main menu changes to PPOS INIT. By selecting PPOS INIT, the operator will access the Present Position Initialization menu, and will be able to set the present- position coordinates with the data set knob or confirm the stored one. The coordinates are sent to the AH-900 computer when the ENT bezel button is pressed.

No attitude and heading data is displayed during align mode.

NAVIGATION MODE

The AHRU enters the NAV mode from the align mode. In the NAV mode, the AHRU uses the last valid position data entered during the align mode as its initial present position, and updates the present position based only on inertial data while it remains in the NAV mode. The AHRU algebraically adds computed magnetic variation from a magnetic variation topographical map (MAGVAR) to true heading and true track to produce magnetic heading and track magnetic angle. The magnetic heading and magnetic tracking angle outputs are set to no computed data (NCD) inside a northern and southern latitude cutout area.

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ATTITUDE MODE

The attitude mode is the AHRU's reversionary mode. It is automatically entered by the AHRU if power is lost in flight, and it provides a quick attitude restart: during the first 20 seconds in the attitude transitional mode, the AHRU enters the erect attitude transitional mode. In this transitional mode the AHRS 1 (2) ALN advisory message is displayed on the EICAS and the AHRU computes a new level axis set. The aircraft must be held steady, straight and level until the AHRS 1 (2) ALN message extinguishes.

When operating in the attitude mode the AHRS 1 (2) ATT MODE advisory message is presented on the EICAS. In this mode, attitude outputs are not as accurate as when operating in the NAV mode, and magnetic heading is not available.

For airplanes equipped with EICAS 18 and on, the AH-900 must be initialized with magnetic heading. In this case the operator needs to know the airplane's magnetic heading. Whenever the airplane is in the air and the AH-900 is in attitude mode, a menu bezel button annunciates MHDG INIT on the pilot's MFD. The AHRS 1 (2) NO MAG HDG or AHRS 1-2 NO MAG HDG advisory messages will be displayed on the EICAS. By selecting MHDG INIT, the operator will access the Magnetic Heading Initialization menu, and will be able to set the magnetic heading with the data set knob. The magnetic heading data is sent to the AH-900 computer when the ENT bezel button is pressed. The associated EICAS messages are cleared.

POWER-DOWN MODE

The AHRU enters the power-down mode automatically when the system detects an "end-of-flight" event. In this mode, the AHRU will transfer the last calculated position and other AHRS parameters to its non-volatile memory.

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AH-900 EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	AHRS 1 (2) OVERHEAT	The associated AHRS is overheated.
	AHRS 1 (2) ALN FAULT	The associated AHRS did not complete the alignment phase successfully.
	AHRS 1 (2) FAIL	The associated AHRS has failed.
ADVISORY	AHRS 1 (2) ATT MODE	The associated AHRS is in the attitude mode.
	AHRS 1 (2) ALN	The associated AHRS is in the alignment phase.
	AHRS 1 (2) ON BATT	The associated AHRS is being powered by the airplane batteries.
	AHRS 1 (2) EXC MOTION	The associated AHRS detected excessive motion during the alignment phase.
	AHRS 1 (2) NO PPOS	The present position has not been set.
	AHRS 1-2 NO PPOS	The present position has not been set.
	AHRS 1 (2) NO MAG HDG	Magnetic heading has not been set.
	AHRS 1-2 NO MAG HDG	Magnetic heading has not been set.

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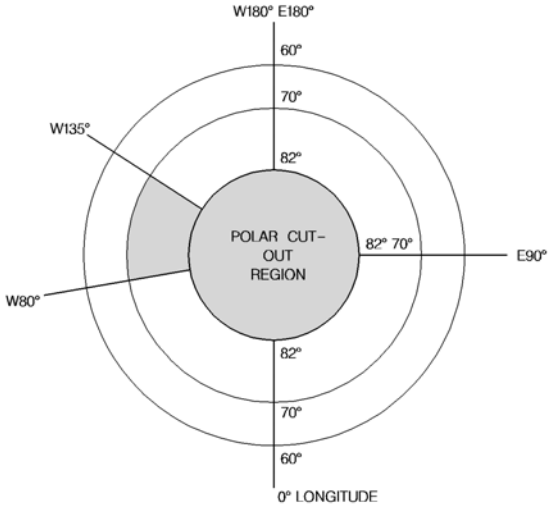
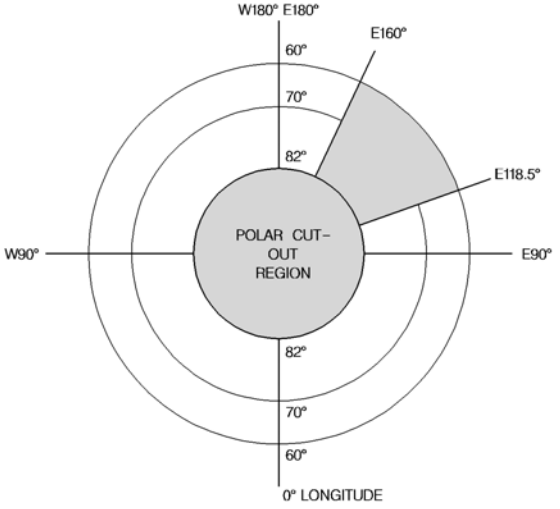


NORTHERN LATITUDE CUTOUT



SOUTHERN LATITUDE CUTOUT

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MAGNETIC VARIATION LATITUDE CUTOUTS (AH-900 ONLY)

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AHRS INDICATIONS ON THE PFD

ELECTRONIC ATTITUDE DIRECTOR INDICATOR (EADI)

1 - ATTITUDE SPHERE

- Color:
  - Sky: blue.
  - Ground: brown.

2 - ROLL SCALE

- Color: White
- Range: 360 degrees.
- Resolution: 10, 20, 30 and 60 degrees for left and right roll attitudes.
- Fixed pointers (unfilled triangles) are located at zero degrees and 45 degrees (LH and RH).

3 - ROLL POINTER

- Color: White.
- Provides the roll angular indication against the roll scale.

4 - EXCESSIVE PITCH CHEVRONS

- Color: Red
- Marks –45 and 65 degrees pitch up, and 35, 50 and 65 degrees pitch down.

5 - PITCH SCALE

- Color: White.
- Range: 0 to 90 degrees (pitch up and pitch down).
- Marks:
  - Pitch up: 0, 5, 10, 15, 20, 25, 30, 40, 60 and 90 degrees.
  - Pitch down: 5, 10, 15, 20, 25, 30, 45, 60 and 90 degrees.

6 - GROUND/SKY REFERENCE EYEBROW

- Color: Blue or brown.
- The eyebrow provides a quick ground/sky reference for attitudes where the horizon line is out of the display.

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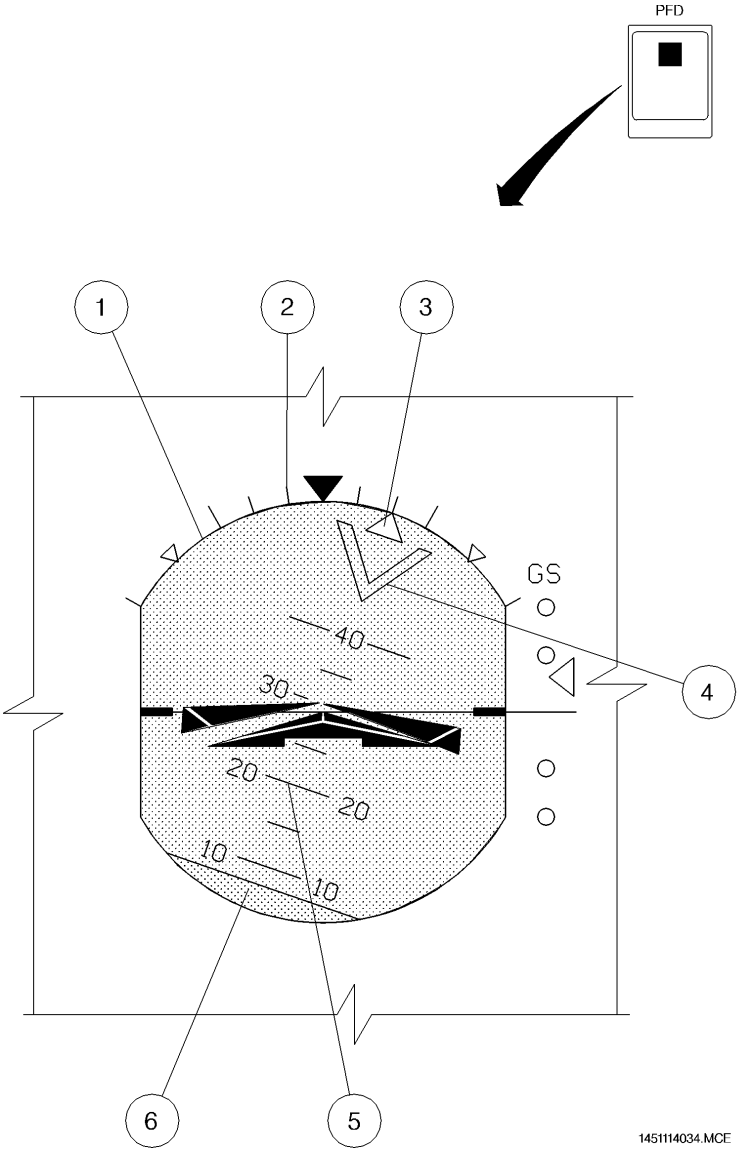

ELECTRONIC ATTITUDE DIRECTOR INDICATOR

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ATTITUDE DECLUTTER

When there is an excessive attitude situation, certain indicators are removed in order to declutter the PFD.

Excessive attitude situation occurs when roll attitude is greater than 65 degrees, or pitch attitude greater than 30 degrees nose up or 20 degrees nose down.

In this case, the following symbology shall be removed from the display:

– Flight Director couple arrow,
– Low Bank limit arc,
– Flight Director command bars,
– Vertical Deviation scale, pointer and label,
– Radio Altitude digits, label and box,
– Marker beacons indicators,
– Decision Height digits and labels,
– Selected Airspeed bug and indicators,
– Vertical Speed bug and indicators,
– Selected Altitude bug, indicators and box,
– All failure flags associated with the items listed above,
– The Heading, Radio Altitude, LOC, GS, and ILS comparison monitor displays

The PFD indicators will be restored when both conditions below are met:

– Roll attitude less than 63 degrees left and right.
– Pitch less than 28 degrees nose up and greater than 18 degrees nose down.

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ELECTRONIC HORIZONTAL SITUATION INDICATOR (EHSI)

1 - COMPASS CARD DISPLAY

May be displayed in the Full Compass or Arc formats, selected via the Display Control Panel (see section 2-18-40).

- Color: white.
- Range: 360 degrees.
- Resolution: 5 degrees.

2 - HEADING LUBBER LINE (FULL COMPASS FORMAT)

- Color: White.
- Provides the current heading reading against the heading scale.

3 - CURRENT HEADING DIGITAL DISPLAY (ARC FORMAT)

- Color:
  - Open box: white
  - Digits: white
- Range: 0 to 360 degrees.
- Resolution: 1 degree.

User: fhhernа0f - Printed By myTechCare - Nov 21/24 - 00:36:37

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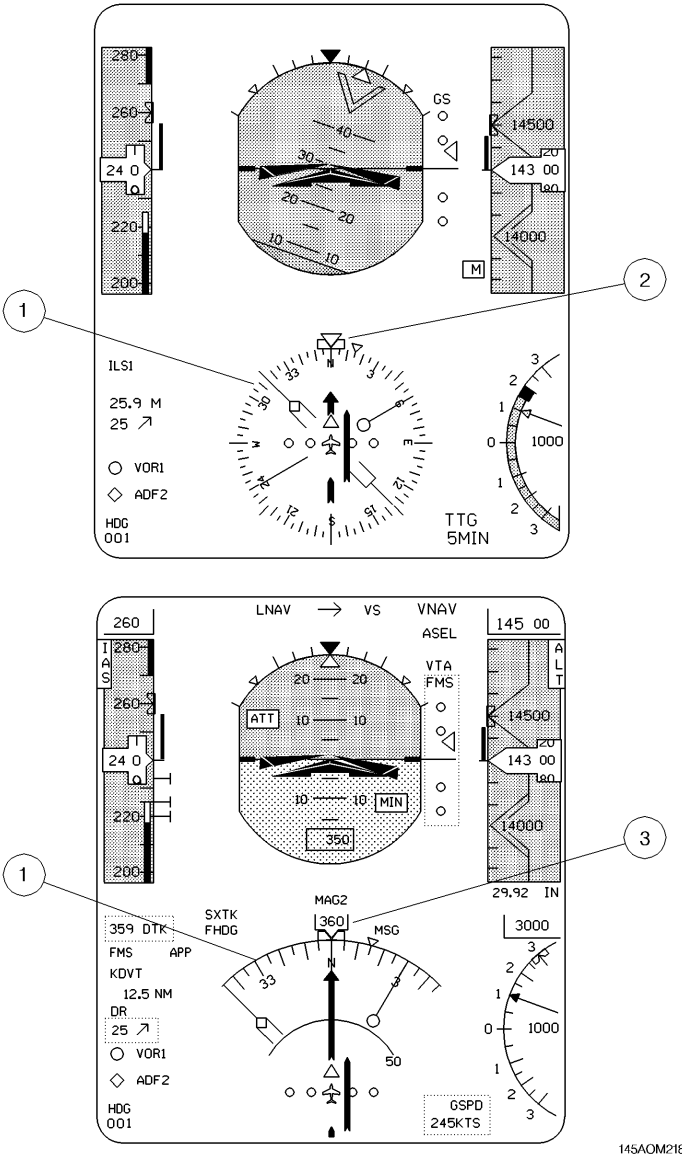

EHSI - FULL COMPASS AND ARC FORMATS

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COMPARISON MONITORS

1 - ATTITUDE COMPARISON MONITOR DISPLAY

- Label: ROL, PIT or ATT.
- Color: Amber.
- If roll information deviates by more than 6 degrees between PFD 1 and PFD 2, a ROL comparison monitor will be displayed inside the attitude sphere.
- If pitch information deviates by more than 5 degrees between PFD 1 and PFD 2, a PIT comparison monitor will be displayed in the upper-left portion of the attitude sphere.
  Simultaneous activation of the both pitch and roll comparison monitors will be announced by an ATT label displayed in the upper-left portion of the attitude sphere, in the same field of the ROL and PIT comparison monitors.

2 - ATTITUDE FAILURE DISPLAY

- Removal of the pitch scale and roll pointer.
- Coloring the attitude sphere all blue.
- A red ATT FAIL label is displayed on the top center of the attitude sphere.

3 - ATTITUDE SOURCE ANNUNCIATION

- Label: ATT1 for AHRS 1 and ATT2 for AHRS 2.
- Color: Amber when one AHRS supplies both sides or both AHRS are supplying cross-side.
- Annunciations are removed when both AHRS are supplying on-side PFDs.

4 - HEADING SOURCE ANNUNCIATION

- Label:
  - MAG1 or MAG2 when AHRS heading source is magnetic.
  - DG1 or DG2 when AHRS heading source is the directional gyro.
- Color:
  - For MAG: amber when the same AHRS is supplying both sides or both AHRS are supplying cross-side.

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  - For DG: - amber when the same AHRS is supplying both sides.
    - white when both AHRS are supplying on-side.
- When both AHRS are supplying on-side, annunciation is removed.
- If a heading source becomes invalid the heading source annunciation will refer to the invalid heading source, HDG1 or HDG2, as applicable.

5 - HEADING COMPARISON MONITOR DISPLAY

- Color: Amber.
- Label: HDG
- Activated when a difference of 6 degrees between both PFDs is detected and airplane roll is less than 6 degrees.
- For airplane rolls greater than 6 degrees, annunciation will be displayed if the difference between both PFDs is greater than 12 degrees.
- The HDG threshold will be restored to 6 degrees if airplane roll is less than 5 degrees for 90 seconds. Otherwise, a 12 degrees HDG threshold will be maintained.

6 - HEADING FAILURE DISPLAY

- Digital heading bug symbol is removed and a red HDG FAIL annunciation is displayed on the PFD and MFD compass cards.
- The bearing pointers, map display, To/From, selected heading bug, drift angle, selected course/track and course deviation displays will be removed.
- Heading source annunciation will be HDG 1 or HDG 2.
- Heading select and course select/desired track digital display will be replaced by amber dashes.

NOTE: In case of heading splits, check if there sources for magnetic interference near the airplane. If this is cause for the problem, the heading split should disappear during the taxi.

7 - COURSE DEVIATION FAILURE

- Pointer is removed.
- Red X displayed over the scale.

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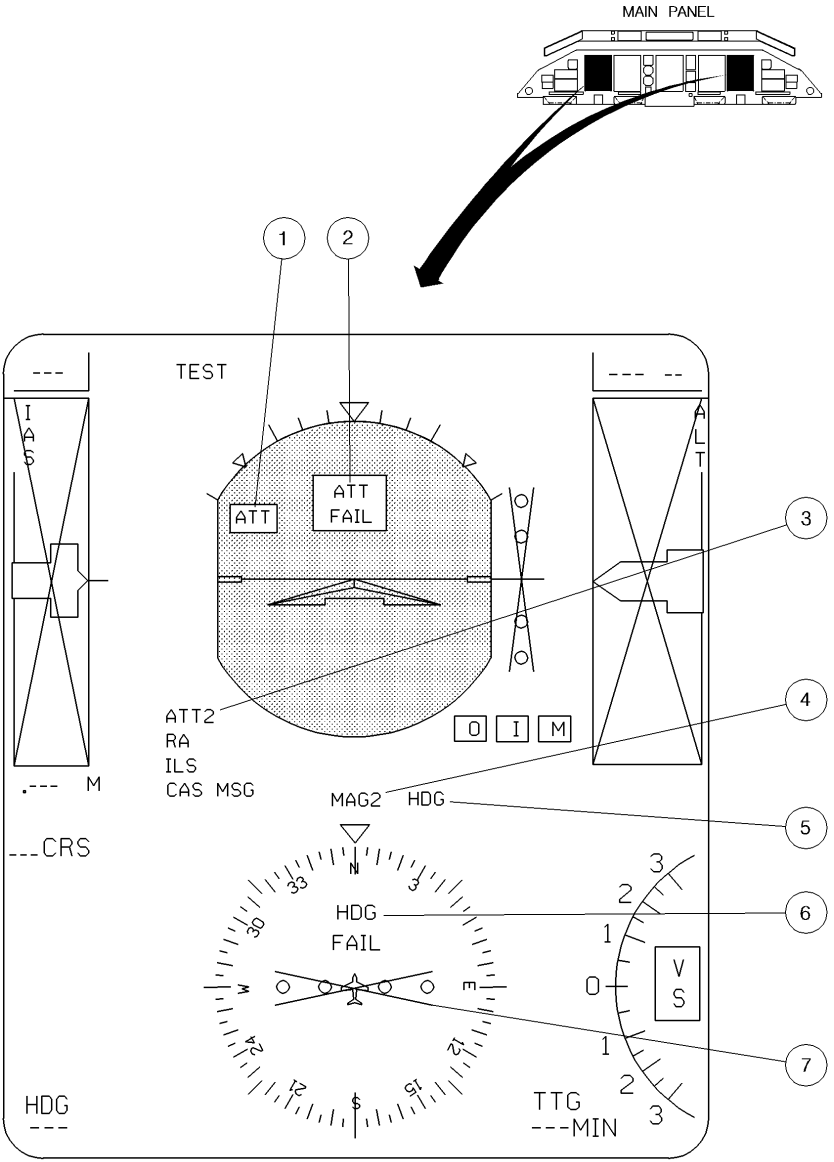

AHRS FAIL INDICATION ON THE PFD (BOTH AH-800 AND AH-900)

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INERTIAL REFERENCE SYSTEM (IRS)

As a replacement for the Attitude and Heading Reference System (AHRS), the EMB-145/135 airplane family may be equipped with two identical and independent Inertial Reference Systems (IRS). Aside replacing AHRS functions, the dual IRS installation is used as an additional navigation sensor for the FMS, and it may also provide accurate attitude and heading data to the Head-Up Guidance System (HGS), when this equipment is installed.

Another possibility for HGS-equipped airplanes is the installation of a single IRS tailored for that equipment, while PFDs, MFDs and RMUs receive information from two AHRS.

Basically, the IRS provides attitude and heading reference data for the airplane displays and navigation data for the FMS by sensing linear motion and angular rates through inertial sensors.

The IRS interface with the airplane's systems and equipment is as follows:

- Air Data Computers (ADC 1 and ADC 2): The IRS 1 and IRS 2 receive altitude, altitude rate and true airspeed information from the ADC 1 and ADC 2 respectively, to improve the precision of computed navigation data.
- Integrated Computers (IC1 and IC2): The IRS 1 and IRS 2 provide pitch, roll and heading information to the respective PFD, and heading information to the respective MFD, through the IC-600s. Data is transmitted separately to both sides, to ensure that a single IC failure does not compromise the data path.
- Radio Management units (RMU 1 and RMU 2): the IRS 1 provides heading information to both RMUs via DAU 2.
- Autopilot System: The IRS 1 provides pitch, roll and acceleration information to the Autopilot System via IC-600-1.
- Weather Radar: The IRS 2 provides attitude information to the Weather Radar for antenna stabilization.
- Flight Management System (FMS): The IRS provides attitude, heading and navigation information to the FMS. The IRS receives position, magnetic heading, UTC time and date from the FMS.
- EGPWS/GPWS: The IRS 1 provides attitude and heading information to the EGPWS/GPWS.

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- Stall Protection System (SPS): The IRS provides attitude rate variation and vertical acceleration information to the SPS.
- Integrated Standby Instrument System (ISIS): The IRS 1 provides heading information to the ISIS.
- Head-Up Guidance System HGS: The IRS 1 (or the dedicated IRS) provides acceleration, speed, attitude, heading and wind information to the HGS.
- Windshear Detection And Escape Guidance System: The IRS 1 provides attitude rate variation and vertical acceleration information to the windshear computer.
- Flight Data Recorder (FDR): The IRS 1 provides attitude and heading information to the FDR via DAU 2 and IC-600.

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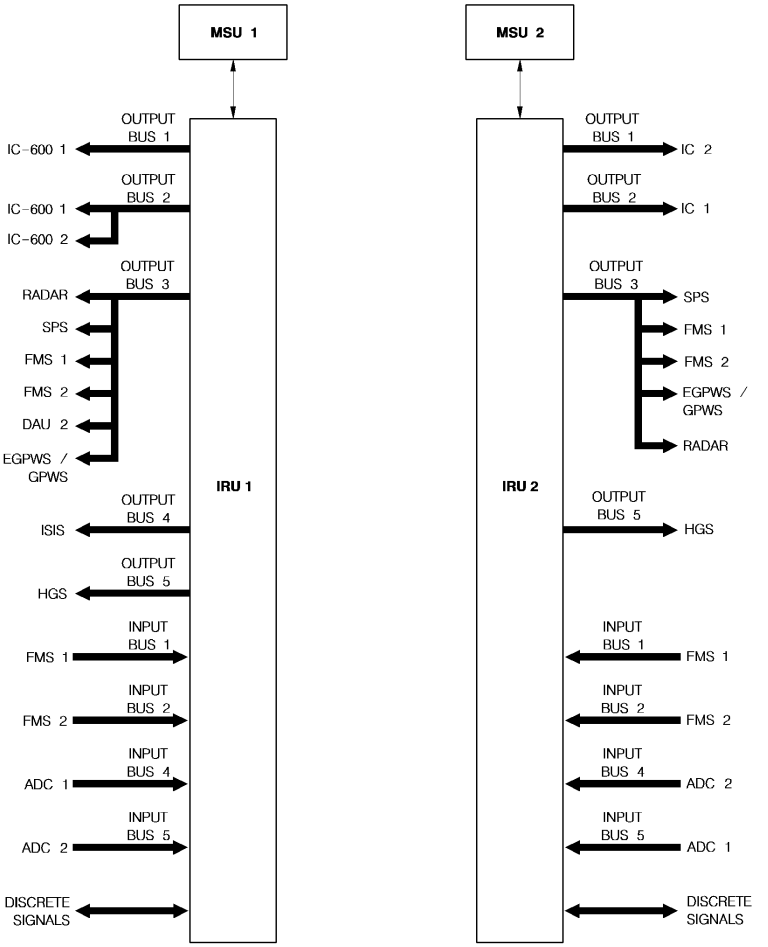

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IRS INTERFACES WITH OTHER SYSTEMS

INERTIAL REFERENCE SYSTEM COMPONENTS

Each IRS consists of an Inertial Reference Unit (IRU) and a Mode Select Unit (MSU).

Each IRU uses two 28 VDC power inputs, one for normal power (primary source) and the other for backup power (airplane batteries). The IRU 1 primary power source is the Essential DC Bus 1 and its backup power source is the Backup Essential Bus. The IRU 2 primary power source is the DC Bus 2 and its backup power source is the Backup Bus 2. If the IRU loses the primary power, it automatically switches to backup power.

When the IRU operates solely on backup power, it will operate for 40 minutes and the ON BATT annunciator on the Mode Selector Unit will illuminate. Airplanes equipped with EICAS 17 onwards will also present the IRS 1 (2) ON BATT advisory message on the EICAS.

INERTIAL REFERENCE UNIT (IRU)

The Inertial Reference Unit contains three laser gyros and three accelerometers that are mounted on each of the three axis inside the IRU, which it uses to measure inertial motion.

The IRU requires initialization data from the Flight Management System and Air Data Computer. From the inertial measurements, initialization data, and air data inputs, the IRU performs the calculations necessary to provide position, velocity, heading and attitude data to the airplane.

The IRUs are located in the forward electronics compartment.

MODE SELECTOR UNIT (MSU)

The Mode Selector Unit is a cockpit-mounted control panel that provides mode selection, status indication and test initialization for the associated IRU. It has a four-position mode select switch and status and fault annunciators.

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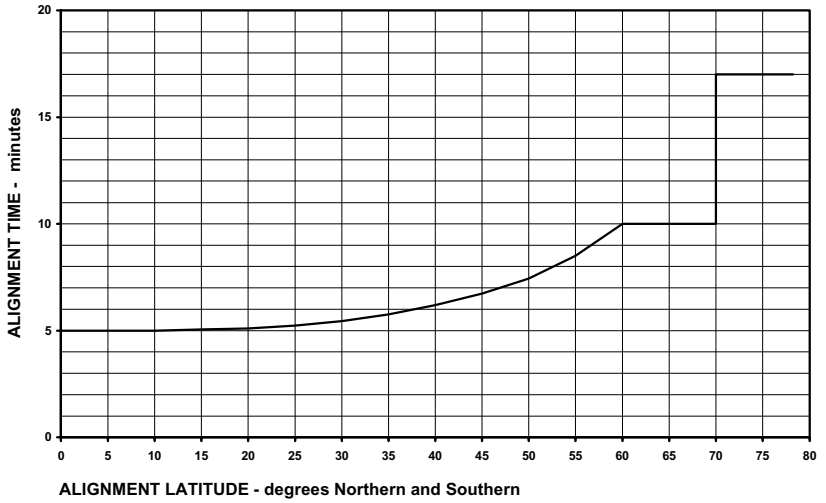
IRS OPERATING MODES

The IRS operating modes may be selected by setting the MSU mode select switch to the desired mode. Under certain conditions the IRU may automatically revert to specific modes and sub-modes.

ALIGNMENT MODES

MSU SET FROM OFF TO ALIGN OR NAV

In the alignment mode, the IRU aligns its reference axis to the local vertical and true north, and estimates the horizontal earth rate components to compute latitude. The latitude at which the IRU is aligned affects the alignment time. The relationship between alignment time and latitude is shown in the chart below.



The airplane must remain stationary during alignment, while the MSU ALIGN annunciator is lit and IRS 1 (2) ALN advisory message presented on the EICAS (only for airplanes equipped with EICAS 17 onwards). If the IRU detects excessive airplane motion (IRS 1 (2) EXC MOTION advisory message is presented, on airplanes equipped with EICAS 17 and on), it starts an automatic full realignment 30±1 seconds after the motion stops. Normal passenger-loading or cargo-loading activities should not cause an excessive airplane motion condition.

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NOTE: To complete the alignment, the IRU requires a valid input of the airplane's present position (latitude and longitude) from the FMS.

If the present position is not entered during the normal alignment time, the MSU ALIGN annunciator flashes and the IRS 1 (2) ALN FAIL caution message (only for airplanes equipped with EICAS 17 onwards) will be presented on the EICAS. The IRU will not complete the alignment phase and/or will not enter the NAV mode until it receives a valid position input from the FMS.

The IRU accepts multiple entries of latitude and longitude. More than one entry may be necessary to confirm, update or correct the position. However, the IRU does not accept new position inputs until 2 seconds after the previous input. A new position entry overwrites the previous entry, and the IRU uses only the latest entry for its calculations. The IRU conducts a position comparison test on latitude and longitude immediately after each data has been entered. To pass the test, the entered data must compare within 1 degree of the stored latitude/longitude from the last power down from the NAV mode. If the test fails, the MSU ALIGN annunciator flashes and an IRS 1 (2) ALN FAIL caution message (only for airplanes equipped with EICAS 17 onwards) will be presented on the EICAS.

No attitude and heading is displayed during align mode.

MSU SET FROM NAV TO ALIGN OR NAV TO ALIGN AND BACK TO NAV (TO BE USED ON THROUGH FLIGHTS):

This command will revert the IRU to the align down-mode, which zeroes residual velocity errors accumulated during the previous navigation mode operation. The fine leveling process of the align mode is reactivated, and heading accuracy is updated. When the IRU enters the align down-mode, the ALIGN annunciator illuminates and an IRS 1 (2) ALN advisory message is presented on the EICAS (only for airplanes equipped with EICAS 17 onwards).

The airplane must be stationary (ground speed less than 20 knots) during the align down-mode otherwise an automatic full realignment will begin in 30 seconds after an excessive aircraft motion stops.

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AUTOMATIC NAVIGATION REALIGNMENT (ANR):

The ANR is entered automatically and concurrently with normal mode operations, when the IRU senses that the airplane has completed a “no motion period” (between 7.5 and 15 minutes, as a function of latitude). In the ANR sub-mode, the IRU applies corrections by zeroing velocities, resetting the attitude platform, and correcting heading errors accumulated during the previous navigation mode operation. When the IRU enters the ANR sub-mode, the ALIGN annunciator illuminates and an IRS 1 (2) ALN advisory message is presented on the EICAS (only for airplanes equipped with EICAS 17 onwards).

NAVIGATION MODE

The IRU enters the NAV mode after completing its alignment when the IRU MSU switch is set to NAV. In the NAV mode, the IRU uses the last valid position data entered during the align mode or align down-mode as its initial present position and updates the present position based only on inertial data while it remains in the NAV mode. The IRU algebraically adds computed magnetic variations from a magnetic variation topographical map (MAGVAR) to true heading and true track to produce magnetic heading and track magnetic angle. The magnetic heading and magnetic tracking angle outputs are set to no computed data (NCD) inside a northern and southern latitude cutout area.

ATTITUDE MODE

The attitude mode is the IRU’s reversionary mode. It is automatically entered by the IRU if it experiences in-flight loss of power, or it may be selected by the crew if the FAULT annunciator lights and an IRS 1 (2) FAIL caution message is presented on the EICAS (only on airplanes equipped with EICAS 17 onwards), indicating a critical fault, that invalidates all outputs.

CAUTION: THE MSU SWITCH MUST NOT BE SET TO ATTITUDE MODE INADVERTENTLY. IF THIS OCCURS ON THE GROUND, IT IS NECESSARY TO SET THE MSU SWITCH TO OFF FOR AT LEAST 3 SECONDS, THEN BACK TO ALIGN OR NAV. IF ATTITUDE MODE IS SET IN-FLIGHT, IT IS NOT POSSIBLE TO RECOVER THE NAV MODE.

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This mode provides a quick attitude restart: during the first 20 seconds the IRU enters the erect attitude transitional mode. In this transitional mode the IRU computes a new level axis set. The airplane must be held steady, straight and level until the MSU ALIGN annunciator extinguishes itself and an IRS 1 (2) ALN advisory message (only for EICAS 17 onwards) disappears from the EICAS.

When operating in the attitude mode the IRS 1 (2) ATT MODE caution message (only for airplanes equipped with EICAS 17 onwards) is presented on the EICAS. In this mode, attitude outputs are not as accurate as when operating in the NAV mode, and magnetic heading must be entered periodically through the FMS Control Display Unit.

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POWER-OFF MODE

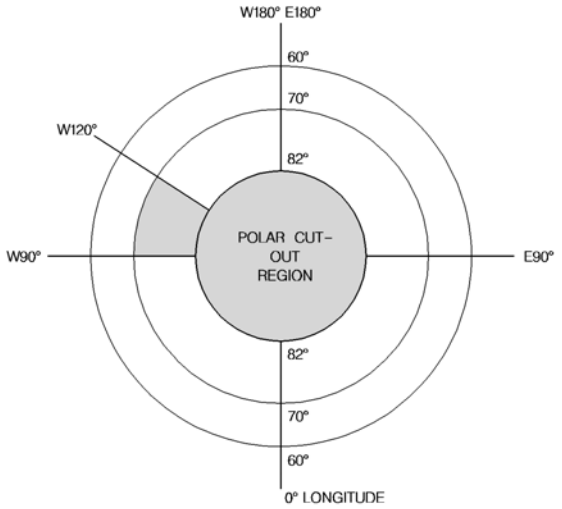
The IRU enters the power-down mode when the MSU switch is set to OFF and remains in that position for 3 seconds (to prevent inadvertent selection). After that, power continues for 10 to 15 seconds to transfer the last calculated latitude and longitude and other IRS parameters to its non-volatile memory. The ALIGN annunciator illuminates when the IRU is in the power-down mode (and an IRS 1 (2) ALN advisory message is presented on the EICAS, for airplanes equipped with EICAS 17 onwards).

NOTE: The airplane must not be de-energized before the ALIGN annunciator light extinguishes.

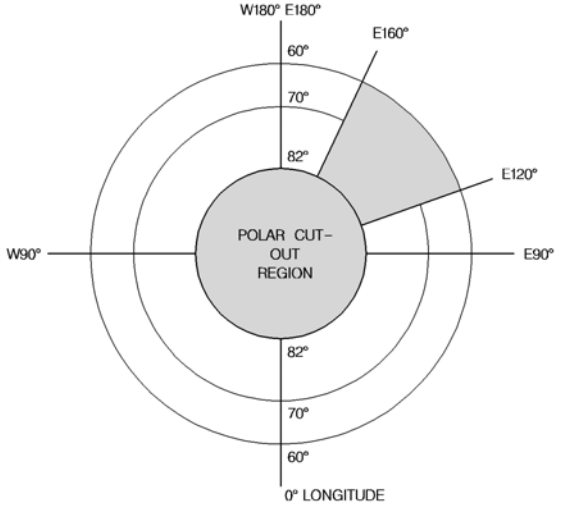
De-energizing the airplane before the ALIGN annunciator extinguishes itself (and an IRS 1 (2) ALN advisory message is removed from the EICAS, on airplanes equipped with EICAS 17 onwards) may interrupt the transferring process of the IRU's last calculated position and other IRS parameters to its non-volatile memory, which will affect the next alignment.

TEST MODE

The test mode is selected by pressing the MSU test switch. The test mode can be selected in either the align mode or the NAV mode without affecting basic IRS function. The test mode is inhibited in the attitude mode and in the NAV mode when aircraft ground speed exceeds 20 knots.



NORTHERN LATITUDE CUTOUT



SOUTHERN LATITUDE CUTOUT

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MAGNETIC VARIATION LATITUDE CUTOUTS

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IRS OPERATING PROCEDURES

POWER-ON AND ALIGNMENT

– Check the MSU switch set to OFF.
– After energizing the airplane press the AVIONICS MASTER Buttons.
– Set the MSU switch to ALIGN or NAV. ALIGN annunciator illuminates. (ON BATT and NO AIR annunciators may illuminate briefly). On airplanes equipped with EICAS 17 onwards, an IRS 1 (2) ALN advisory message is displayed on the EICAS.
– Through the FMS initial position page, accept one of the present position options.
– Wait for completion of alignment. When selecting NAV directly, the IRU automatically enters the NAV mode after successful completion of alignment.

NAVIGATION MODE ENTRY

– If the MSU switch was set to NAV, make sure that the ALIGN annunciator goes out and an IRS 1 (2) ALN advisory message disappears from the EICAS (on airplanes equipped with EICAS 17 onwards).
– If the MSU switch is set to ALIGN, set the MSU switch to NAV when the NAV RDY annunciator lights.
– The IRU outputs inertial data to all displays and systems.

ALIGNMENT DOWNMODE ("FAST ALIGNMENT" - to be used on through flights)

– The airplane must be stationary.
– Pull the MSU switch out of NAV detent and set it from NAV to ALIGN. The ALIGN annunciator will illuminate and an IRS 1 (2) ALN advisory message displayed on the EICAS (on airplanes equipped with EICAS 17 onwards).
– If the IRU position is the same as the known position, set MSU switch to NAV after the ALIGN annunciator illuminates (and an IRS 1 (2) ALN advisory message is presented on the EICAS, on airplanes equipped with EICAS 17 onwards). The IRU automatically enters NAV mode after 30 seconds.
– If the IRU position is different from the known position, re-initialize the IRU with a new position entry through the FMS CDU.

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ATTITUDE MODE SELECTION

The following procedure applies to the selection of the ATT mode after the FAULT annunciator has illuminated (and an IRS 1 (2) FAIL caution message is presented on the EICAS, on airplanes equipped with EICAS 17 onwards):

- Set the MSU switch to ATT.
- If the FAULT annunciator extinguishes itself, the ALIGN annunciator will illuminate for 20 seconds (and an IRS 1 (2) ALN advisory message is presented on the EICAS, on airplanes equipped with EICAS 17 onwards).
- Hold the airplane steady, straight and level until the ALIGN annunciator extinguishes itself (and an IRS 1 (2) ALN advisory message disappears from the EICAS, on airplanes equipped with EICAS 17 onwards).
- Initialize the IRU with magnetic heading through the FMS CDU.
- Update heading periodically through the FMS CDU.
- When operating in the attitude mode the IRS 1 (2) ATT MODE caution message (only for airplanes equipped with EICAS 17 onwards) is presented on the EICAS.

CAUTION: WHEN OPERATING IN THE ATTITUDE MODE, ATTITUDE OUTPUTS ARE NOT AS ACCURATE AS WHEN OPERATING IN THE NAV MODE, AND MAGNETIC HEADING MUST BE ENTERED PERIODICALLY, THROUGH THE FMS CDU.

POWER DOWN

- Set the MSU switch to OFF. The ALIGN annunciator illuminates (and an IRS 1 (2) ALN advisory message is presented on the EICAS, on airplanes equipped with EICAS 17 onwards).
- After the ALIGN annunciator extinguishes itself (and an IRS 1 (2) ALN advisory message is removed from the EICAS, on airplanes equipped with EICAS 17 onwards), de-energize the airplane.

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IRS EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	IRS 1 (2) OVERHEAT	The associated IRS is overheated.
	IRS 1 (2) ALN FAULT	The associated IRS did not complete the alignment phase successfully.
	IRS 1 (2) FAIL	The associated IRS has failed.
ADVISORY	IRS 1 (2) ALN	The associated IRS is in the alignment phase or the IRU mode select switch is set at ALIGN position.
	IRS 1 (2) ON BATT	The associated IRS is being powered by the airplane batteries.
	IRS 1 (2) EXC MOTION	The associated IRS detected excessive motion during the alignment phase.
	IRS 1 (2) ATT MODE	The associated IRS is selected to attitude mode.

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IRS CONTROLS AND INDICATORS

MSU CONTROL PANEL

1 - TEST SWITCH

TEST – When the TEST switch is pressed the IRU enters the self-test sub-mode.

2 - ANNUNCIATORS

ALIGN – Indicates that the IRU is in the align mode. A flashing ALIGN annunciator indicates that latitude/longitude was not accepted by the IRU.

FAULT – Indicates an IRU fault.

ON BATT – Indicates that the IRU is being powered by the airplane batteries.

BATT FAIL – Indicates that the airplane batteries are incapable of sustaining IRS operation on backup power operation.

NAV RDY – Indicates that alignment is complete, if the MSU switch is set to ALIGN.

NO AIR – Indicates that cooling air is inadequate to cool the IRU.

3 - MODE SELECTOR SWITCH

- OFF: the IRU circuitry is OFF. However, when the IRU is operating and the MSU switch is moved from another position to OFF, there will be a delay of 3 seconds before the IRU starts the power-down routine, in order to prevent its inadvertent selection.
- ALIGN: once this mode is selected the IRU starts the full alignment or alignment down-mode. ALIGN annunciator is ON and an IRS 1 (2) ALN advisory message is presented on the EICAS (only for airplanes equipped with EICAS 17 onwards).
- NAV: there is a detent in the NAV position. The switch must be pulled out of the detent to be moved to another position.
- ATT: if the MSU switch is placed at this position, after 2 seconds (time delay incorporated to prevent inadvertent selection of the ATT mode) the IRU enters the erect attitude sub-mode for 20 seconds, during which the ALIGN annunciator illuminates. Then the IRU enters the attitude mode. On airplanes equipped with EICAS 17 onwards, the IRS 1 (2) ATT MODE caution message will be presented on the EICAS. On the ground, the MSU switch must be set to OFF for at least 3 seconds before the ALIGN or NAV mode can be re-established.

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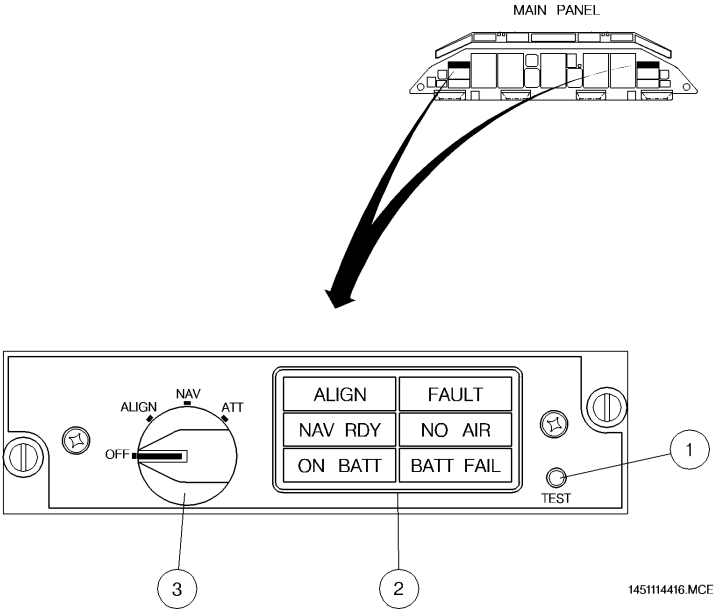

IRS MODE SELECTOR UNIT

IRS INDICATIONS ON THE PFD

ELECTRONIC ATTITUDE DIRECTOR INDICATOR (EADI)

1 - ATTITUDE SPHERE

- Color:
  - Sky: blue.
  - Ground: brown.

2 - ROLL SCALE

- Color: White
- Range: 360 degrees.
- Resolution: 10, 20, 30 and 60 degrees for left and right roll attitudes.
- Fixed pointers (unfilled triangles) are located at zero degrees and 45 degrees (LH and RH).

3 - ROLL POINTER

- Color: White.
- Provides the roll angular indication against the roll scale.

4 - EXCESSIVE PITCH CHEVRONS

- Color: Red
- Marks –45 and 65 degrees pitch up, and 35, 50 and 65 degrees pitch down.

5 - PITCH SCALE

- Color: White.
- Range: 0 to 90 degrees (pitch up and pitch down).
- Marks:
  - Pitch up: 0, 5, 10, 15, 20, 25, 30, 40, 60 and 90 degrees.
  - Pitch down: 5, 10, 15, 20, 25, 30, 45, 60 and 90 degrees.

6 - GROUND/SKY REFERENCE EYEBROW

- Color: Blue or brown.
- The eyebrow provides a quick ground/sky reference for attitudes where the horizon line is out of the display.

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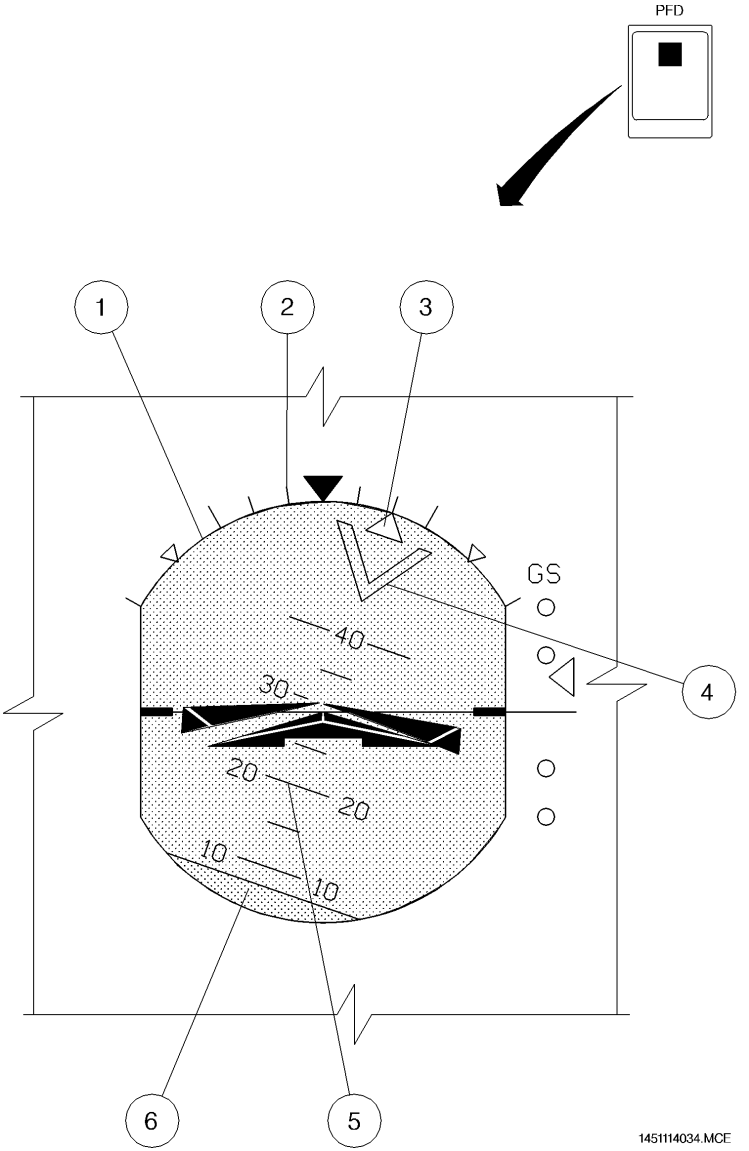

ELECTRONIC ATTITUDE DIRECTOR INDICATOR

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ATTITUDE DECLUTTER

When there is an excessive attitude situation, certain indicators are removed in order to declutter the PFD.

Excessive attitude situation occurs when roll attitude is greater than 65 degrees, or pitch attitude greater than 30 degrees nose up or 20 degrees nose down.

In this case, the following symbology shall be removed from the display:

– Flight Director couple arrow,
– Low Bank limit arc,
– Flight Director command bars,
– Vertical Deviation scale, pointer and label,
– Radio Altitude digits, label and box,
– Marker beacons indicators,
– Decision Height digits and labels,
– Selected Airspeed bug and indicators,
– Vertical Speed bug and indicators,
– Selected Altitude bug, indicators and box,
– All failure flags associated with the items listed above,
– The Heading, Radio Altitude, LOC, GS, and ILS comparison monitor displays

The PFD indicators will be restored when the two conditions below are met:

– Roll attitude less than 63 degrees left and right.
– Pitch less than 28 degrees nose up and greater than 18 degrees nose down.

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ELECTRONIC HORIZONTAL SITUATION INDICATOR (EHSI)

1 - COMPASS CARD DISPLAY

May be displayed in the Full Compass or Arc formats, selected via the Display Control Panel (see section 2-18-40).

- Color: white.
- Range: 360 degrees.
- Resolution: 5 degrees.

2 - HEADING LUBBER LINE (FULL COMPASS FORMAT)

- Color: White.
- Provides the current heading reading against the heading scale.

3 - CURRENT HEADING DIGITAL DISPLAY (ARC FORMAT)

- Color:
  - Open box: white
  - Digits: white
- Range: 0 to 360 degrees.
- Resolution: 1 degree.

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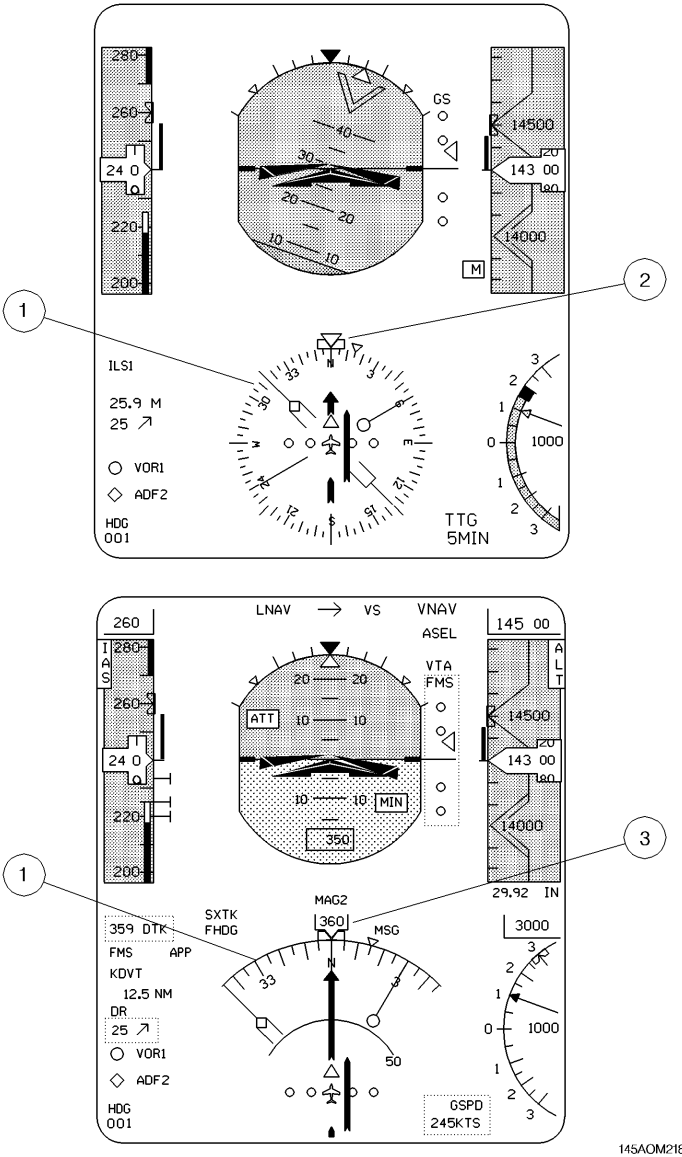

EHSI - FULL COMPASS AND ARC FORMATS

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COMPARISON MONITORS

1 - ATTITUDE COMPARISON MONITOR DISPLAY

- Label: ROL, PIT or ATT.
- Color: Amber.
- If roll information deviates by more than 6 degrees between the PFD 1 and PFD 2, a ROL comparison monitor will be displayed inside the attitude sphere.
- If pitch information deviates by more than 5 degrees between the PFD 1 and PFD 2, a PIT comparison monitor will be displayed in the upper-left portion of the attitude sphere.
  Simultaneous activation of the both pitch and roll comparison monitors will be announced by an ATT label displayed in the upper-left portion of the attitude sphere, in the same field of the ROL and PIT comparison monitors.

2 - ATTITUDE FAILURE DISPLAY

- Removal of the pitch scale and roll pointer.
- Coloring the attitude sphere overall blue.
- A red ATT FAIL label is displayed on the top center of the attitude sphere.

3 - ATTITUDE SOURCE ANNUNCIATION

- Label: ATT1 for IRS 1 and ATT2 for IRS 2.
- Color: Amber when one AHRS supplies both sides or both IRS are supplying cross-side.
- Annunciations are removed when both IRS are supplying on-side PFDs.

4 - HEADING SOURCE ANNUNCIATION

- Label:
  - MAG1 or MAG2 when cross-side IRS source is selected.
- Color:
  - For MAG: amber when the same IRS is supplying both sides or both IRS are supplying cross-side.
- When both IRS are supplying on-side, annunciation is removed.
- If a heading source becomes invalid the heading source annunciation will refer to the invalid heading source, HDG1 or HDG2, as applicable.

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5 - HEADING COMPARISON MONITOR DISPLAY

- Color: Amber.
- Label: HDG
- Activated when a difference of 6 degrees between both PFDs is found and the airplane roll is less than 6 degrees.
- For airplane rolls greater than 6 degrees, annunciation will be displayed if the difference between both PFDs is greater than 12 degrees.
- The HDG threshold will be restored to 6 degrees if the airplane roll is less than 5 degrees for 90 seconds. Otherwise, a 12 degrees HDG threshold will be maintained.

6 - HEADING FAILURE DISPLAY

- Digital heading bug symbol is removed and a red HDG FAIL annunciation is displayed on the PFD and MFD compass cards.
- The bearing pointers, map display, To/From, selected heading bug, drift angle, selected course/track and course deviation displays will be removed.
- Heading source annunciation will be HDG 1 or HDG 2.
- Heading select and course select/desired track digital display will be replaced by amber dashes.

7 - COURSE DEVIATION FAILURE

- Pointer is removed.
- Red X displayed over the scale.

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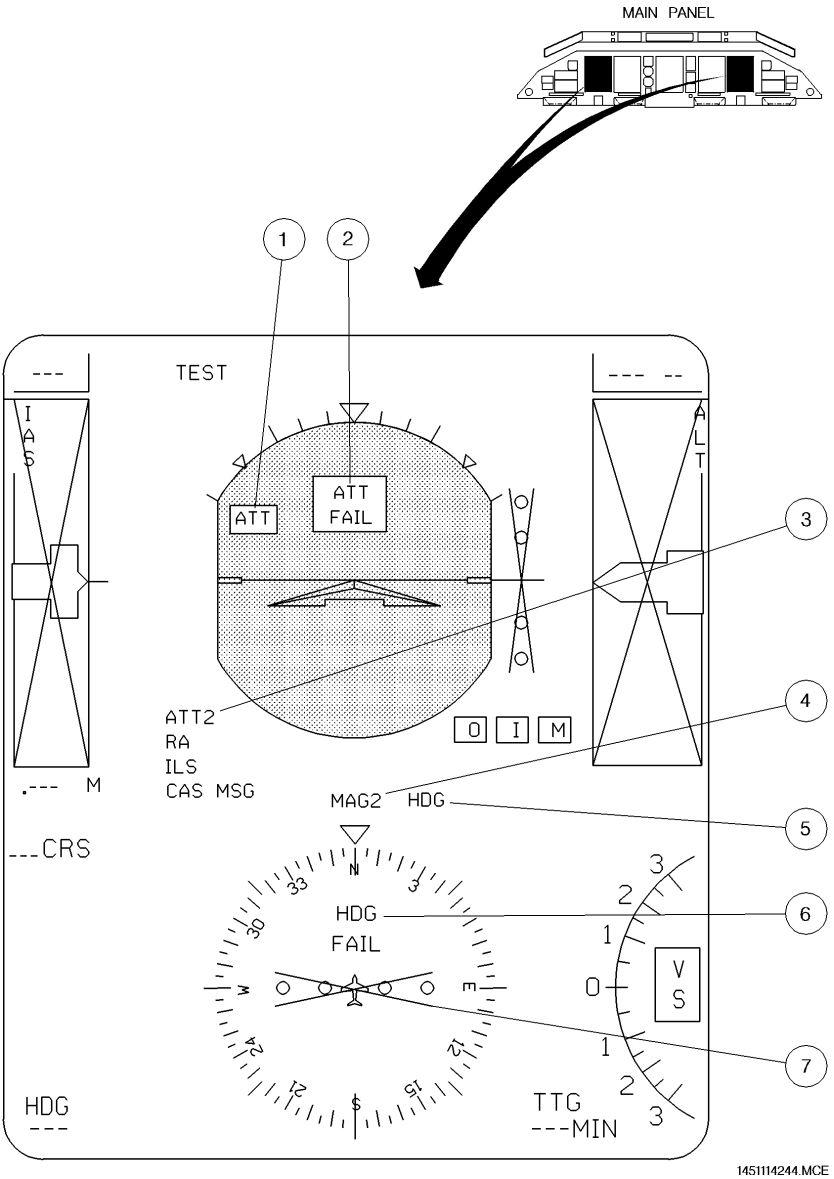

IRS FAIL INDICATION ON THE PFD

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FLIGHT MANAGEMENT SYSTEM

The FMZ 2000 Flight Management System (FMS) controls a complete range of navigation functions. Its primary purpose is to provide high accuracy in long range lateral and vertical navigation. The system may be installed with a single or dual configuration. Should the airplane have a dual configuration, each unit can provide navigation data to the other unit. For additional information on functions and operation, refer to the manufacturer's manual.

The FMS is mainly composed of the following components:

- Control Display Unit (CDU).
- Navigation Computer (NZ).
- Data Loader (DL) or Portable Data Transfer Unit (PDTU).

The FMS operates in the following situations: Oceanic, Remote, North Atlantic Minimum Navigation Performance Specification Airspace, Enroute, Terminal, Non-Precision Approach and Required Navigation Performance 10.

The FMS interfaces with the followings systems and equipment:

- GPS sensor(s), ADC 1 and 2 - The GPS receives satellite data through the passive GPS antenna, processing and blending collected data with ADC data and sends the resulting information to the FMS computer.
- AHRS/IRS 1 and 2 - Provides the necessary data to compute wind and for Dead Reckoning Mode, when the subsystem is not capable of navigating by itself.
- MFD and PFD - The FMS provides data for display navigation guidance on the PFD and navigation map data on the MFD.
- RMU 1 and 2 - The RMU interfaces with the FMS computer to control the operating frequencies, modes and channels of the various radios. For the dual configuration, each RMU supplies each respective on-side NZ.
- COM 1 and 2, NAV 1 and 2 - The FMS includes a radio-tuning page on which the pilot can manually select the VHF NAV and COM frequencies. Only the NAV frequency is fed back to the FMS computer for verification of the tuning action. COM 1 and 2 interface with FMS through the RMUs. The FMS can also automatically select the NAV radio frequencies. The FMS tune function for tuning communication frequencies with 8.33 kHz frequency spacing is available only for the Honeywell NZ5.2 FMS software version.
- The FMS also provides latitude and longitude to TCAS.

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– The Control Display Unit (CDU), located on the control pedestal, provides control functions management and operating modes for proper FMS operation. The EMB-145 should have two types of FMZ 2000 CDU installed, CD-810, CD-820, or CD-830. In dual FMS configuration, the intermix operation is not recommended.

– The CD-810 CDU is equipped with a Cathodic Ray Tube (CRT). The CD-820 and CD-830 CDU are equipped with a full-color Liquid Crystal Display (LCD) and contains nine lines, being the first a title line and the ninth the scratchpad.

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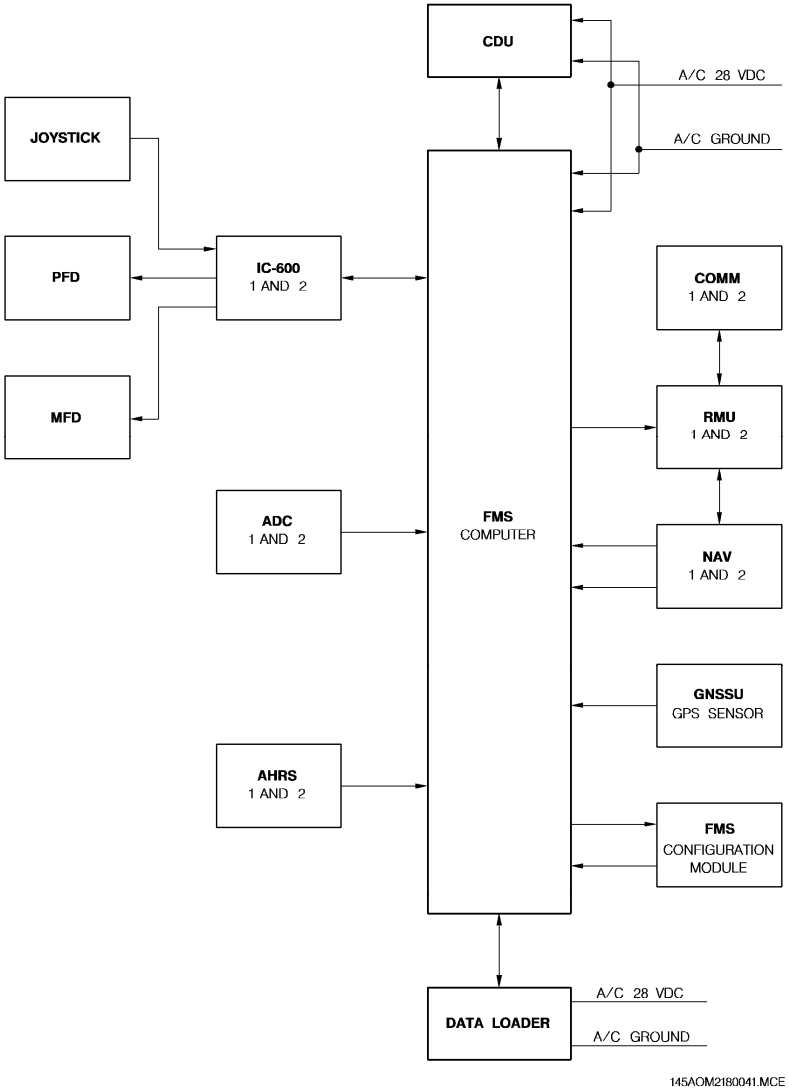

FMS SCHEMATIC

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FMS OPERATING MODES

FMS FUNCTIONS

NAVIGATION

The navigation function computes the airplane position and velocity for all phases of flight. The navigation priority modes, based on sensor accuracy, are as follows:

– GPS
– DME/DME
– VOR/DME
– IRS (if installed)

The GPS is the most accurate sensor. When the GPS is in use, the other sensors are still monitored for position differences, but they do not contribute to FMS position, unless the GPS becomes inaccurate, unavailable or is manually deselected. In this case, the FMS automatically tunes the DME/DME in order to provide position. When DME/DME is not accurate, the VOR/DME is selected.

On airplanes equipped with dual Inertial Reference System (IRS), replacing the AHRS, the IRS is used as a primary navigation sensor when other navaid are not available.

If all position sensors and radios are lost, the FMS shifts to Degrade Mode (DGRAD) and in approximately 2 minutes it enters the Dead Reckoning Mode (DR). In this mode, the position is calculated using the last known airplane position. The ground speed and track are estimated with AHRS/IRS heading, ADC TAS and the last known wind data.

The dual FMS configuration (NZ5.2 software version and on) may operate with dual IRS and dual GPS providing four long-range navigation sensors. The sensors status may be accessed in the NAV INDEX 1/2 page.

In this configuration, on-side FMS outputs and flight plan information are available to the opposite-side FMS through an interconnecting bus.

The automatic tuning is made through the rmu for computing an optimum position. The fms also includes a radio-tuning page on which the pilot can manually select vhf nav, com, adf and transponder frequencies. The nz5.2 software version and on has the capability of tuning communication frequencies in the 8.33 khz channel spacing.

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FLIGHT PLANNING

The flight planning function computes the active flight plan with both lateral and vertical definition.

When the FMS long-range navigation is selected, the flight director command bars will provide the visual command to bank the airplane to the desired track.

The VNAV is applicable only for the descent path and it is not coupled to the flight director, being only a reference information displayed on the PFD glide slope scale.

Additionally, the navigation computer can be programmed by the operator to automatically fly different types of holding patterns.

DATA BASE

The database contains worldwide coverage of navaids, airways, departure procedures, approach procedures, Standard Terminal Arrival Routes (STARs), airports and runways. This information is updated every 28 days. The database can also store up to 200 pilot-defined flight plans and waypoints, which are only updated when changed by the pilot.

In single configuration, the Data Loader (DL) is used to update the Database, transferring data to and from the Navigation Computer. In this configuration, this unit can be installed on the left lateral console, close to the pilot's mask stowage box.

In dual configuration, the Portable Data Transfer Unit (PDTU) is used to reload entire information package at each update by using a 3 $^{1}/_{2}$" floppy disk.

NAVIGATION DISPLAY

A multiple waypoints map, based on the airplane's present position, can be displayed on the MFD. It comprises the Waypoints connected by white lines defining a pre-planned route, and also navaids and airports.

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FMS MODES

The dual FMS configuration provides four operating modes that may be accessed through the FMS MAINTENANCE 1/3 page:

DUAL MODE

In this mode, the following information is automatically transferred to the cross-side FMS: flight plan, performance data, waypoints defined by the pilot, flight plans created in one system and radio tuning.

NOTE: For the proper operation in DUAL mode it is necessary to use the same software version, same NAV and CUSTOM data bases and same settings for both systems in the Configuration Modules. The initial position difference between both systems shall not be more than 10 NM.

INITIATED TRANSFER MODE

In this mode the flight plan and performance data entry will only be transferred to the cross-side FMS through the prompt command available in the last page of the ACTIVE FLT PLAN pages. Waypoints defined by the pilot, created flight plans and radio tuning are automatically transferred to the cross-side FMS.

NOTE: For the proper operation in INITIATED TRANSFER mode it is necessary to use the same software version, same NAV and CUSTOM data bases and same settings for both systems in the Configuration Modules. The initial position difference between both systems shall not be more than 10 NM.

INDEPENDENT MODE

In this mode, only the radio tuning is automatically transferred to the cross-side FMS.

NOTE: To operate in the INDEPENDENT mode, it is necessary to use the same software version and same settings in the Configuration Modules. If any of these requirements is not accomplished, the system automatically passes for the possible operating mode. For instance, if only the CUSTOM database differs in both systems, the operating mode automatically switches from DUAL to INDEPENDENT.

SINGLE MODE

no information is exchanged between both systems.

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FMS CONTROLS AND INDICATORS

CONTROL DISPLAY UNIT (CDU)

1 - ANNUNCIATORS

The CD-810 CDU has the annunciator lights directly above the display and the CD-820 and CD-830 CDU has the annunciators on the top of LCD display.

- Colors:
  - White: indicating advisory annunciation.
  - Amber: indicating alerting annunciation.

DSPLY (White)	Illuminates when the CDU displays a page that is not relative to the current airplane lateral or vertical flight path. This annunciator is not shown on the PFD.
DR (Amber)	Illuminates when a radio updating loss occurs, as well as all other position sensors, for a period longer than 2 minutes.
DGRAD (Amber)	Illuminates when the FMS cannot guarantee the position accuracy for the present phase of the flight.
MSG - (CD-810 and CD-820) FMS MSG - (CD-830) (White)	Illuminates when there is a message (advisory or alert) on the scratchpad. The annunciator turns off when the message is cleared from the scratchpad.
OFFSET (White)	Illuminates when a lateral offset path has been entered in the FMS. The annunciator turns off when the offset is removed.

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APRCH (White)	Illuminates when the FMS is selected as navigation source and the following conditions are valid: a non-precision instrument approach has been activated from the navigation database, the airplane position is between 2 NM outside the final approach fix and the missed approach point, the DGRAD must be off and FMS using approved sensors for non-precision approach.

NOTE: The FMS transmits all the annunciators to the PFD, except the DSPLY annunciator, so the pilot must not trust only on the FMS CDU for checking the FMS system status.

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2 - LINE SELECT BUTTONS

- There are four line select buttons on each side of the CDU that provide the following functions:
  - Select submodes within major modes when in an indexed display.
  - Used as direct access to the other FMS modes when in a non-indexed display.
  - Enter data to the scratchpad.

3 - BRIGHTNESS CONTROL KNOB/BUTTON

- Used to manually control the brightness of the display.
- After using this knob, the photo sensors are activated and maintain the brightness level through a wide range of lighting conditions. In CD-820 and CD-830 CDU the brightness is adjusted pressing the Bright/Dim button, so a control bar will be displayed in the scratchpad.
- The brightness can be adjusted so that, during daylight conditions, the display cannot be seen.

4 - MODE BUTTONS

PERF	Displays the performance pages.
NAV	Displays the NAV index pages.
ATC	NOT AVAILABLE.
FPL	It may be used to display the first page of the active flight plan, if the flight plan was previously entered, to manually create a flight plan, to select a stored flight plan and to create a flight plan for storage.
PROG	Displays the first progress page, the current status of the flight.
DIR	Displays the active flight plan with the DIRECT and INTERCEPT prompts.
MENU (CD-830)	Display the MENU pages.

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5 - ALPHANUMERIC BUTTONS

- Consist of alphabet letters, the numbers 0 through 9, a decimal, a dash and a slash. It is used to enter inputs to the FMS. In the CD-820 and CD-380 a SP (Space) key is used to insert a space following a character in the scratchpad, and a +/- (Plus/Minus) key will result in a - being entered, changing to + in a subsequent press.
- The alphanumeric keys make entries only on the scratchpad.

6 - FUNCTIONS BUTTONS

PREV	Changes the current page to the previous page.
NEXT	Changes the current page to the next page.
CLR	Clears alphanumeric entries in the scratchpad or a scratchpad message.
DEL	Works together with line select buttons in order to delete waypoints and other items displayed on the CDU. This button is inhibited when a message is displayed.

The CD-820 has five function buttons directly above the LCD display that will not work if pressed. The following messages will be displayed in the scratchpad:

VIDEO	VIDEO NOT AVAILABLE.
GRAPHIC	GRAPHIC NOT AVAILABLE.
ATC	ATC NOT AVAILABLE.
BACK	BACK COMPLETE.
FN	FN NOT AVAILABLE.

The CD-830 has a different layout from the CD-820. The function keys are re-arranged. It includes:

- The function keys “BACK” and “FN” are always accessible, meanwhile “VIDEO” and “GRAPHIC” were moved to the submenu in the key “MENU”;
- The line select keys (LSKs) are soft keys on touch screen display;
- The keys that were not available in CD-820 are the same as the ones in CD-830.

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7 - SCRATCHPAD

- It is the working area, located on the bottom line of the display, where the pilot can enter data and/or verify data before line selecting the data into its proper position.
- Data is retained on the scratchpad throughout all mode and page changes.
- The scratchpad also provides advisory and alerting messages to be displayed.

The colors on the CD-820 and CD-830 are designed to highlight important information. Color assignments are coordinated as much as possible with other displays. See below the parameters associated to each color:

Vertical	Cyan (Blue)
Atmospheric Data	Cyan (Blue)
Lateral	Green
FROM Waypoint	Yellow
TO Waypoint	Magenta
Prompts and Titles	White
Flight Plan Names	Orange
Index Selections	Green

8 - TOUCH SCREEN (If applicable)

For airplanes equipped with Control Display Unit CD-830, the display of the CDU is touch sensitive.

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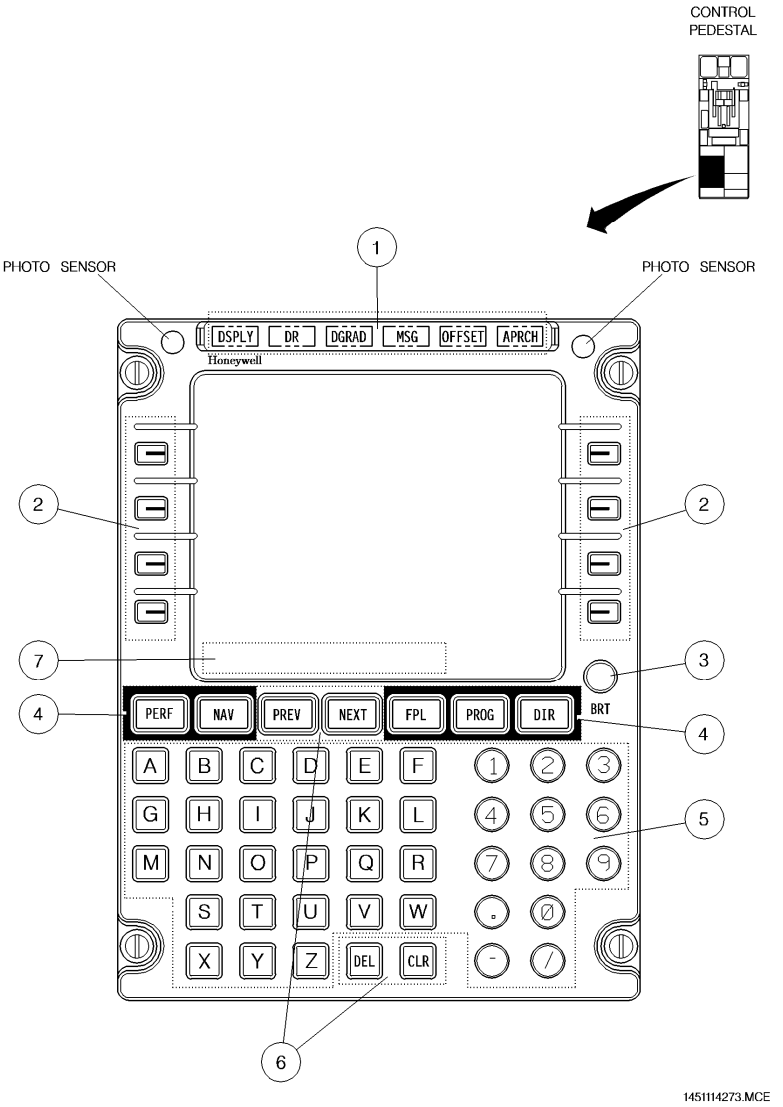

FMZ 2000 FMS CD-810 CONTROL PANEL

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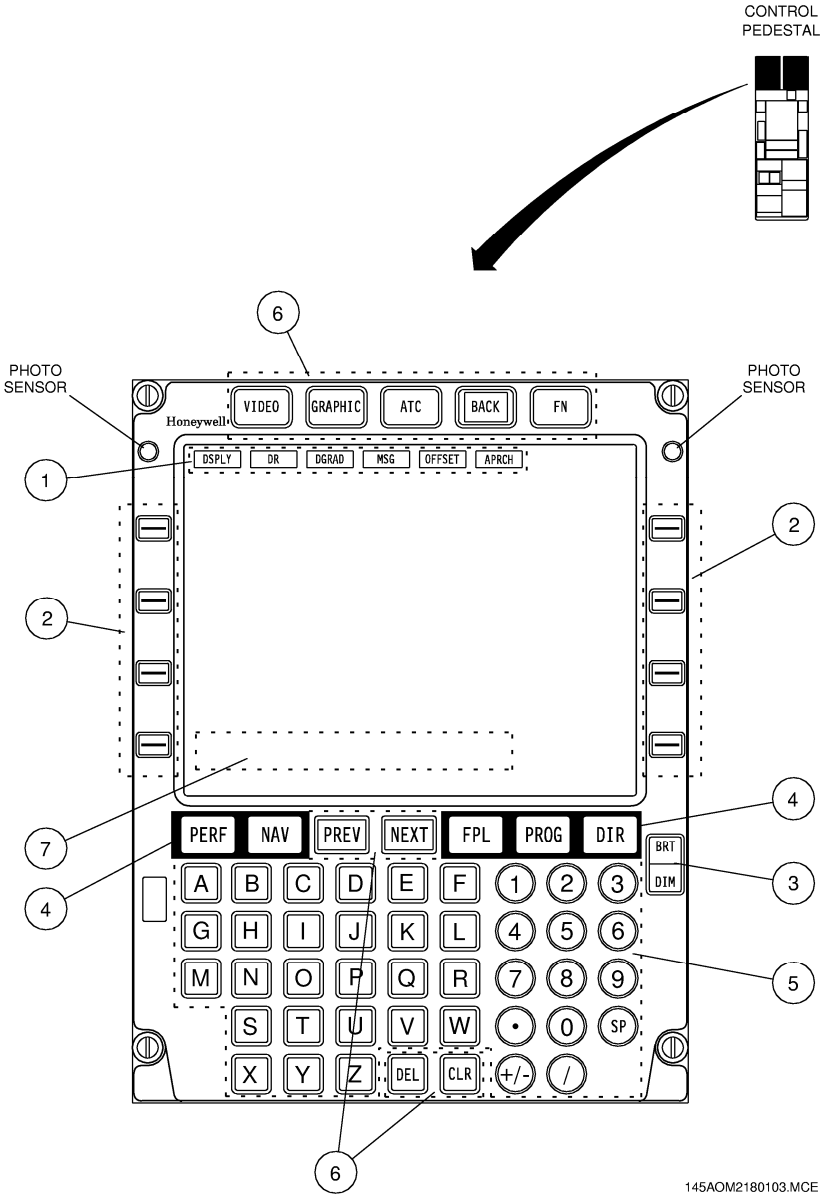

FMZ2000 FMS CD-820 CONTROL PANEL

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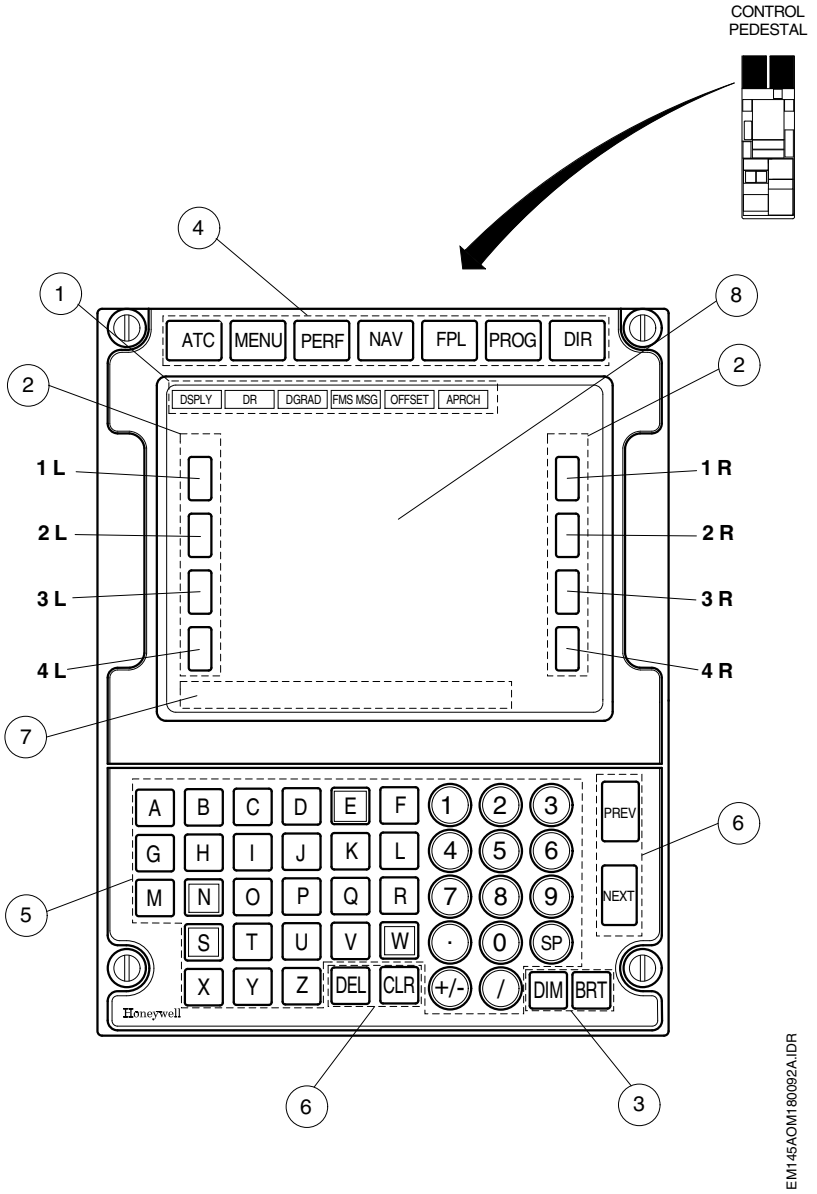

FMZ2010 FMS CD-830 CONTROL PANEL

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JOYSTICK (OPTIONAL)

The joystick functions are available through the joystick controller that is located on the control pedestal and through the selection of the MFD JSTK menu.

When the MFD joystick menu is selected, the joystick controller is available to control the Designator Symbol movement on the MFD FMS flight plan.

JOYSTICK OPERATION

On power-up, the designator is co-located with the present flight plan waypoint position.

If MAP mode is selected, moving the joystick controller, will cause the Designator Symbol to be displayed in blue color with a broken line which moves in the same direction from its last waypoint position.

If PLAN mode is selected, moving the joystick controller, the flight plan moves to the opposite direction from its last position, while the Designator Symbol remains fixed at the center of the plan format.

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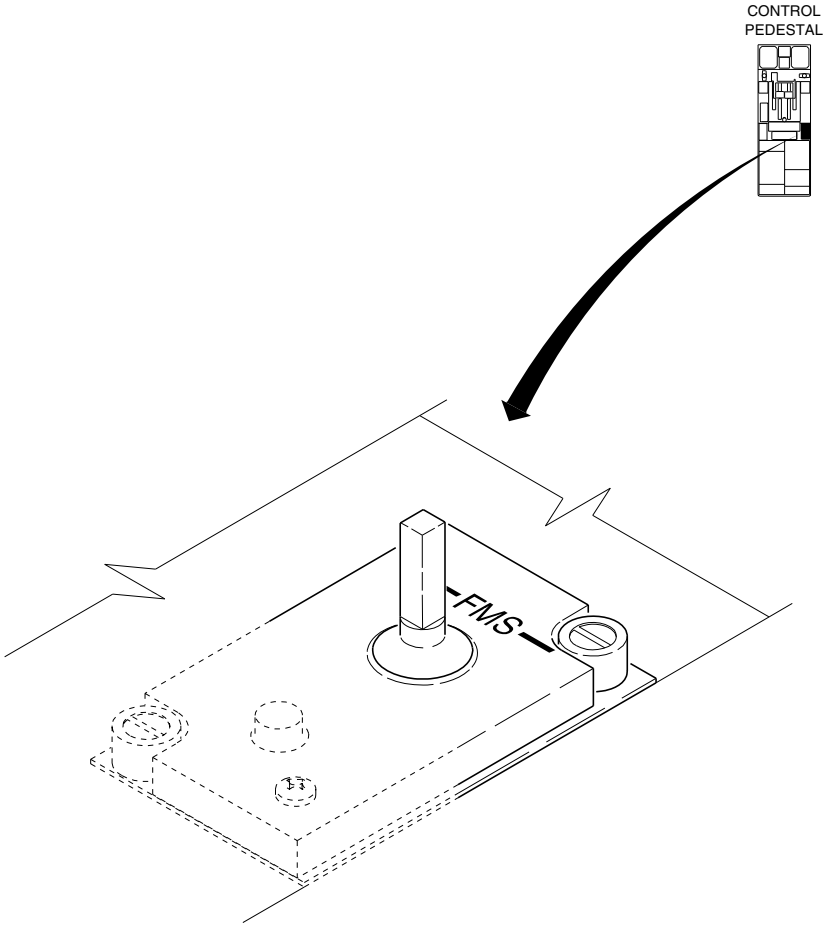

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JOYSTICK CONTROLLER

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JOYSTICK MENU BUTTONS FUNCTION AT MAP MODE

- SKIP ("SKP") button: Skips the designator to the position of the next waypoint in the flight plan in case of the designator is co-located with a plan waypoint. Otherwise, the designator broken line tail skips to the next waypoint in the flight plan.
- RECALL ("RCL") button: Positions the designator at the present position of the airplane and removes the designator box from the display in case of the designator is co-located with the flight plan waypoint. Otherwise, the designator is positioned over the waypoint from which the designator line is extended and the designator line is removed from the display.
- ENTER ("ENT") button: The latitude and longitude coordinates of the designator are transmitted to the selected FMS scratchpad as a requested waypoint.

JOYSTICK MENU BUTTONS FUNCTION AT PLAN MODE

- SKIP ("SKP") button: Positions the flight plan so the next waypoint is displayed over the designator in case of the designator is co-located with a flight plan waypoint. Otherwise, skips the tail of the designator line to the next waypoint in the flight plan.
- RECALL ("RCL") button: Positions the designator at the present position of the airplane and removes the designator box from the display in case of the designator is co-located with a flight plan waypoint. Otherwise, it positions the designator over the waypoint from which the designator line is extended and removes the designator line from the display.
- ENTER ("ENT") button: The latitude and longitude coordinates of the designator are transmitted to the selected FMS scratchpad as a requested waypoint.

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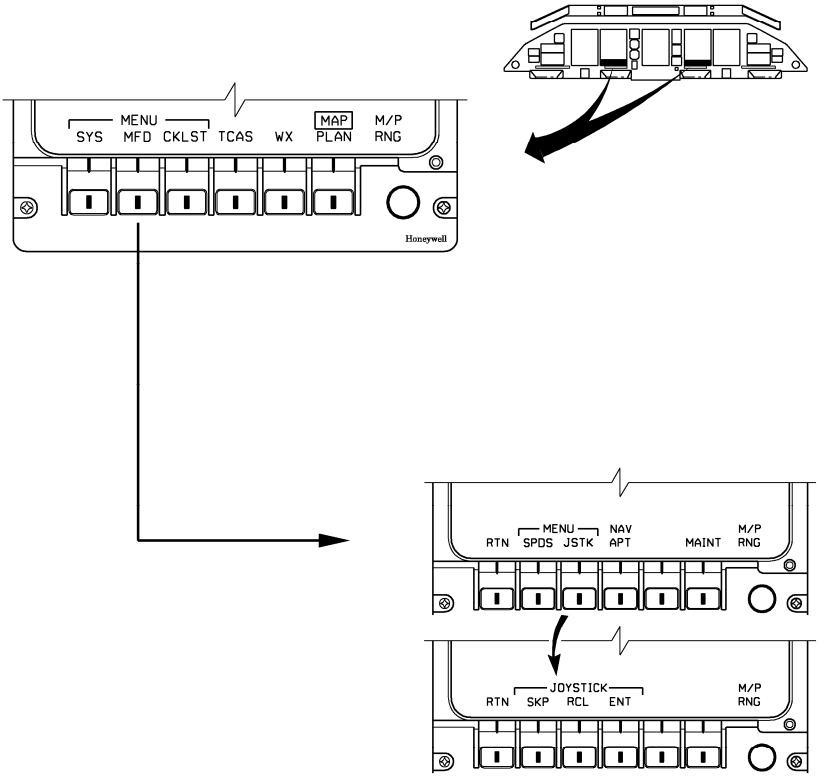

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MFD JOYSTICK MENU

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FLIGHT MANAGEMENT SYSTEM

The UNS-1K Flight Management System (FMS) controls a complete range of navigation functions. Its primary purpose is to provide high accuracy in long range lateral and vertical navigation. The system may be installed with a single or dual configuration. Should the airplane have a dual configuration, each unit can provide navigation data to the other unit. For additional information on functions and operation, refer to the manufacturer's manual.

The FMS is mainly composed of four components:

– Control Display Unit (CDU).
– Navigation Computer Unit (NCU).
– Data Transfer Unit (DTU).
– Configuration Module (CM).

The FMS operates in the following situations: Oceanic, Remote, North Atlantic Minimum Navigation Performance Specification Airspace, Enroute, Terminal, Non-Precision Approach and Required Navigation Performance 10.

The FMS interfaces with the followings systems and equipment:

– GPS sensor(s), ADC 1 and 2 - The GPS receives satellite data through the passive GPS antenna, processing and blending collected data with ADC data and sends the resulting information to the FMS computer.
– AHRS/IRS 1 and 2 - Provides the necessary data to compute the wind and for Dead Reckoning Mode, when the subsystem is not capable of navigating by itself.
– MFD and PFD - The FMS provides data for display navigation guidance on the PFD and navigation map data on the MFD.
– RMU 1 and 2 - The RMU interfaces with the FMS computer to control the operating frequencies, modes and channels of the various radios. For the dual configuration, each RMU supplies each respective on-side NCU.
– COM 1 and 2, NAV 1 and 2 - The FMS includes a radio-tuning page on which the pilot can manually select the VHF NAV and COM frequencies. Only the NAV frequency is fed back to the FMS computer for verification of the tuning action. COM 1 and 2 interface with FMS through the RMUs. The FMS can also automatically select the NAV radio frequencies.
– The FMS also provides latitude and longitude to TCAS.

The Control Display Unit (CDU), located on the control pedestal, provides control functions management and operating modes for proper FMS operation.

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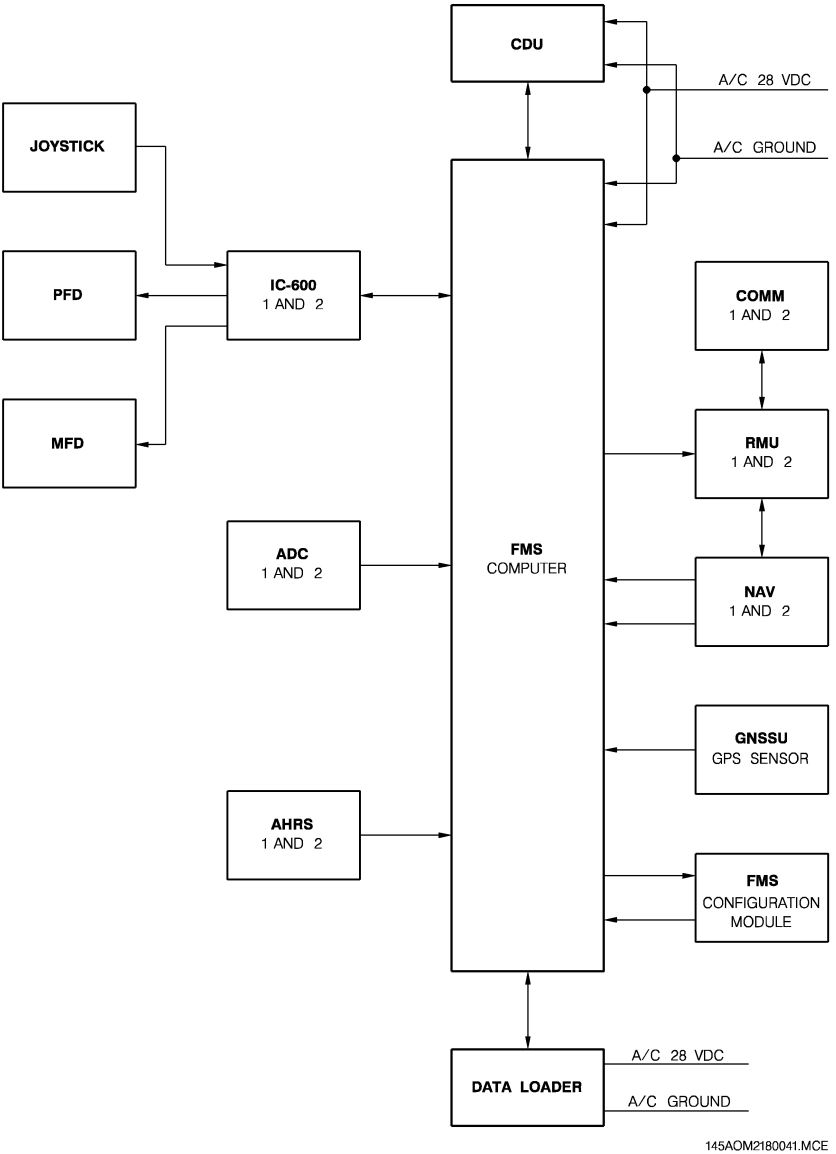

FMS SCHEMATIC

FMS OPERATING MODES

NAVIGATION

The navigation function computes the airplane position and velocity for all phases of flight. The navigation priority modes, based on sensor accuracy, are as follows:

– GPS
– DME/DME
– VOR/DME
– IRS (if installed)

The GPS is the most accurate sensor. When the GPS is in use, the other sensors are still monitored for position differences, but they do not contribute to FMS position, unless the GPS becomes inaccurate, unavailable or is manually deselected. In this case, the FMS automatically tunes the DME/DME in order to provide position. When DME/DME is not accurate, the VOR/DME is selected.

The GPS DESELECT message may be displayed on the CDU scratchpad during the flight, which will cause the FMS to enter into DME/DME mode. Two different scenarios can explain the GPS sensor being deselected.

1. In a multi-sensor configuration, the GPS position is monitored the same as DME-DME, IRS and Loran C sensor in relation to the average of all sensors currently selected. A position difference greater than 50 NM or a divergence at greater than 50 kt in relation to the FMS position or speed will cause automatic deselection of the GPS from the position solution. In this case, the sensor monitor has determined that the specified GPS data is unreasonable and has deselected the sensor for use in navigation.
2. The GPS DESELECT message can also occur when flying on a poor DME coverage area. Flying on a poor DME region will cause a rapid positioning of DME compared to GPS, inducing the GPS deselecting.

Based on this information, when facing a GPS DESELECT event, the flight crew should verify the condition of both GPS and DME sensors in order to determine the root cause of the scratchpad message.

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If the event was caused by the GPS sensor (satellite signal, GPS' antenna or receptor), the pilot should monitor HIL (Horizontal Integrity Limit in NM) on GPS STATUS Page (1/4) and when it meets phase of flight accuracy, reselect GPS. The GPS integrity monitor is defined for three phases of flight, each with a specified Alarm Limit and Time to Alarm, as showed in the table below:

Phase of Flight	Alarm Limit	Time to Alarm
Enroute	2.0 NM	27 seconds
Terminal	1.0 NM	7 seconds
Approach	0.3 NM	7 seconds

Otherwise, if the GPS was deselected due to a poor DME environment and the pilot has verified that the HIL value is within the limit for the respective phase of flight, it will be necessary to first manually deselect the DME through DME STATUS Page (1/1) and then reselect the GPS on GPS STATUS Page (1/4).

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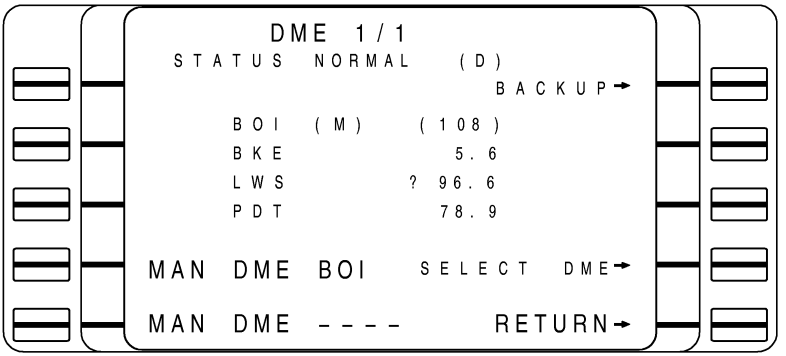

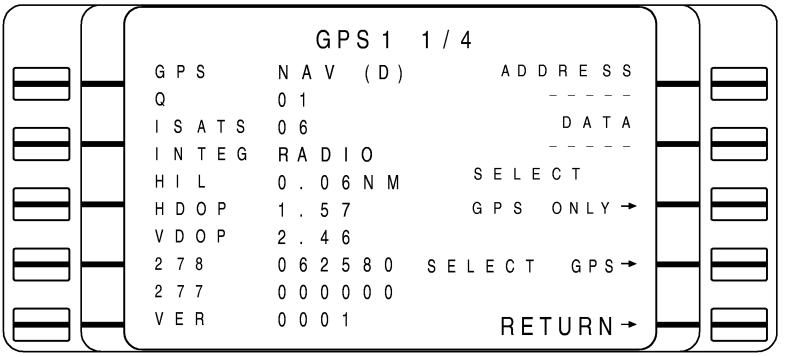

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CDU SCREEN

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On airplanes equipped with dual Inertial Reference System (IRS), replacing the AHRS, the IRS is used as a primary navigation sensor when other navaid are not available.

The dual FMS configuration may operate with dual IRS and dual GPS, providing four long-range navigation sensors.

In this configuration, on-side FMS outputs and flight plan information are available to the opposite-side FMS through an interconnecting bus.

The automatic tuning is made through the RMU for computing an optimum position. The FMS also includes a radio-tuning page on which the pilot can manually select VHF NAV, COM, ADF and transponder frequencies.

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FLIGHT PLANNING

The flight planning function computes the active flight plan with both lateral and vertical definition.

When the FMS long-range navigation is selected, the flight director command bars will provide the visual command to bank the airplane to the desired track.

The VNAV is applicable only for the descent path and it is not coupled to the flight director, being only a reference information displayed on the PFD glide slope scale.

Additionally the navigation computer can be programmed by the operator to automatically fly different types of holding patterns.

DATA BASE

The database contains worldwide coverage of navaids, airways, departure procedures, approach procedures, Standard Terminal Arrival Routes (STARs), airports and runways. The database can also store up to 200 pilot-defined flight plans and waypoints, which are only updated when changed by the pilot.

The database must be updated every 28 days through a 3 ½" floppy or ZIP disk inserted in the Data Transfer Unit (DTU).

NAVIGATION DISPLAY

A multiple waypoints map, based on the airplane's present position, can be displayed on the MFD. It comprises the Waypoints connected by white lines defining a pre-planned route, and also navaids and airports.

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FMS CONTROLS AND INDICATORS

CONTROL DISPLAY UNIT (CDU)

The CDU provides information to the flight crew through a 4-inch liquid crystal display in full color, which is put in action by an alphanumeric and function keyboard.

1 - ANNUNCIATORS

Six annunciators are scheduled to alert the crew about flight plan status and sequencing.

MSG (Yellow) - This message appears when a new message is generated.

WPT (Yellow) - Indication concerning Lateral waypoint alert when steady. A flashing indication announces a Vertical waypoint flight plan angle alert.

SXTK (Amber) - Indication concerning FMS selected crosstrack mode.

FMS HDG (White) - This label indicates that the FMS is in heading mode.

FMS APPR (White) - Indication concerning approach mode.

NOTE: GPS INTEG (White) - A fault is detected or RAIM is not available with the possibility of functioning DME.

2 - LINE SELECT BUTTONS

There are five line select keys on each side of the CDU to position the cursor. It is used with the alphanumeric buttons to input data and pressing ENTER completes the entry.

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3 - MODE SELECT BUTTONS

NAV - Displays the navigation function pages. This mode normally contains two pages, but when another NAV mode is selected there are two or more pages available by pressing the PREV or NEXT button.

DTO - Displays the DTO (Direct to) function.

FPL - Displays the Flight Plan pages or stored arrivals and routes.

VNAV - Provides access to the VNAV function.

LIST - Provides a list of options appropriated to input data.

MENU - Displays a list of alternate formats or options for FUEL, FPL, or TUNE.

PERF - Displays Performance pages. The first page PERF 1/1 provides a synopsis of pertinent in-flight performance information.

DATA - Provides information concerning the FMS, NAV Data Base and operating attached sensors, as well as their status.

FUEL - Displays all fuel management functions.

TUNE - Provides access to the TUNE function.

4 - FUNCTION BUTTONS

MSG - Displays the activated message when the MSG annunciation appears on display.

PWR DIM - Turns on and off the FMS and provides the dimming function.

PREV - Changes the current page to the previous page.

NEXT - Changes the current page to the next page.

BACK - Deletes an alphanumeric entry, if over it, and serves as backspace function.

ENTER - Stores input data each time it is pressed. It is required for all data entries.

5 - ALPHANUMERIC BUTTONS

Consist of alphabet letters, the numbers 0 through 9 and a +/- button. They are used to enter inputs to the FMS.

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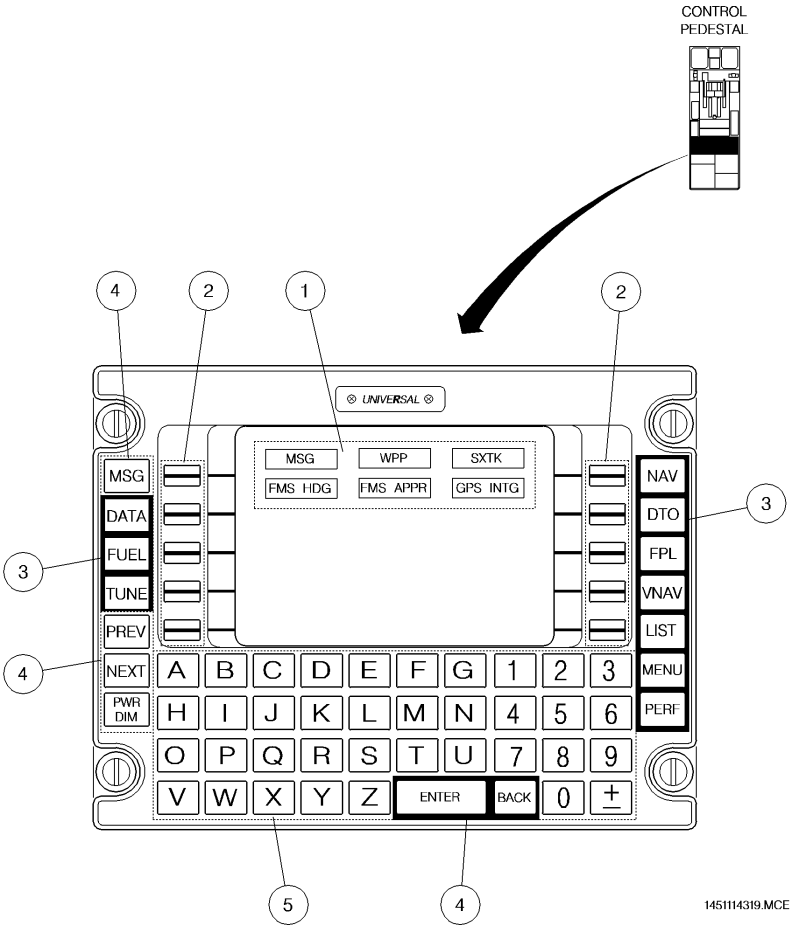

UNS-1K FMS CONTROL PANEL

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JOYSTICK (OPTIONAL)

The joystick functions are available through the joystick controller that is located on the control pedestal and through the selection of the MFD JSTK menu.

When the MFD joystick menu is selected, the joystick controller is available to control the Designator Symbol movement on the MFD FMS flight plan.

JOYSTICK OPERATION

On power-up, the designator is co-located with the present flight plan waypoint position.

If MAP mode is selected, moving the joystick controller, will cause the Designator Symbol to be displayed in blue color with a broken line which moves in the same direction from its last waypoint position.

If PLAN mode is selected, moving the joystick controller, the flight plan moves to the opposite direction from its last position, while the Designator Symbol remains fixed at the center of the plan format.

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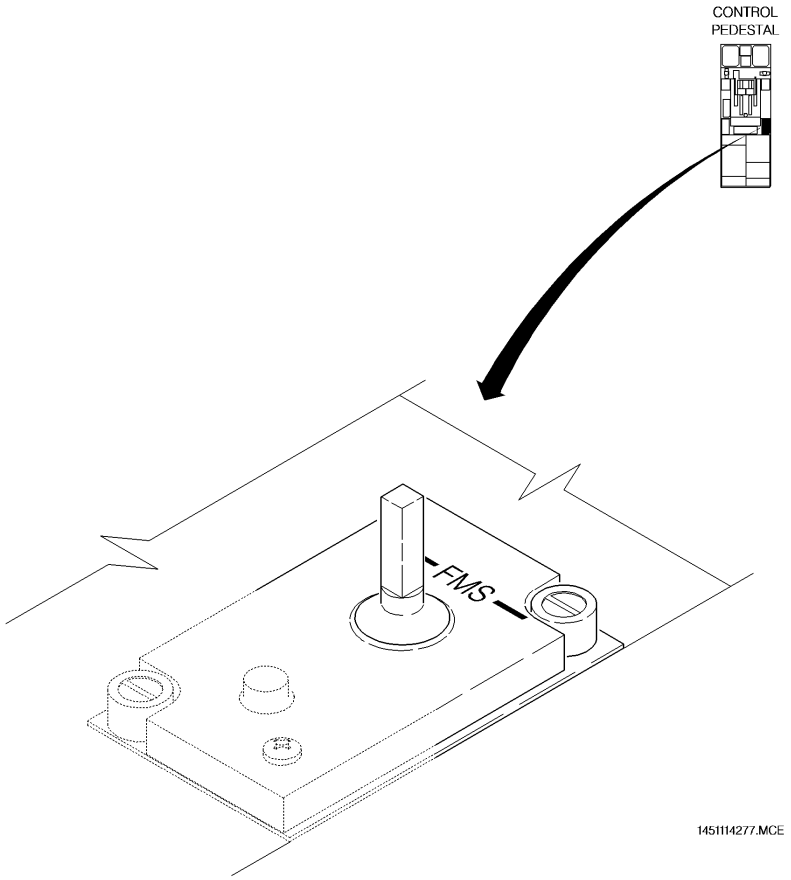

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JOYSTICK CONTROLLER

JOYSTICK MENU BUTTONS FUNCTION AT MAP MODE

- SKIP ("SKP") button: Skips the designator to the position of the next waypoint in the flight plan in case of the designator is co-located with a plan waypoint. Otherwise, the designator broken line tail skips to the next waypoint in the flight plan.
- RECALL ("RCL") button: Positions the designator at the present position of the airplane and removes the designator box from the display in case of the designator is co-located with the flight plan waypoint. Otherwise, the designator is positioned over the waypoint from which the designator line is extended and the designator line is removed from the display.
- ENTER ("ENT") button: Confirms the waypoint desired location.

JOYSTICK MENU BUTTONS FUNCTION AT PLAN MODE

- SKIP ("SKP") button: Positions the flight plan so the next waypoint is displayed over the designator in case of the designator is co-located with a flight plan waypoint. Otherwise, skips the tail of the designator line to the next waypoint in the flight plan.
- RECALL ("RCL") button: Positions the designator at the present position of the airplane and removes the designator box from the display in case of the designator is co-located with a flight plan waypoint. Otherwise, it positions the designator over the waypoint from which the designator line is extended and removes the designator line from the display.
- ENTER ("ENT") button: Confirms the waypoint desired location.

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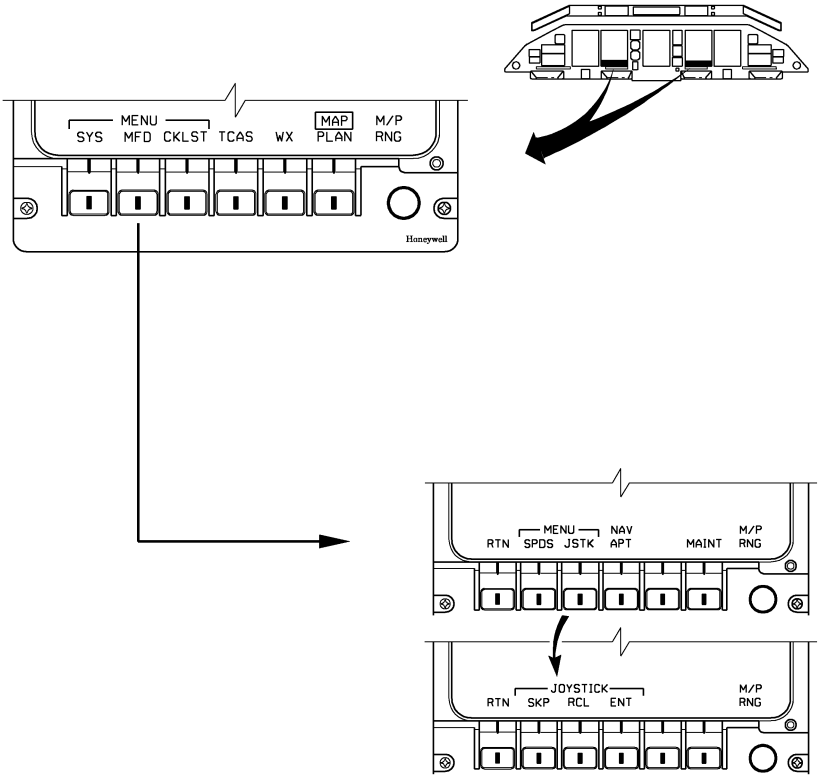

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MFD JOYSTICK MENU

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FLIGHT MANAGEMENT SYSTEM

The FMZ 2010 Flight Management System (FMS) operates with the FMS NZ6.1.1 software, indicated on its NAV IDENT page. The FMS NZ6.1.1 controls a complete range of navigation functions. The primary purpose of a Flight Management System (FMS) is to manage navigation sensors to produce a composite lateral position and provide lateral flight path guidance together with performance predictions for trip planning. For additional information on functions and operation, refer to the manufacturer's manual.

The FMS consists of the following components:

- NZ-2010 Navigation Computer (NZ),
- IM-803 Configuration Module,
- Control Display Unit (CDU), and
- Data Loader (DL).

The FMS operates in the following situations: Oceanic, Remote, North Atlantic Minimum Navigation Performance Specification Airspace, Enroute, Terminal, Non-Precision Approach, and Required Navigation Performance.

The FMS interfaces with the followings systems and equipment:

- GPS sensor(s) - The GPS receives satellite data through the active GPS antenna, and provides Latitude, Longitude, and ground speed for FMS navigation.
- ADC 1 and 2 - Air data computer provides barometric altitude and Airspeed to FMS computer.
- AHRS 1 and 2 - Provides latitude, longitude, ground speed, and Heading information for FMS Navigation, FMS wind computation and for FMS Dead Reckoning Mode.
- VOR and DME radios - provides track angle to VOR stations and Distance to DME stations, allowing FMS to compute navigation data.
- MFD and PFD - The FMS provides Navigation guidance on the PFD HSI, when FMS is selected as Navigation Source on DC-550 panel, and also next waypoint, Distance to waypoint and Lateral Flight Plan on navigation MAP data on the MFD.

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- RMU 1 and 2 - The RMU interfaces with the FMS computer to control the operating frequencies, modes, and channels of the various radios. For the dual configuration, each RMU supplies each respective on-side NZ.
- COM 1 and 2, NAV 1 and 2 - The FMS includes a radio-tuning page on which the pilot can manually select the VHF NAV and COM frequencies. Only the NAV frequency is fed back to the FMS computer for verification of the tuning action. COM 1 and 2 interface with FMS through the RMUs. The FMS can also automatically select the NAV radio frequencies.
- The FMS also provides latitude and longitude to TCAS and EGPWS.

The Control Display Unit (CDU), located on the control pedestal, provides control functions management and operating modes for proper FMS operation.

The FMS Part Number may be identified following the steps below:

1. Push the NAV key to access the NAV INDEX 1/2 page.
2. Push NEXT to access the NAV INDEX page 2/2.
3. Push the MAINTENANCE key to access the maintenance page.
4. Push NEXT key twice to access the Return to Service Page.
5. Read the FMS PN according to the following table.

FMS PN	RELATED FMS PN OBTAINED VIA RETURN TO SERVICE PAGE
7018879-03046	FMS_NZ_GEN18001

Some additional features available for airplanes with FMS NZ6.1.1 software version are:

- Custom database changes: The custom database consists of pilot-defined waypoints and stored flight plans. In which up to 1000 pilot-defined waypoints can be stored. The pilot can store commonly flown routes using the pilot-defined flight plan procedure. It can retain up to 3000 flight plans with a total of 45000 waypoints (whichever comes first). Each flight plan with the maximum of 100 waypoints.

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- Automated Holding to Altitude (HA) leg sequencing: It removes the need to manually sequence an HA leg when achieves an HA altitude constraint. It adds to the streamlining of auto sequencing for all FMS leg types. When the airplane achieves the HA altitude constraint, the FMS deletes the holding pattern, resulting in an immediate exit of the holding pattern. It is possible to delete the hold manually from the flight plan before entering the pattern. Manually exit is inhibited when in the pattern.
- Enroute holding procedures: It allows the flight crew to select a published holding procedure from the database or insert a manual hold into the flight plan at any enroute waypoint. When the crew selects a hold at an enroute waypoint, the FMS determines if there is a database defined hold at that waypoint. When a hold is defined at that waypoint, it is possible to select the database hold or a default hold. If there is no database hold, the FMS shows the default hold and it is possible to change before inserting it into the flight plan. If multiple patterns exist for a particular fix, all are displayed on the page and the crew chose the one to be activated.
- Navigation database changes: It allows the inclusion of circling approaches and Multi-RNAV runways, i.e., multiple approaches with the same guidance RNAV to the same runway are annotated with an alphabetical suffix beginning at the end of the alphabet and working backwards for subsequent procedures.
- Circling approaches: Added to the navigation database and applicable to all runways at an airport. It is allowed to change the runway subsequently without having to reselect the circling approach. When a runway is selected with a circling approach and the runway is the missed approach point, the FMS use the higher altitude constraint of the missed approach point rather than the runway altitude.
- RNP Settings Page: Display and modify the RNP values and is accessed through RNP on PROGRESS 2/3 PAGE. It is possible to the crew to entry the RNP values for each phase of flight or a manual override RNP value.

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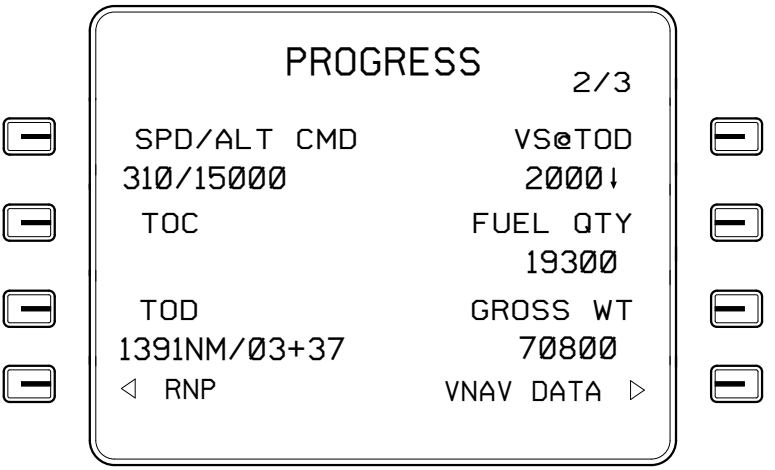
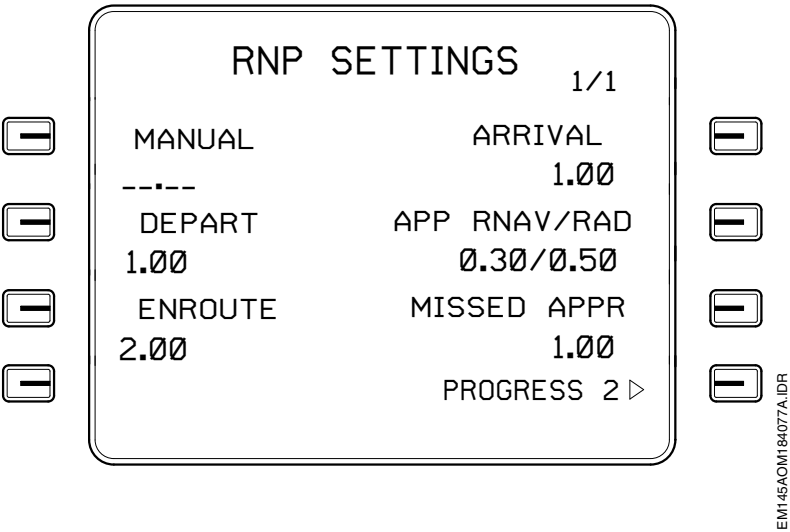


PROGRESS 2/3 PAGE WITH RNP



RNP SETTINGS PAGE

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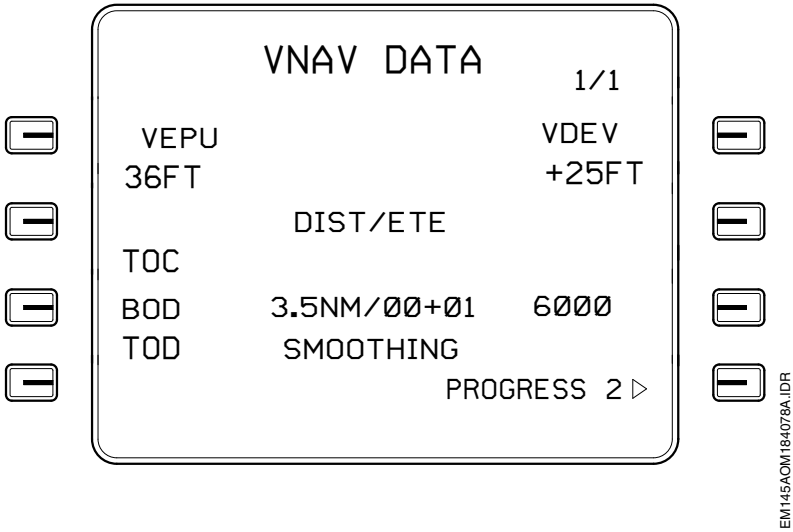
– VNAV Data: Displays vertical data for the entire flight (Vertical deviation, TOC, BOD, TOD distance, ETE, and altitude). For airplanes Post-Mod. SB145-34-0125, temperature compensation is available when Baro-VNAV is enabled. It is accessed through VNAV DATA on PROGRESS 2/3 PAGE.



VNAV DATA PAGE

– Vectors to Final: Allows the flight crew to comply with ATC-directed vectoring in the terminal area by removing unneeded approach waypoints from the flight plan.

When vector operations are being conducted and LNAV is armed, the FMS computes a capture point as the first intersection of the current track from the selected heading with the flight plan to determine the TO and FROM waypoints (flight plan cleanup).

When armed, LNAV engages the intercept course with the airplane within normal capture range of the inbound course to the active waypoint.

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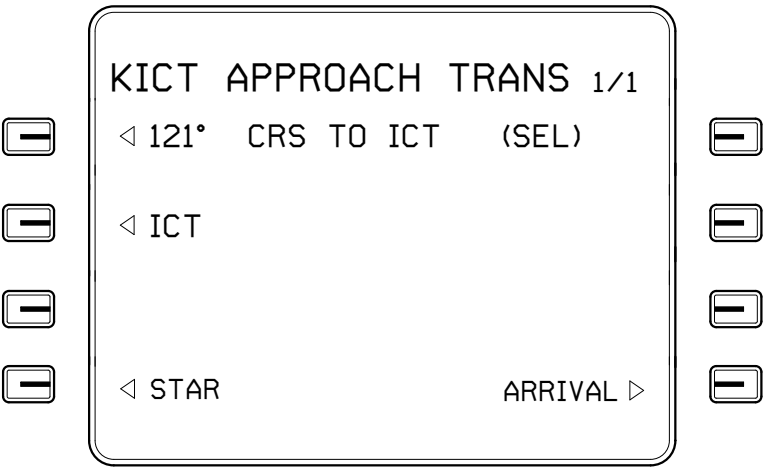
When a vectored approach transition is selected, the FMS creates an approach consisting of an intercept leg leading to the FAF and removes any legs existing in the approach before the FAF. Only the approach legs before the FAF are removed, the departure, cruise, and arrival legs remain in the flight plan.

If there is no published approach transition and the initial fix of the approach is the FAF, there is no course available for leg construction. In this condition, the course field is dashed, and pilot entry is required.

The vectored approach transition is the default selection on the APPROACH TRANS page.



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APPROACH TRANS PAGE WITH INCLUSION OF VECTORED APPROACH

When vector operations are being conducted in TERM area with the FAF not sequenced, the ACT VECTORS displays and FLY VECTORS TO INTERCEPT displays as the FROM waypoint.

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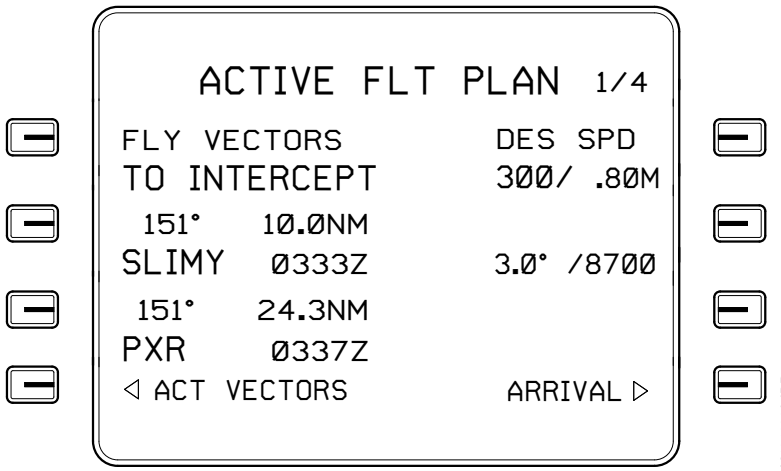

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ACTIVE FLIGHT PLAN PAGE WITH FLY VECTORS TO INTERCEPT AS THE FROM WAYPOINT

If a vectored approach transition is selected during preflight, FLY VECTORS TO INTERCEPT is inserted as a segment into the flight plan immediately prior to the FAF.

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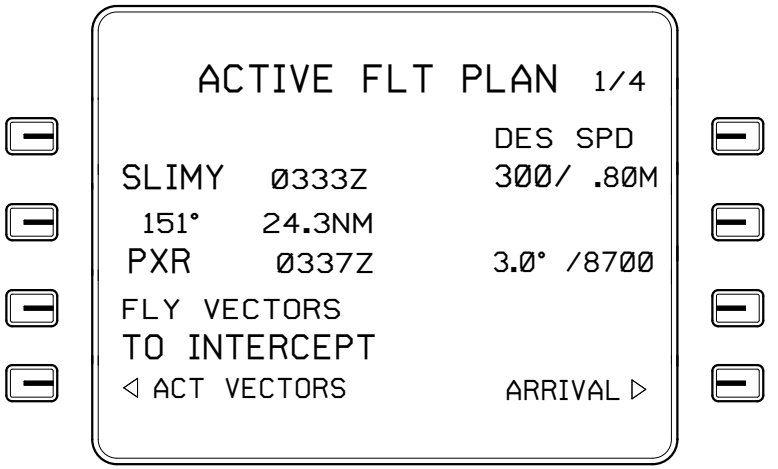

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ACTIVE FLIGHT PLAN PAGE WHEN A VECTORED APPROACH TRANSITION IS SELECTED DURING PREFLIGHT

Selecting the ACT VECTORS makes the FLY VECTORS TO INTERCEPT the FROM waypoint and results in LNAV to drop.

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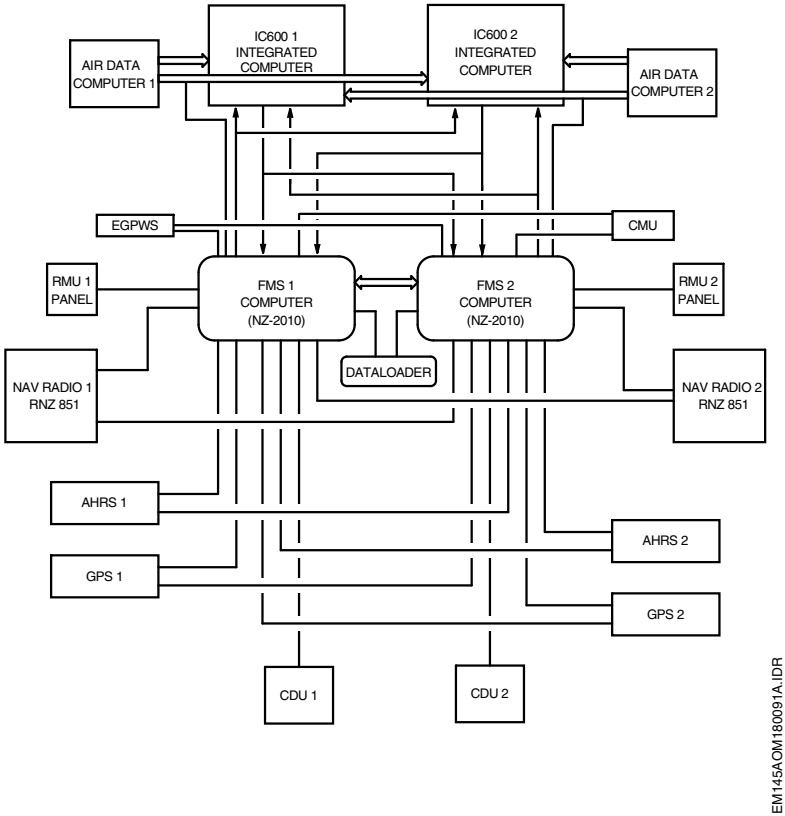

FMS SCHEMATIC

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FMS OPERATING MODES

FMS FUNCTIONS

NAVIGATION

The position determination function computes the airplane position and velocity for all phases of flight. The FMS receives navigation data from various sensors on board the airplane. The priority of the navigation modes is as follows:

– GPS,
– DME/DME,
– VOR/DME, and
– IRS.

The GPS is the most accurate sensor. When GPS is in use, the other sensors are still monitored for position differences, but they do not contribute to FMS position, unless the GPS becomes inaccurate, unavailable, or is manually deselected. In this case, the FMS automatically tunes the DME/DME in order to provide position. When DME/DME is not accurate, the VOR/DME is selected.

If all position sensors and radios are lost, the FMS shifts to Degrade Mode (DGRAD) and in approximately 2 minutes it enters the Dead Reckoning Mode (DR). In this mode, the position is calculated using the last known airplane position. The ground speed and track are estimated with AHRS heading, ADC TAS and the last known wind data.

The lateral navigation (LNAV) function of the FMS calculates navigation information relative to selected geographical points. The pilot can define flight plan routes worldwide. The system outputs information and steering signals that show the pilot or flight guidance system (FGS/Autopilot/Flight Director) how to guide the airplane along the desired route. Routes are defined from the present position of the airplane to a destination waypoint along a great circle route or through a series of great circle legs defined by intermediate waypoints.

The vertical navigation (VNAV) provides vertical guidance with steering targets to FGS to guide the airplane in the vertical profile. A deviation scale for the VNAV is located on the PFD, on the same place where the glide slope scale.

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For airplanes Post-Mod. SB145-34-0125, the FMZ2010 with the FMS NZ6.1.1 software also provides the functions: barometric-vertical navigation (Baro-VNAV) and Localizer Performance with Vertical guidance (LPV) operations. The application of the service bulletin by itself does not allow their usage without operational approval and training as required by airworthiness authority.

FLIGHT PLANNING

The flight planning function computes the active flight plan with both lateral and vertical definition.

The navigation computer has the ability to store and retrieve information of navaids and earth reference points such as airports, navaids, intersections, runways and routes. This information is stored in a database, which is updated every 28 days from a USB drive via the data loader. A reserved area of the internal database memory is used to store up to 1000 pilot-defined waypoints, which are only updated when changed in memory by the operator.

The operation of saving a Flight Plan may prevent the Speed Intervention function on the FMS, depending on how many waypoints on all Flight Plans have been stored in the Custom Database.

DATABASE

The database contains worldwide coverage of navaids, airways, departure procedures, approach procedures, Standard Terminal Arrival Routes (STARs), airports and runways. This information is updated every 28 days.

FMS MODES

The dual FMS configuration provides four operating modes that may be accessed through the FMS MAINTENANCE 1/3 page:

DUAL MODE

In this mode, the following information is automatically transferred to the cross-side FMS: flight plan, performance data, waypoints defined by the pilot, flight plans created in one system and radio tuning.

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INITIATED TRANSFER MODE

In this mode the flight plan and performance data entry will only be transferred to the cross-side FMS through the prompt command available in the last page of the ACTIVE FLT PLAN pages. Waypoints defined by the pilot, created flight plans and radio tuning are automatically transferred to the cross-side FMS.

INDEPENDENT MODE

In this mode, only the radio tuning is automatically transferred to the cross-side FMS.

NOTE: To operate in the INDEPENDENT mode, it is necessary to use the same software version and same settings in the Configuration Modules. If any of these requirements is not accomplished, the system automatically passes for the possible operating mode. For instance, if only the CUSTOM database differs in both systems, the operating mode automatically switches from DUAL to INDEPENDENT.

SINGLE MODE

No information is exchanged between both systems.

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FMS CONTROLS AND INDICATORS

CONTROL DISPLAY UNIT (CDU)

TEXT COLORS

The colors are designed to highlight important information. Color assignments are coordinated as much as possible with other displays. See below the parameters associated to each color:

Vertical	Cyan (Blue)
Atmospheric Data	Cyan (Blue)
Lateral	Green
FROM Waypoint	Yellow
TO Waypoint	Magenta
Prompts and Titles	White
Flight Plan Names	Orange
Index Selections	Green

1 - ANNUNCIATORS

The annunciators are located on the top of the LCD display.

- Colors:
  - White: indicating advisory annunciation.
  - Amber: indicating alerting annunciation.

DSPLY (White)	Illuminates when the CDU displays a page that is not relative to the current airplane lateral or vertical flight path. This annunciator is not shown on the PFD.
DR (Amber)	Illuminates when a radio updating loss occurs, as well as all other position sensors, for a period longer than 2 minutes.
DGRAD (Amber)	Illuminates when the FMS cannot guarantee the position accuracy for the present phase of the flight.

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MSG - (CD-810 and CD-820) FMS MSG - (CD-830) (White)	Illuminates when there is a message (advisory or alert) on the scratchpad. The annunciator turns off when the message is cleared from the scratchpad.
OFFSET (White)	Illuminates when a lateral offset path has been entered in the FMS. The annunciator turns off when the offset is removed.
APRCH (White)	Illuminates when the FMS is selected as navigation source and the following conditions are valid: a non-precision instrument approach has been activated from the navigation database, the airplane position is between 2 NM outside the final approach fix and the missed approach point, the DGRAD must be off and FMS using approved sensors for non-precision approach.

NOTE: The FMS transmits all the annunciators to the PFD, except the DSPLY annunciator, so the pilot must not trust only on the FMS CDU for checking the FMS system status.

2 - LINE SELECT BUTTONS

There are four line select buttons on each side of the CDU that provide the following functions:

- Select submodes within major modes when in an indexed display,
- Used as direct access to the other FMS modes when in a non-indexed display, and
- Enter data to the scratchpad.

For airplanes equipped with Control Display Unit CD-830, the Line Select Buttons are touch-sensitive keys. The feedback to the touch is the display of a cyan highlight round the button. The selection of the button only occurs when the touch and the lift off are from the same area.

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3 - BRIGHTNESS CONTROL BUTTON

- Used to manually control the brightness of the display.
- To adjust the brightness, press up or down the Bright/Dim button, and a control bar is displayed in the scratchpad.
- The brightness can be adjusted so that, during daylight conditions, the display cannot be seen.

4 - GROUP OF FUNCTIONS BUTTONS

PERF	Displays the performance pages.
NAV	Displays the NAV index pages.
FPL	Displays the first page of the active flight plan when the flight plan was previously entered. Also used to create a flight plan manually, to select a stored flight plan, and to create a flight plan for storage.
PROG	Displays the first progress page, the status of the flight.
DIR	Start the DIRECT-TO Function and displays the FLPN page with the prompts for the PATTERN and INTERCEPT functions.
ATC (FANS)	If interface is installed, it displays the ATC pages. If not installed, it returns a message that the function is not available.
VIDEO (CD-820)	Returns a scratchpad message that the function is not available.
GRAPHIC (CD-820)	Returns a scratchpad message that the function is not available.
BACK (CD-820)	Displays the last page that was selected when that page is available.

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FN (CD-820)	When a special function is defined by the FMS, this function is shown in reverse video (magenta) as an annunciator under the FN function key. Press FN to perform the function when the annunciator is shown. When a special function is not defined by the FMS, the area directly under the FN function key is empty. Pressing FN when no annunciator is shown returns a message that FN is not available.
MENU (CD-830)	Displays the MENU pages.

5 - ALPHANUMERIC BUTTONS

– Consist of alphabet letters, the numbers 0 through 9, a decimal, and a slash. It is used to enter inputs to the FMS. A SP (Space) key is used to insert a space following a character in the scratchpad, and a +/- (Plus/Minus) key will result in a - being entered, changing to + in a subsequent press.

– The alphanumeric keys make entries only on the scratchpad.

6 - EDITION BUTTONS

PREV	Changes the current page to the previous page.
NEXT	Changes the current page to the next page.
CLR	Clears alphanumeric entries in the scratchpad or a scratchpad message.
DEL	Works together with line select buttons in order to delete waypoints and other items displayed on the CDU. This button is inhibited when a message is displayed.

7 - SCRATCHPAD

– It is the working area, located on the bottom line of the display, where the pilot can enter data and/or verify data before line selecting the data into its proper position.

– Data is retained on the scratchpad throughout all mode and page changes.

– The scratchpad also displays advisory and alerting messages.

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8 - TOUCH SCREEN (If applicable)

For airplanes equipped with Control Display Unit CD-830, the display of the CDU is touch-sensitive.

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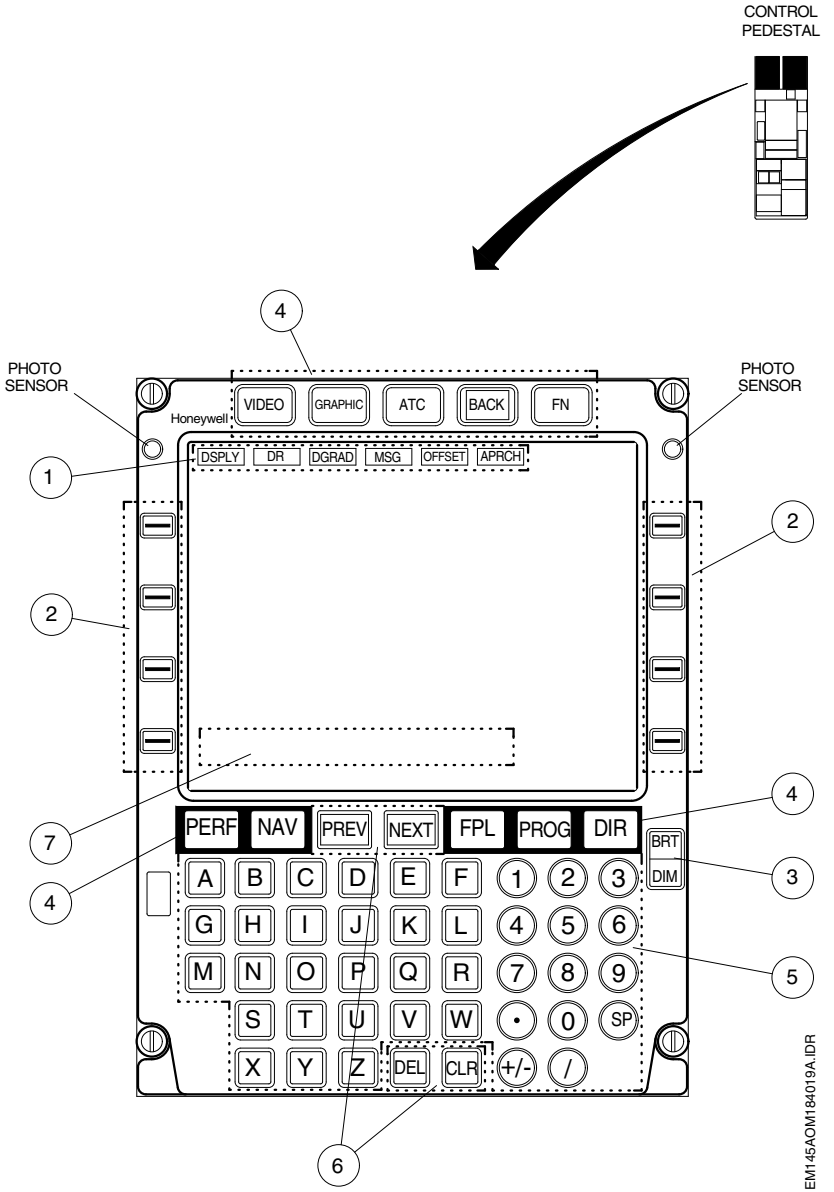

FMZ2010 FMS CD-820 CONTROL PANEL

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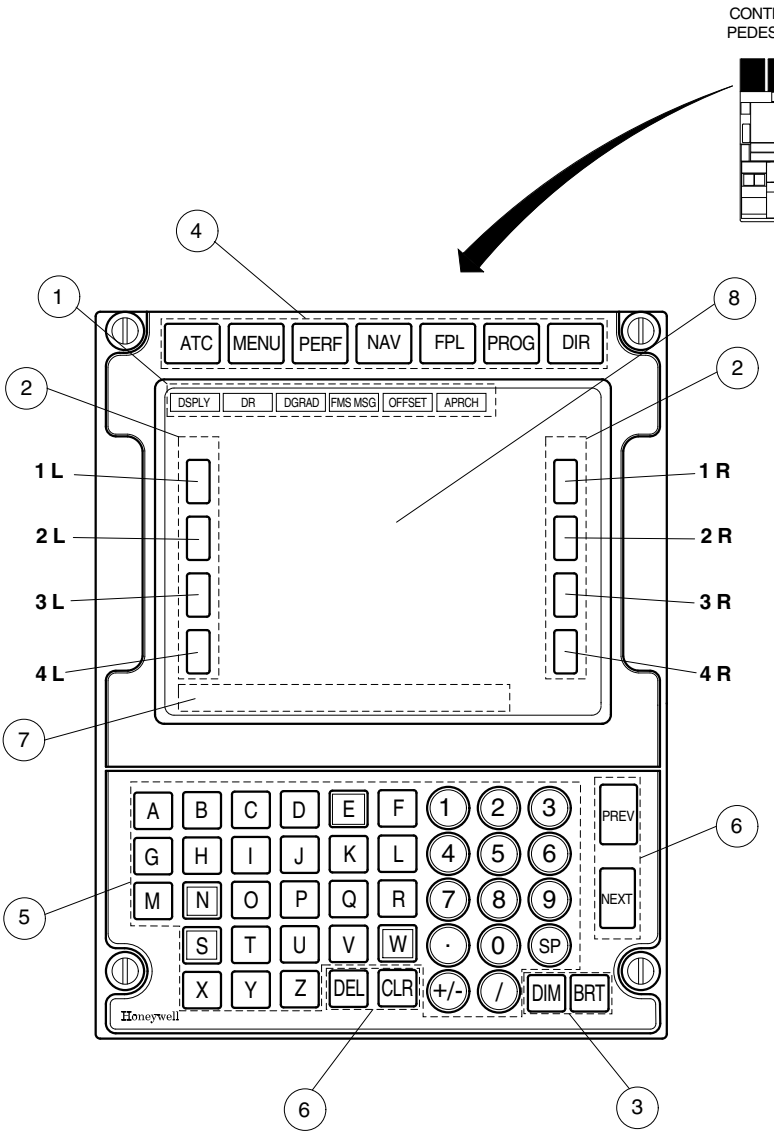

FMZ2010 FMS CD-830 CONTROL PANEL

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JOYSTICK (OPTIONAL)

The joystick functions are available through the joystick controller that is located on the control pedestal and through the selection of the MFD JSTK menu.

When the MFD joystick menu is selected, the joystick controller is available to control the Designator Symbol movement on the MFD FMS flight plan.

JOYSTICK OPERATION

On power-up, the designator is co-located with the present flight plan waypoint position.

If MAP mode is selected, moving the joystick controller, will cause the Designator Symbol to be displayed in blue color with a broken line which moves in the same direction from its last waypoint position.

If PLAN mode is selected, moving the joystick controller, the flight plan moves to the opposite direction from its last position, while the Designator Symbol remains fixed at the center of the plan format.

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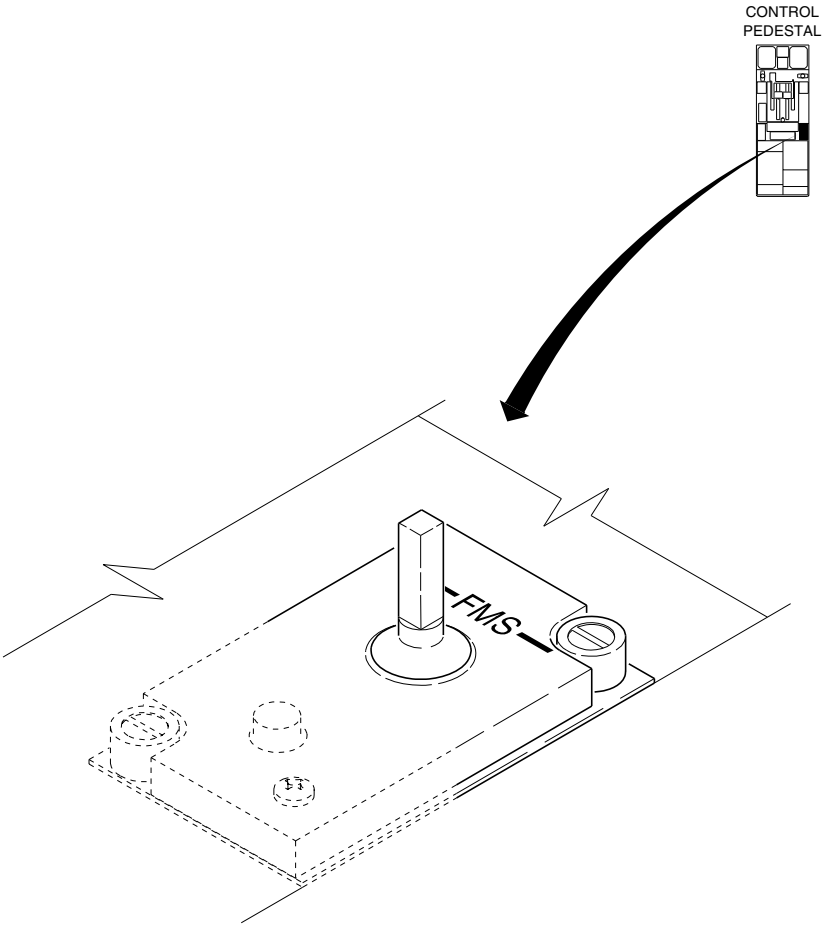

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JOYSTICK CONTROLLER

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JOYSTICK MENU BUTTONS FUNCTION AT MAP MODE

- SKIP ("SKP") button: Skips the designator to the position of the next waypoint in the flight plan in case of the designator is co-located with a plan waypoint. Otherwise, the designator broken line tail skips to the next waypoint in the flight plan.
- RECALL ("RCL") button: Positions the designator at the present position of the airplane and removes the designator box from the display in case of the designator is co-located with the flight plan waypoint. Otherwise, the designator is positioned over the waypoint from which the designator line is extended and the designator line is removed from the display.
- ENTER ("ENT") button: The latitude and longitude coordinates of the designator are transmitted to the selected FMS scratchpad as a requested waypoint.

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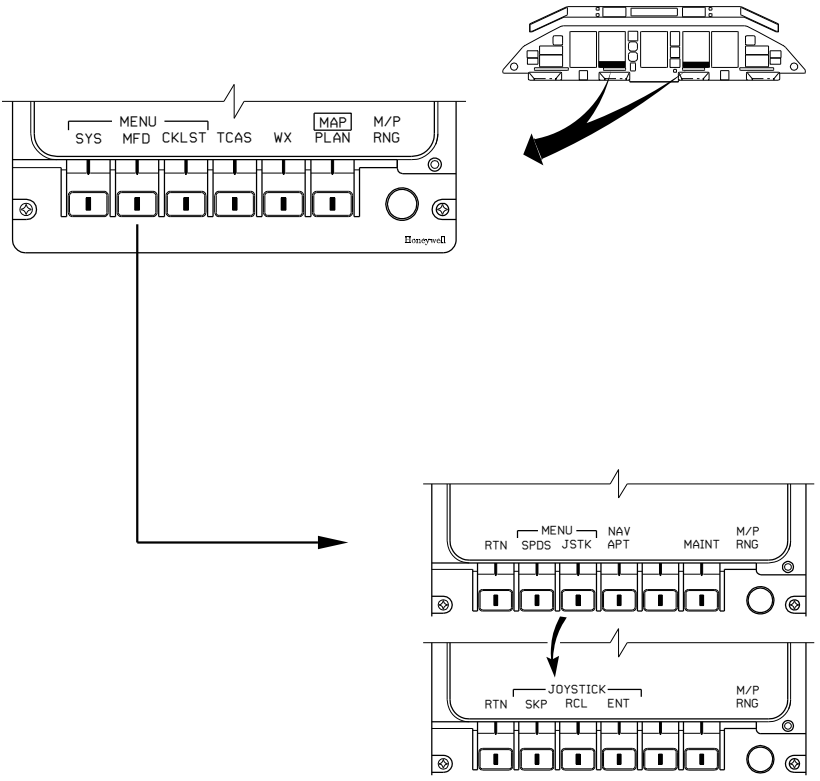

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MFD JOYSTICK MENU

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NAVIGATION DISPLAYS

The navigation data provided by the Radio Management System and Flight Management System are displayed to the crew through the PFDs, MFDs and RMUs.

ADF and/or VHF NAV bearings and VHF NAV or FMS CDI (Course Deviation Indicator) are displayed on the PFD in an Electronic Horizontal Situation Indicator (EHSI). The EHSI navigation sources as well as the display format (Full Compass or Arc) may be selected by the crew via the Display Control Panel (DCP).

Several other navigation data are also presented on the PFDs: GS (Glide Slope) pointer, DME distance, Ground Speed/Time-to-go, marker beacon indicators, wind intensity and direction vector, etc.

The MFDs present Weather Radar, TCAS and the route selected on the FMS. Additional information is also presented on the MFD: wind intensity and direction vector, TAS, Time-to-go, etc.

The RMUs NAV Backup Page also present the EHSI, in the Arc format only (see section 2-18-11).

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DISPLAYS CONTROLS AND INDICATORS

DISPLAY CONTROL PANEL (DCP)

1 - DISPLAY FORMATS SELECTOR BUTTON

- Pressing the FULL/WX Button alternates the EHSI presentation on the PFD between Full Compass format and Arc format.
- In Arc format the Weather Radar Display is also presented whenever the Weather Radar is operating.

2 - GROUND SPEED AND TIME-TO-GO SELECTOR BUTTON

- Pressing the GSPD/TTG Button alternates the respective information on the PFD between ground speed and time-to-go.

3 - ELAPSED TIME SELECTOR BUTTON

- The first actuation enters the Elapsed Time Mode on the PFD respective field. The subsequent actuation provides the following sequence of control: RESET - ELAPSED TIME - STOP - REPEAT.

4 - NAVIGATION SOURCES SELECTOR BUTTON

- Provides the selection of the VHF NAV (VOR, ILS and MLS) as navigation source for the EHSI. If the VHF NAV is already selected, pressing the NAV Button selects the opposite VHF NAV as navigation source for the on-side EHSI. Pressing the NAV Button once again will restore the normal operation: VHF NAV 1 information presented on the PFD 1 and VHF NAV 2 information presented on the PFD 2.

5 - FMS SOURCE SELECTOR BUTTON (OPTIONAL)

- Provides the selection of the FMS as navigation source for the EHSI.
- On airplanes equipped with dual FMS, pressing the FMS Button for the second time selects the opposite FMS as navigation source for the on-side EHSI (and for the on-side MFD MAP). Pressing the FMS Button once again will restore the normal operation: FMS 1 information presented on the PFD 1 (and MFD 1) and FMS 2 information presented on the PFD 2 (and MFD 2).

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6 - BEARING SELECTOR KNOB

OFF: The associated PFD bearing pointers are disabled.

NAV 1 (2): Selects the respective VHF NAV as source for the associated bearing pointer.

ADF: Selects the respective ADF as source for the associated bearing pointer.

FMS: Selects the FMS as source for the associated bearing pointer.

7- DECISION HEIGHT SETTING AND IC-600 TEST KNOB

- Provides the Radio Altimeter (RA) decision height setting.
- When pressed on ground provides the IC-600 and RA test activation. Refer to Section 2-4 – Crew Awareness for further information on test function and Section 2-17 – Flight Instruments for further information on decision height setting and RA test in flight.

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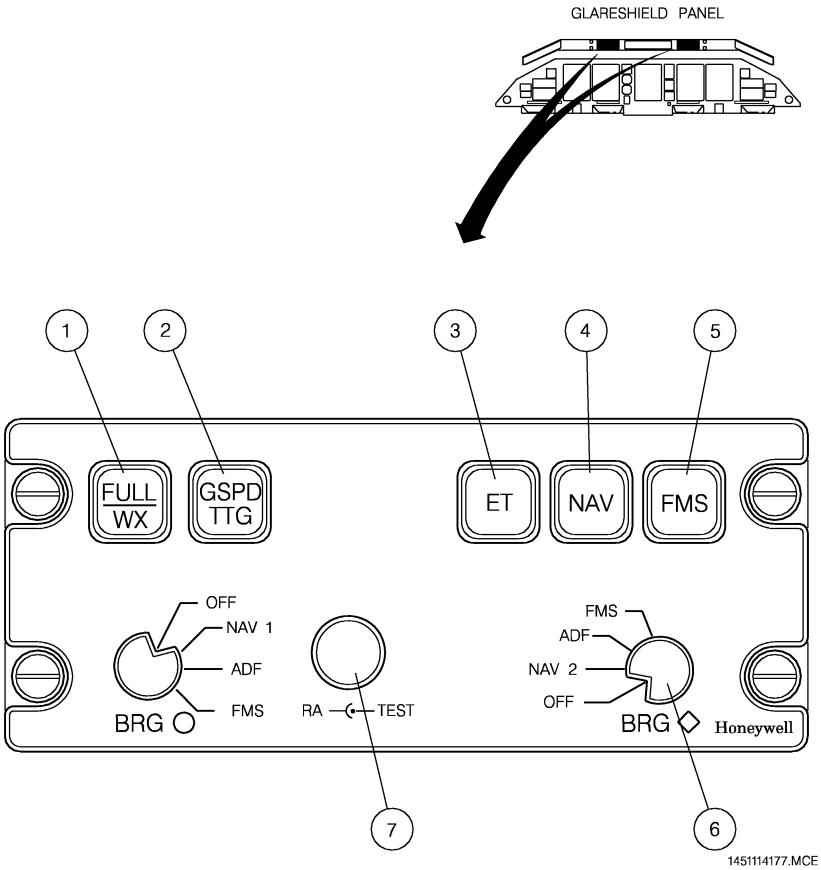

DISPLAYS CONTROL PANEL

FMS SOURCE SELECTION ON THE MFD

As explained on the Display Control Panel (DCP) description (see section 2-18-40), pressing the FMS Button on that panel selects the FMS as navigation source for the PFD and MFD.

On airplanes equipped with dual FMS, pressing the FMS Button (on the Display Control Panel) for the second time selects the opposite side FMS as navigation source for the on-side EHSI (and for the on-side MFD MAP). Pressing the FMS Button once again will restore the normal operation: FMS 1 information presented on the PFD 1 (and MFD 1) and FMS 2 information presented on the PFD 2 (and MFD 2).

However, on airplanes equipped with dual FMS it is possible to select the opposite side FMS as MFD navigation source even if the FMS is not selected as navigation source for the PFD.

In this case, pressing the MFD Bezel Button adjacent to the MFD SRC label (presented on the MFD submenu), the on-side MFD will display the opposite side FMS data. This label is not presented if the FMS is already selected as navigation source for the PFD.

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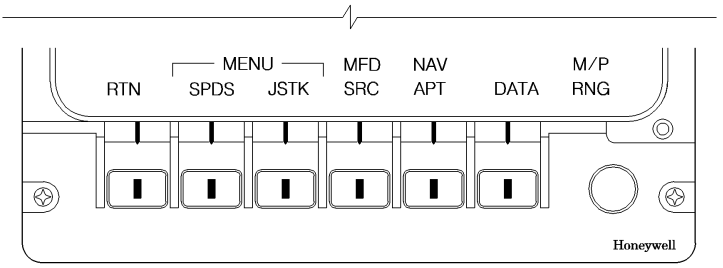

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CROSS-SIDE FMS SOURCE SELECTION ON THE MFD

ADF, VHF NAV AND DME INDICATIONS ON THE PFD

1 - VERTICAL DEVIATION DISPLAY

- Color:
  - Scale: white
  - GS Pointer: - green
    - yellow if the same source is supplying both sides.
  - GS label: green.
- For glide slope presentation the pointer will be parked up or down of the deviation display when the deviation exceeds the external dots.
- Glide slope information will be displayed when SRN NAV is selected for display and tuned to LOC is active.

2 - MARKER BEACON DISPLAY

- Color:
  - O label: cyan.
  - M label: amber.
  - I label: white.
  - Box: white.
- An O, an M or an I flashing annunciation is displayed when the outer marker, the middle marker or the inner marker is detected, respectively.
- A beacon box surrounding the MB flashing annunciations will be shown when a SRN is displayed, tuned-to-localizer is active and a marker is also active.

3 - BEARING POINTER

- Color:
  - Cyan for Bearing 1
  - White for Bearing 2
- Circle coded for #1 source {VOR 1, ADF (for single installation) or ADF 1 (for dual installation)}.
- Diamond coded for #2 source {VOR 2, ADF (for single installation) or ADF 2 (for dual installation)}.
- Pointer is removed if the selected source signal is invalid.

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4 - TO/FROM POINTER

- Color: White.
- Displayed towards the nose or the tail of the airplane to indicate, respectively, "TO" or "FROM" the navigation aid.

5 - DME FIELD

- Displays Ground Speed, Time-to-go, and Elapsed Time.
- GROUND SPEED DISPLAY
  - Color: Digits: green.
    GSPD label: white.
  - Range: 0 to 550 KIAS.
  - Resolution: 1 KIAS.
- TIME TO GO DISPLAY
  - Color: Digits: the same of the NAV source color.
    TTG label: white.
  - Range: 0 to 399 min.
  - Resolution: 1 minute.
- ELAPSED TIME
  - Color:
  - Digits: green.
    ET label: green.
  - Range: 00:00 to 09:59 h.
  - Resolution: Displayed in the format minutes: seconds (for less than one hour), and hours (minutes for more than one hour).

6 - COURSE DEVIATION SCALE

- Color: White.

7 - COURSE DEVIATION BAR

- Color:
  - Green: when the source is the on-side VOR.
  - Yellow: when the source is the cross-side VOR.
- Indicates against the course deviation scale, the difference between the selected course and the VOR bearing.

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8 - BEARING SOURCE ANNUNCIATIONS

- Label: VOR1, VOR2, ADF1 or ADF2.
- Color:
  - Cyan for Bearing 1
  - White for Bearing 2
- Circle coded for #1 source {VOR 1, ADF (for single installation) or ADF 1 (for dual installation)}.
- Diamond coded for #2 source {VOR 2, ADF (for single installation) or ADF 2 (for dual installation)}.
- Indicates the current source of input to the bearing pointers.
- Source annunciation will be retained on the PFD, even in case of an invalid bearing signal.

9 - DME HOLDING AND DISTANCE ANNUNCIATION

- Color:
  - Digits: green.
  - NM label: white.
  - H label: amber.
- Range:
  - Short Range NAV: 0 to 300 NM.
- Resolution: 0.1 NM.
- When the DME hold is active an H label is displayed on the RH of the DME distance digital readout. In this condition the H label replaces the distance NM label.

10 - COURSE DEVIATION NAV SOURCE ANNUNCIATION

- Label: VOR1, VOR2, ILS1, ILS2 or FMS (optional)
- Color:
  - Yellow: when the same source is selected for both sides or is supplying cross-side.
  - Green: when both sides present on-side sources, even if they are different.

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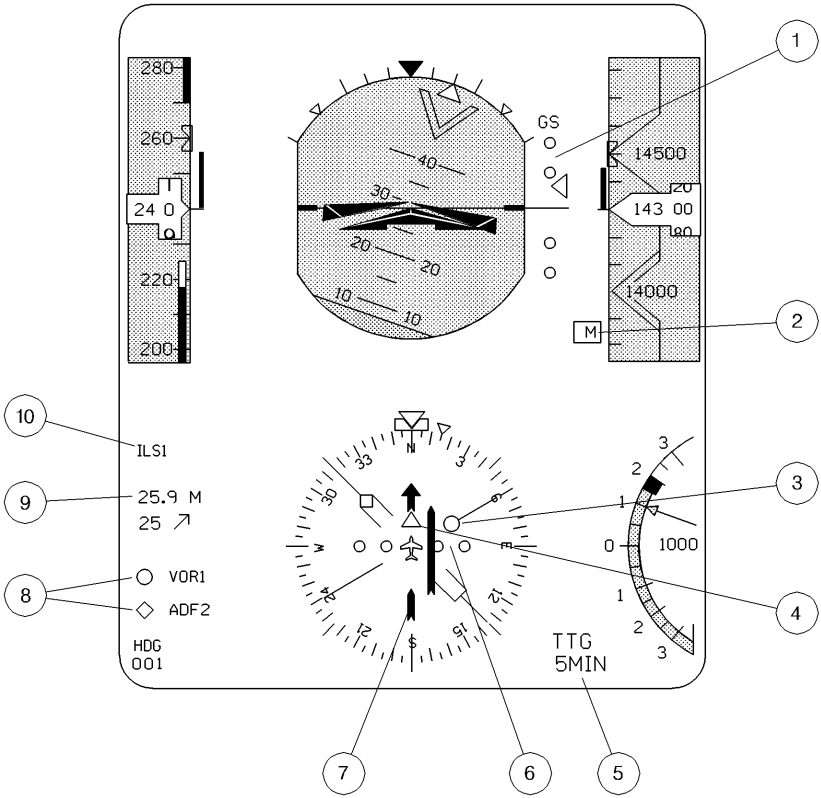

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ADF, VHF NAV AND DME INDICATIONS ON THE PFD (EHSI IN FULL COMPASS FORMAT)

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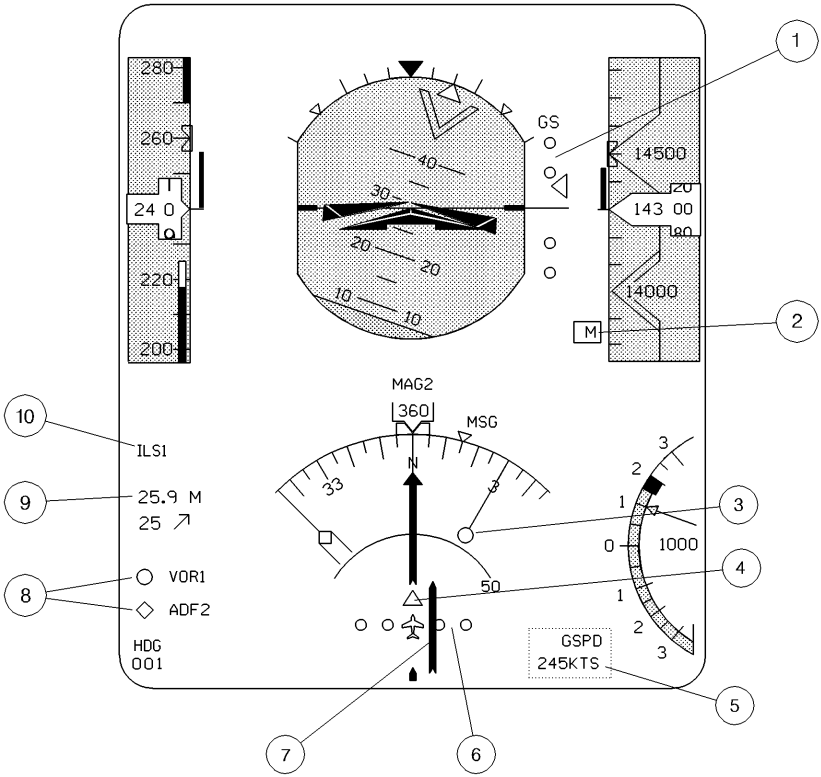

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ADF, VHF NAV AND DME INDICATIONS ON THE PFD (EHSI IN ARC FORMAT)

FMS INDICATION ON THE PFD

1 - VERTICAL ALERT ANNUNCIATION

- Label: VTA
- Color: Amber
- The VTA is displayed when the vertical alert bit is received from the FMS.

2 - VERTICAL DEVIATION DISPLAY

- When the FMS VNAV is selected the Vertical Deviation is activated.
- The Vertical Deviation Display indicates the vertical deviation between the airplane and the selected vertical path.
- Label: FMS
- Color: Amber
  - The FMS label and the scale are white.
  - If the FMS is the navigation source for only one side, the pointer will be magenta, otherwise it will be amber.

3 - MESSAGE ANNUNCIATION

- Label: MSG
- Color: Amber
- The MSG is displayed when a message is available on the FMS Panel.

4 - GROUND SPEED/TIME TO GO DATA

- Label: GSPD for Ground Speed.
  TTG for Time To Go.
- Color: Labels and units are white.
  - For single configuration, if the FMS is the navigation source for only one side, the GSPD and TTG readouts will be magenta, otherwise, they will be amber.
  - For dual configuration, if each FMS is the navigation source of the respective side, the GSPD and TTG readouts will be magenta. Otherwise, they will be amber.
- The Ground Speed unit is knots (KTS) and the Time To Go unit is minutes (MIN).
- The resolution of the digital values is 1 unit.
- For invalid values, the digits will be replaced with three amber dashes.

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5 - DRIFT ANGLE BUG

- Color: Magenta.
- The Drift Angle Bug rotates around the compass card, providing the reading of the airplane tracking.

6 - COURSE DEVIATION BAR

- Color: If the FMS is the navigation source for only one side, the Course Deviation Bar will be magenta, otherwise, it will be amber.

7 - TO/FROM POINTER

- Color: White.

8 - BEARING POINTER

- Color: Cyan for Bearing 1 (circle shaped).
  White for Bearing 2 (diamond shaped).

9 - BEARING SOURCE ANNUNCIATIONS

- Color: Cyan for Bearing 1 (circle shaped).
  White for Bearing 2 (diamond shaped) in single FMS configuration.
  In dual configuration there will be an indication if FMS 1 or 2 is being used.

10 - WIND VECTOR DISPLAY

- Color: Magenta.
- A single vector shows the direction of the wind relative to the airplane symbol. The digits indicate the wind intensity in knots.

11 - DEGRADE MODE/DEAD RECKONING MODE/WAYPOINT ANNUNCIATIONS

- Label: DGRAD for Degrade Mode (single FMS configuration only)
  DR for Dead Reckoning mode.
  WPT for waypoint.
- Color: Amber
- WPT is lit when the airplane is approaching the next waypoint.

12 - DISTANCE DISPLAY

- Color:
  - In single configuration, if the FMS is the navigation source for only one side, the distance readout will be magenta. Otherwise, it will be amber.
  - In dual configuration, if each FMS is the navigation source of the respective side, the distance readout will be magenta, otherwise it will be amber.
  - The unit is white.
  - The distance unit is nautical miles (NM).

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13 - TO WAYPOINT SYMBOL

- Label: Waypoint identifier name (Ex: KDVT).
- Color: Magenta. For dual configuration, when using cross-side information, the color is amber.
- In the sequence established, the TO waypoint is the next one from the current airplane position.

14 - APPROACH/TERMINAL AREA ANNUNCIATIONS

- Label: APP for Approach.
  TERM for Terminal Area.
- Color: Cyan.
- When APP is displayed it indicates that the FMS is in the flight approach phase and also can indicate that the lateral deviation scaling has been set to approach scale factor.
- In the APP mode the deviation indicator sensitivity and FMS tracking gains are increased.
- The TERM annunciator is displayed when the airplane enters in the terminal area or when the lateral deviation scaling has been set to the enroute scale factor.
- Priority is given to the APP message.

15 - FMS SOURCE ANNUNCIATION

- Label: FMS.
- Color:
  - For single configuration, if the FMS is the navigation source for only one side, the FMS label will be magenta. Otherwise, it will be amber.
  - For dual configuration, if each FMS is the navigation source for the respective side, the FMS label will be magenta, otherwise it will be amber.
- FMS is displayed only when a single source is installed.

16 - HEADING ANNUNCIATION

- Label: HDG SEL (For dual FMS configuration).
- Color: White. For dual configuration, if each FMS is the navigation source for the respective side the color will be white, otherwise it will be amber.

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17 - SELECTED COURSE/DESIRED TRACK ANNUNCIATIONS AND READOUTS

- Label: DTK for Desired Track.
  CRS for Selected Course.
- Color:
  - For single configuration, if the FMS is the navigation source for only one side, the CRS label will be green and DTK will be magenta. Otherwise, both labels will be amber.
  - For dual configuration, if each FMS is the navigation source for the respective side, the CRS and DTK labels will be magenta. Otherwise they will be amber.
  - The readouts will have the same color as the CRS and DTK annunciations.
- DTK is displayed when the FMS is the selected navigation source.

18 - CROSSTRACK ANNUNCIATION

- Label: SXTK
- Color:
  - For single configuration, if the FMS is the navigation source for only one side the label will be magenta, otherwise it will be amber.
  - For dual configuration: The color will be ever amber.
- SXTK is displayed to indicate that the airplane is off track.

19 - CAPTURED LATERAL MODE

- Refer to Section 2-19 - Autopilot.

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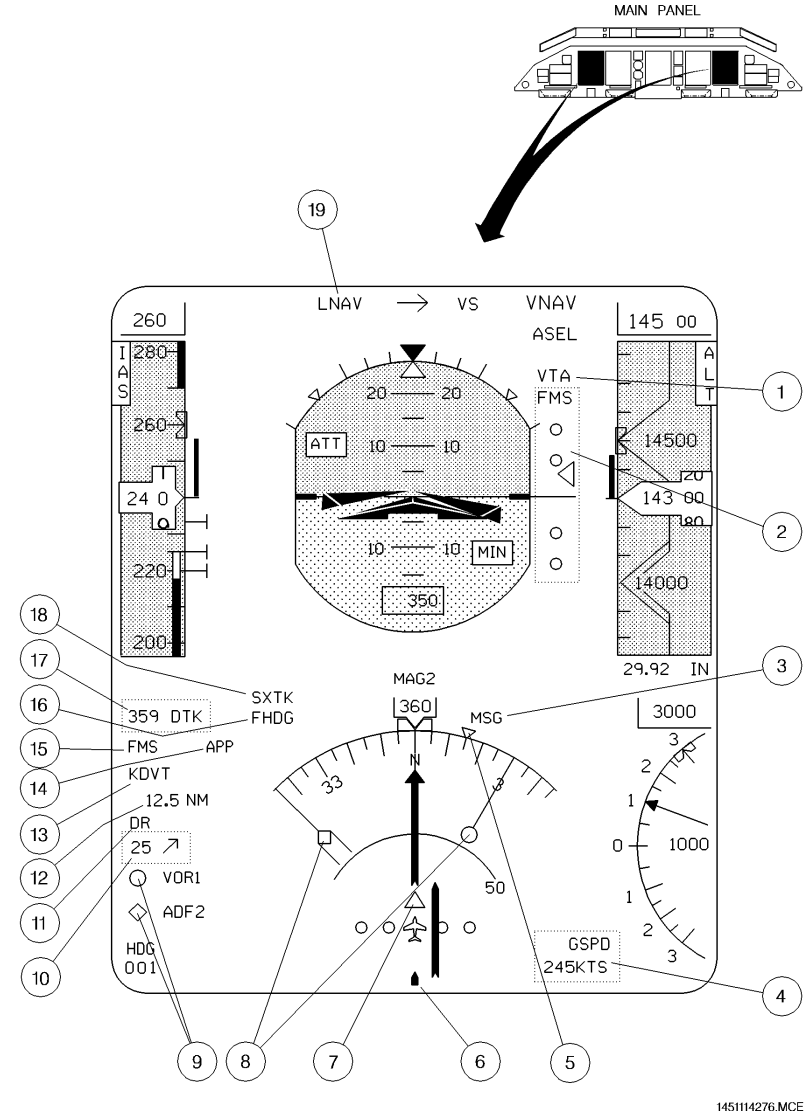

FMS INDICATION ON THE PFD

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FMS INDICATION ON THE MFD

1 - FMS SOURCE ANNUNCIATION

- Label: FMS for single configuration.
  FMS1 or FMS2 for dual configuration.
- Color:
  - Magenta: when the source is the on-side FMS.
  - Yellow: when the source is the cross-side FMS.

2 - DRIFT ANGLE BUG

- Color:
  - Magenta: when the source is the on-side FMS.
  - Yellow: when the source is the cross-side FMS.
- The Drift Angle Bug rotates around the compass card, providing the reading of the airplane tracking.

3 - WAYPOINT SYMBOL

- Label: Waypoint identifier name (Ex: KDVT).
- Color: All Waypoints are white except the TO waypoint.
- Waypoint is displayed as a four pointed star at the geographical locations, referenced to the current present position, where the selected transitions of the flight plan occur.
- A maximum of 10 Waypoints can be displayed, including the FROM waypoint.
- A navigation aid or airport can also be located on the flight plan at a transition point and is accounted in the maximum allowable number of Waypoints.

4 - AIRPORT ANNUNCIATION

- Label: APT.
- Color: Cyan.
- Appears when an airport symbol is shown along the route.

5 - NAVAID ANNUNCIATION

- Label: NAV.
- Color: Cyan for single or green for dual configuration.
- Appears when a navaid symbol is shown along the route.

6 - DESIGNATOR RANGE AND BEARING READOUT

- Color: Cyan.
- The range readout indicates the distance between the airplane and the Designator Symbol.
- The bearing readout bearing location of the Designator Symbol related to the airplane position.

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7 - TO WAYPOINT SYMBOL

- Color:
  - Magenta: when the source is the on-side FMS.
  - Yellow: when the source is the cross-side FMS.
- In the sequence established, the TO Waypoint is the next one from the current airplane position.

8 - LATERAL DEVIATION DISPLAY

- Color: White.
- Right after the values there is a letter which may be L or R standing for Left and Right respectively.

9 - WIND VECTOR DISPLAY

- Color:
  - Magenta: when the source is the on-side FMS.
  - Yellow: when the source is the cross-side FMS.
- A single vector shows the direction of the wind relative to the airplane symbol. The digits indicate the wind intensity in knots.

10 - DESIGNATOR SYMBOL

- Color:
  - Same color of the Waypoint: If the Designator is co-located with a connected Waypoint.
  - Cyan: If it is not connected.
- The Designator symbol is displayed as an unfilled rectangle applied in two distinct methods: co-located with a Waypoint or positioned with the joystick.
- Designator will not be displayed if it represents the current position.

11 - TO WAYPOINT DATA ANNUNCIATIONS

- It is composed of the annunciators and presented as follows:
  - Identification.
  - Distance in nautical miles (NM).
  - Time to the TO Waypoint in minutes (MIN).voyeur
- Color:
  - For single FMS configuration the identification is magenta. The distance and the time are white.
  - For dual FMS configuration the identification, distance and time are magenta, when the source is the on-side FMS, or yellow, when the source is the cross-side FMS

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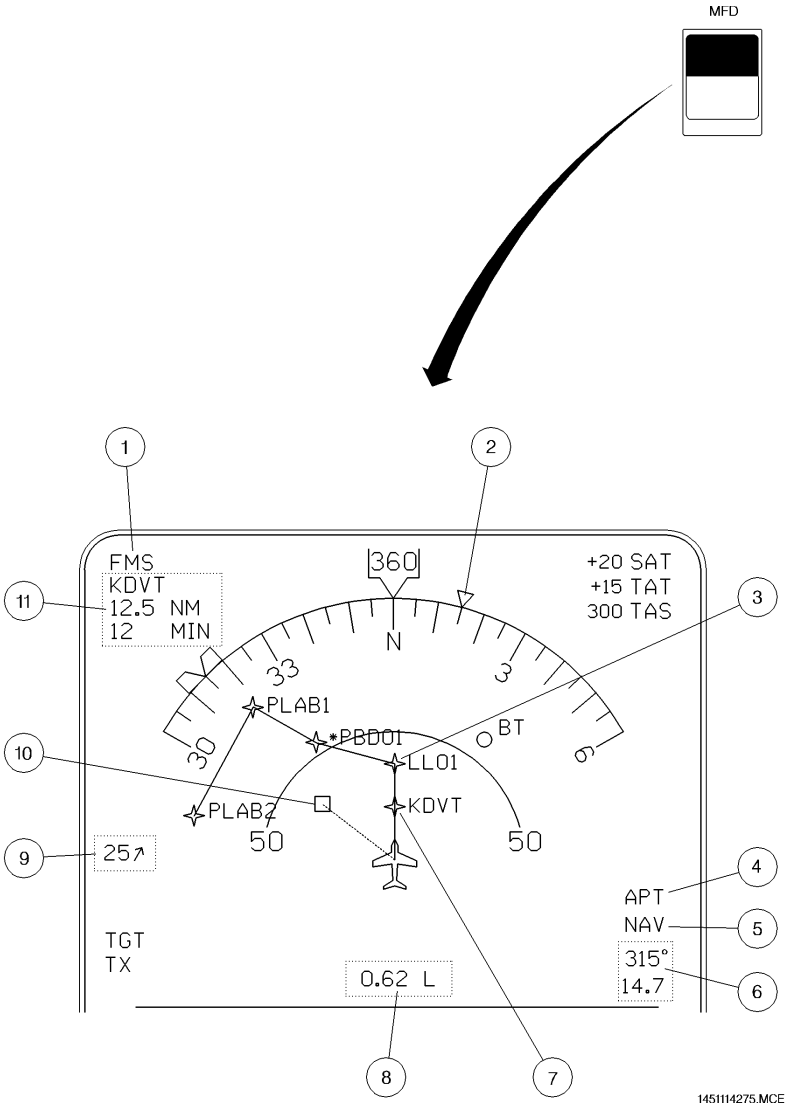

FMS INDICATION ON THE MFD

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WEATHER RADAR SYSTEM

The airplane may be equipped with P-660 or P-880 weather radar models and 12 inch antenna. For additional information on functions and operations, refer to the manufacturer's manual.

The weather radar system is designed for detection and analysis of precipitation in storms along the flight path of the airplane. The system provides the flight crew with visual indications regarding turbulence content (P-880 only) and rainfall intensity.

Precipitation intensity level is displayed in four bright colors (magenta, red, yellow and green) contrasted against a deep black background on the PFDs' and MFDs' radar mode field. Magenta represents the heaviest rainfall intensity while green indicates the lightest.

The radar may also be used for ground mapping. When operating in ground mapping mode, prominent landmarks are displayed, which allows identification of coastlines, mountainous regions, cities or even large structures.

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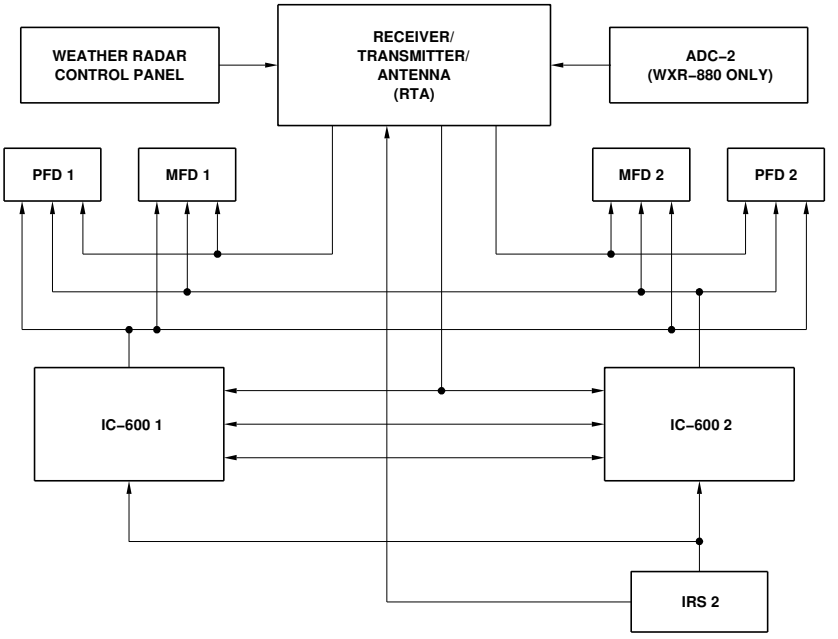
GENERAL

The weather radar system consists of an integrated Receiver/Transmitter/Antenna unit (RTA) and a dedicated control panel. The RTA transmits and receives on the X-band radio frequency. The RTA processes radar echoes received by the antenna. The scan-converted data are displayed on PFDs' and MFDs' radar mode field.

The weather radar system run on 28 V DC powered by one of the Avionics Switched DC Buses. Should a power supply failure occur, the weather radar system will become inoperative, as there is no backup power source for this system.

The weather radar interfaces with other airplane systems and equipment as presented in the schematic diagram below.



WEATHER RADAR SCHEMATIC

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WEATHER RADAR NORMAL OPERATION

The weather radar is controlled through the weather radar control panel and via the MFD Bezel Buttons. The weather radar control panel provides control functions and operating modes management for proper weather radar operation. The weather radar control panel may be located on the control pedestal forward panel or on the glareshield panel. Some airplanes may optionally be equipped with two weather radar control panels.

INTERPRETING WEATHER RADAR IMAGES

The weather radar is a water detector. It is calibrated to best see water in its liquid form and with an ideal raindrop diameter. The weather radar can see rain, wet snow, wet hail and dry hail (depending on its diameter). The radar can not see water vapor, ice crystals and small dry hail.

At higher altitudes, there is less humidity in the air and consequently there is less water condensation. It means that heavy precipitation and dense cells are less likely to occur. As a result, flight level 200 (FL200) is defined as "FREEZING LEVEL", i.e., presence of water in its liquid form is not forecast above this level. However, CBs and other phenomena may push humidity and water, sometimes supercooled water, to higher altitudes due to convective activity.

WARNING: DRY HAIL CAN BE PREVALENT AT HIGHER ALTITUDES. SINCE ITS RADAR REFLECTIVE RETURN IS POOR, IT MAY NOT BE DETECTED.

Use increased gain when flying near storm tops in order to display the normally weaker returns that could be associated with hail.

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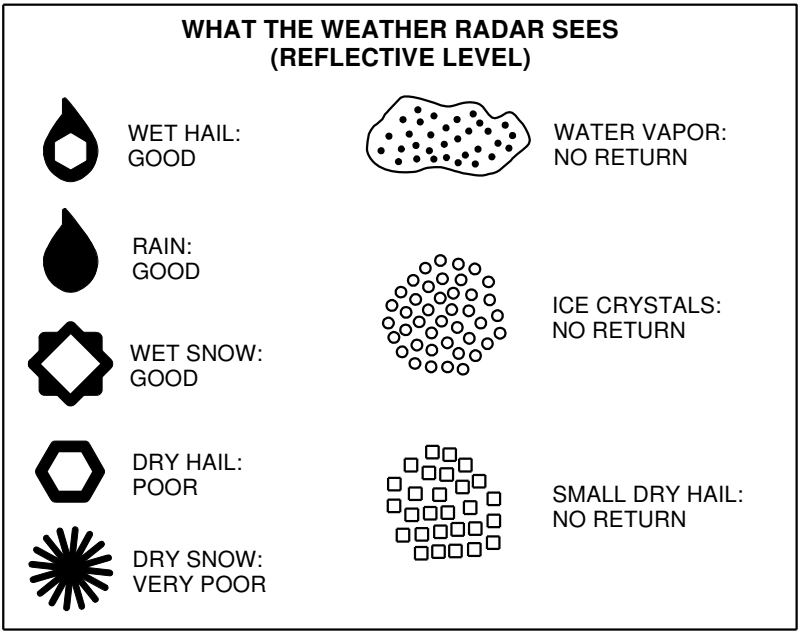

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RADAR WARM UP PERIOD

When power is first applied to the radar, a period of 40 to 100 seconds is required to allow its magnetron to warm up. The radar displays the WAIT message on the PFDs' and MFDs' radar mode field and does not transmit or perform an antenna scan. After the completion of warm-up period, the radar automatically become operational in the selected mode or goes to forced standby (FSBY) if the airplane is on the ground.

GROUND OPERATION PRECAUTIONS

If the radar system is to be operated in any mode other than standby or forced standby while the airplane is on the ground, the following precautions should be taken:

- Direct nose of airplane so that antenna scan sector is free of large metallic objects such as hangars or other airplanes for a distance of 30 meters (100 feet).The antenna must be tilted fully upwards.
- Avoid using the weather radar during airplane refueling or within 30 meters (100 feet) of any other airplane undergoing refueling operations.
- Avoid using the weather radar if personnel are standing too close to the 270° forward sector of airplane.

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WEATHER RADAR OPERATING MODES AND FUNCTIONS

TEST MODE (TST)

After the radar warm-up period is over, the TEST mode may be selected. A special test pattern made up of color bands is displayed. A series of green/yellow/red/magenta/white bands indicate that the signal to color conversion circuits are operating normally. A 100-mile range is automatically selected. A green TEST label will be displayed on the PFDs' and MFDs' radar mode field.

When the airplane is on the ground and the TEST mode is entered, the first page always includes RADAR OK or RADAR FAIL to indicate the current state of the radar, as follows:

RADAR OK: indicates that no faults were found and the radar is ready for service. It is combined with the END OF LIST page.

RADAR FAIL: indicates a radar fault.

During the weather radar test, several fault messages may be presented to the crew. The POC (Power On Counter), aside recording an existing fault, also stores fault information from previous power-on cycles. However, if the first page announces "RADAR OK", the radar is ready for service.

STANDBY MODE (SBY)

The standby mode should be selected any time it is desired to keep the system powered without transmitting. When SBY mode is selected the WX radar remains in a ready state, with the antenna scan motionless and stowed in a tilt-up position. In addition, the transmitter is inhibited and the display memory is erased.

For airplanes equipped with dual control panel, placing only one controller in SBY does not shut the transmitter OFF. Instead, the no-SBY controller governs radar operation. If both controllers are placed in SBY, the transmitter is shut OFF.

In standby mode a STBY label is displayed on the PFDs' and MFDs' radar mode field.

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FORCED STANDBY MODE (FSBY)

The FSBY is an automatic, non-selectable radar mode, that forces the radar into standby when the airplane is on the ground (weight-on-wheels logic) regardless of the selected active radar mode. This is a safety feature that inhibits the transmitter on the ground to eliminate X-band microwave radiation hazards. In FSBY mode, the transmitter and the antenna scan are both inhibited, memory is erased and a FSBY label is displayed on the PFDs' and MFDs' radar mode field.

The forced standby mode may be overridden on the ground by pushing the STAB button 4 times in 3 seconds.

CAUTION: IF FSBY MODE IS OVERRIDEN ON THE GROUND AND ANY RADAR ACTIVE MODE IS SELECTED, THE TRANSMITTER IS TURNED ON. THE RADAR MUST NOT BE OPERATED UNDER THIS CONDITION WHILE REFUELING, NEAR FUEL SPILLS OR PEOPLE.

WEATHER DETECTION MODE (WX)

The WX mode is used to detect areas of severe weather. This will allow the pilots to avoid dangerous weather conditions and possible turbulence areas. WX may be used on the ground, often prior to takeoff, in order to monitor the weather in the immediate vicinity. In this case, the forced standby mode may be overridden.

In WX Mode, the weather radar system is fully operational and all internal parameters are set for enroute weather detection. A WX label is displayed on the PFDs' and MFDs' radar mode field.

The levels and colors associated with the storm category are as follows:

LEVEL	COLOR	RAINFALL CATEGORY
4	Magenta	Extreme/Intense
3	Red	Very Strong/Strong
2	Amber	Moderate
1	Green	Moderate/Weak
0	Black	Weak

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RAIN ECHO ATTENUATION COMPENSATION TECHNIQUE FUNCTION (REACT or RCT)

The REACT is a sub mode of the weather detection mode and when selected activates three separate but related functions:

- **Attenuation Compensation** - Storms with high rainfall rates can attenuate the radar energy making it impossible to see a second cell hidden behind the first cell.

  In the REACT mode, the radar incorporates a function that automatically adjusts receiver gain by an amount equal to the amount of attenuation, i.e., the greater the amount of attenuation, the higher the receiver gain and thus, the more sensitive the receiver.

- **Cyan REACT Field** - Since there is a maximum limit to receiver gain, strong targets (high attenuation levels) cause the receiver to reach its maximum gain value and weather targets can no longer be calibrated. The point where red level weather target calibration is no longer possible is highlighted by changing the background field from black to cyan.

  Cyan areas should be avoided. Any target detected inside a cyan area should be considered very dangerous. All targets in the cyan field are displayed as a magenta-colored 4th level precipitation.

- **Shadowing** - This is an operating technique similar to the Cyan REACT Field. To use the shadowing technique, tilt the antenna down until the ground is being painted just in front of the storm cell(s). An area characterized by no ground returns behind the storm cell has the appearance of a shadow. The cell that produces radar shadowing is a very strong and dangerous cell and should be avoided by 20 NM.

FLIGHT PLAN MODE (FP)

When the Flight Plan Mode is selected a singular display of navigation data and a FLTPLAN label are presented on the PFDs' and MFDs' radar mode field. The radar is put in standby and there is no radar data displayed in this mode.

GROUND MAPPING MODE (GMAP)

This mode is used to alert the flight crew regarding hazards caused by ground targets. This is especially useful in areas of rapidly changing terrain, such as mountainous regions. In this mode the system is fully operational and all internal parameters are set to enhance returns from ground targets.

The TILT control should be turned down until the desired amount of terrain is displayed. The degree of down-tilt depends upon airplane altitude and the selected range. Receiver characteristics are altered to provide equalization of ground-target reflection versus range. The selection of calibrated GAIN will generally provide the desired mapping display. If required, variable gain may be used to reduce the level of strong returns.

In the ground mapping mode a GMAP label is displayed on the PFDs' and MFDs' radar mode field, and the color scheme is changed to cyan, yellow and magenta. Cyan represents the least reflective return, yellow is a moderate return and magenta represents the most highly reflective target return.

For airplanes equipped with dual control panels, it is possible to have one pilot working the GMAP while the other one is using the regular WX mode.

CAUTION: WEATHER TYPE TARGETS ARE NOT CALIBRATED WHEN THE RADAR IS IN THE GMAP MODE. THEREFORE, THE PILOT SHOULD NOT USE THE GMAP MODE FOR WEATHER DETECTION.

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TURBULENCE DETECTION FUNCTION (TRB) (P-880 MODEL ONLY)

When this mode is selected, the radar processes return signals in order to determine if a turbulence condition is present. Areas of potentially hazardous turbulence are displayed as white. Any areas shown as turbulence should be avoided.

Turbulence detection function may only be engaged in the WX mode and at selected ranges of 50 NM or less. When the TRB function is active, a T letter will be displayed on the PFDs' and MFDs' radar mode field.

CAUTION: ALTHOUGH TURBULENCE MAY EXIST WITHIN ANY STORM CELL, WEATHER RADAR CAN ONLY DETECT TURBULENCE IN AREAS OF RAINFALL.

TARGET ALERT (TGT)

Target alert is selectable in all but the 300-mile range. When selected, target alert monitors for red or magenta weather beyond the selected range and 7.5° on either side of the airplane's heading. If such weather is detected within the monitored area and outside the selected range, the target alert annunciation TGT label changes from a green armed condition to an yellow TGT alert condition on the PFDs' and MFDs' radar mode field. This annunciation advises the flight crew that potentially hazardous targets lie directly in front and outside of the selected range. When this warning is received, the flight crew should select longer ranges to view the questionable target.

The target alert is inactive within the selected range. Selecting target alert forces the system to calibrate gain, and turns off the variable gain mode. Target alert can only be selected in WX and FP modes.

NOTE: Keep TGT alert enabled when using short ranges. This allows the issuing of an alert if a new storm cell develops ahead of the airplane's flightpath.

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ANTENNA STABILIZATION (STAB or STB)

The antenna is normally pitch and roll-stabilized by using attitude information from the AHRS or IRS. Momentarily pushing the STAB (or STB) button disables antenna stabilization and an amber “STAB” annunciation label is presented on the PFDs’ and MFDs’ radar mode field.

RECEIVER GAIN (GAIN)

The GAIN knob is a rotary control and push/pull switch that controls radar receiver gain. Two gain modes are available: calibrated or variable.

Calibrated: When the GAIN knob is pushed in, receiver gain is preset and calibrated, which is the normal mode of operation. In calibrated gain, the rotary function of the GAIN knob is disabled.

Variable (VAR): When the GAIN knob is pulled out, the system enters the variable gain mode. Variable gain is used for additional weather analysis and for ground mapping. In the WX mode, variable gain can increase receiver sensitivity over the calibrated level to show very weak targets or can be reduced below the calibrated level to eliminate weak returns. In the GMAP mode, variable gain is used to reduce the level of strong returns from ground targets.

Rotation of the knob counter-clockwise reduces receiver sensitivity. Rotating clockwise increases receiver sensitivity until its maximum. A digital readout and gain setting label are displayed on the PFDs’ and MFDs’ radar mode field.

NOTE: When REACT or TGT modes are selected, the system will be forced into calibrated gain.

CAUTION: VARIABLE GAIN MAY BE USED ONLY FOR SHORT PERIODS OF TIME. DO NOT LEAVE THE RADAR IN VARIABLE GAIN SINCE SIGNIFICANT WEATHER TARGETS MAY NOT BE DISPLAYED.

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TILT

Tilt management is crucial to the safe operation of weather radar. If improperly managed, weather targets can be missed or underestimated. Proper tilt management demands that tilt be changed continuously.

To find the best tilt angle after the airplane is airborne, adjust the TILT antenna downward until a few ground targets are visible at the edge of the display. The table below gives the approximate tilt settings for minimal ground target display for different altitudes and ranges. If the altitude changes or a different range is selected, adjust the tilt control as required to minimize ground returns.

When flying at high altitudes, tilt downward frequently to avoid flying above storm tops. When in low altitude or approaching for landing, tilt management must be performed manually, with the radar beam vertically sweeping from up to down to avoid flying above or below a storm line.

During takeoff, the radar must be adjusted to a minimum range scale, with a horizontal RH and LH scan and with the antenna positioned upwards (climbing angle).

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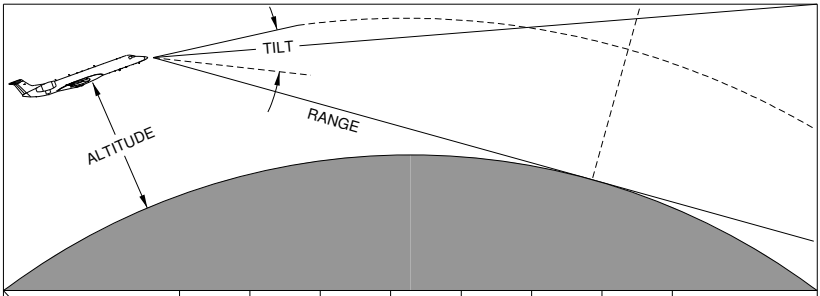

RANGE SCALE – nm / ALTITUDE – ft	5	10	25	50	100	200	300	LINE OF SIGHT – nm
40000	(TILT LIMITED REGION)		–12	–4	–1	+1	(LINE OF SIGHT LIMITED REGION)	246
35000			–10	–3	0	+1		230
30000			–8	–2	0	+1		213
25000			–6	–1	+1			195
20000			–4	0	+1			174
15000		–11	–2	+1	+2			151
10000		–6	0	+2	+2			123
5000	–5	–1	+2	+2				87
4000	–4	0	+2	+3				78
3000	–2	+1	+3	+3				67
2000	0	+2	+3	+3				55
1000	+2	+3	+3					39

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TILT SETTINGS FOR MINIMAL GROUND TARGET DISPLAY
(12 inch antenna)

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The next figure helps to visualize the relationship between tilt angle, flight altitude and selected range. It shows the distance above and below airplane altitude that is illuminated by the radar during level flight with 0° tilt (high altitude) and a low altitude situation, with antenna adjusted for 2.8° up-tilt.

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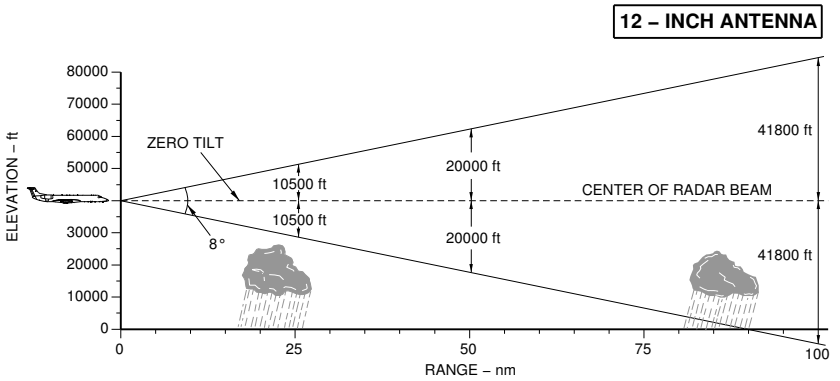
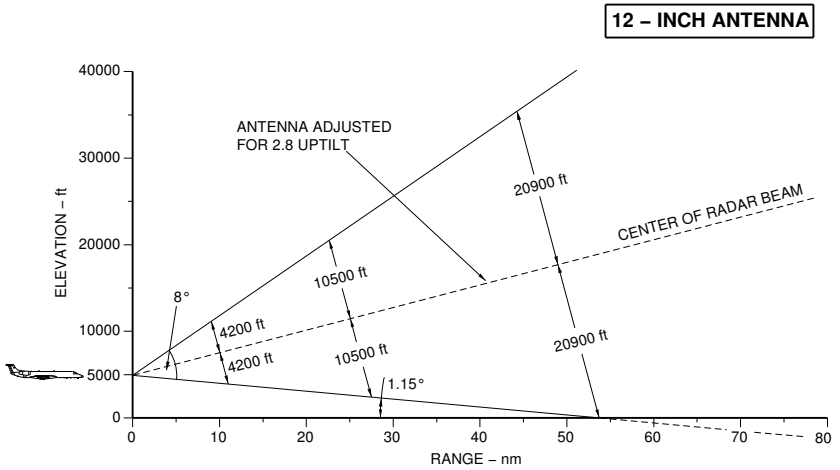


RADAR BEAM ILLUMINATION HIGH ALTITUDE



RADAR BEAM ILLUMINATION LOW ALTITUDE

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ALTITUDE COMPENSATED TILT (ACT) (P-880 MODEL ONLY)

In ACT, the antenna tilt is automatically adjusted with regard to the selected range and airplane altitude. ACT adjusts the tilt to show a few ground targets at the edge of the display. The TILT knob can be used for fixed offset corrections of up to 2°.

NOTE: Proper tilt management demands that tilt be changed continuously, even in airplanes equipped with ACT.

SLAVE (SLV) (DUAL CONTROL PANEL ONLY)

For airplanes equipped with dual weather radar control panels, one controller can be slaved to the other by selecting OFF on that controller only. This condition is annunciated by the illumination of SLV on the control panel. The slave mode allows one controller to set the radar modes for both sides. In the slave mode, the PFDs and MFDs radar information are identical and simultaneously updated.

NOTE: In the slaved condition, both control panels must be set to off before the radar system turns off.

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RADOME

The radome is the primary factor behind degraded weather radar performance. The problems affecting the radome are as follows:

- A water film over the radome's surface when flying in rain.
- Greased radome.
- Cracked radome.
- Holes caused by lightning strike/electrostatic discharges.
- Excessive application of antistatic paint.

Water Film Over The Radome's Surface: When flying in rain, there is indication that at some specific altitudes and speeds a water film is formed on the radome, altering the weather radar indications. The radar display may disappear or turn red. To avoid this problem, there is a hydrophobic coating product named Cytonix® that can be applied to the radome surface.

Greased Radome: The presence of grease or dirt over the radome's surface also impairs radar transmission. These should be reported immediately to maintenance personnel for cleaning or corrective action.

Electrostatic Discharges: Static electricity influences radar performance. The right bonding is necessary. Bonding is accomplished through two metallic meshes that link the radome's metallic bulkhead (diverters) to the airplane's airframe. It is important to make sure that they are in good condition and not painted. If both the metallic meshes and screws are painted, this will isolate the static power generated in the radome, resulting in electrical discharges that will follow towards the radar antenna and/or generate noise in the audio system.

Cracked Radome: Small holes caused by electrostatic discharges, minor damage to structure or paint can cause water infiltration in the radome's honeycomb composite structure. It can result in significant radar signal attenuation, distortion and in some cases, can cause dark spots on the radar screen.

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WEATHER RADAR BEHAVIOR

Depending on the airplane radar controller configuration (single or dual), the WX Controller position and the adjustment between MFD bezel #1 or #2, the weather radar system behavior can be summarized as follows:

- For airplanes equipped with Single Radar Controller Configuration:

	WX Controller	Adjustment through	MFD #1 Indication	MFD #2 Indication
#1	STDBY	MFD Bezel #1	Terrain map image matches local ARC Range setting	Terrain map image matches local ARC Range setting
#2	WX			
#3	STDBY	MFD Bezel #2	Terrain map image is copied from MFD #2, disregarding local ARC Range setting	
#4	WX			

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– For airplanes equipped with Dual Radar Controller Configuration, the system behavior can be summarized as follows:

	WX Controller #1 (LH side)	**WX Controller #2 (RH side)**	**MFD #1 Indication**	**MFD #2 Indication**
#1	STDBY	OFF	Terrain map image and ARC Range setting work independently through MFD Bezel #1 and #2	
#2	STDBY	WX		
#3	WX	OFF		
#4	WX	STDBY		
#5	OFF	WX	Terrain map image is copied from MFD #2, disregarding local ARC Range setting	Terrain map image matches local ARC Range setting
#6	OFF	STDBY		

NOTE: The mentioned characteristic is only valid for the Terrain Map image and does not affect the EGPWS functions.

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WEATHER RADAR CONTROLS AND INDICATORS

WEATHER RADAR CONTROL PANEL

1 - RANGE SELECT BUTTONS

- Allow selection of the radar's operating range, from 5 to 300 NM full scale in WX, REACT, or GMAP mode. In FP mode, additional ranges of 500 and 1000 NM are available. In test mode the range is automatically set to 100 NM.
- The up-arrow button selects increasing ranges, while the down-arrow button selects decreasing ranges. Upon reaching maximum or minimum range, further pushing of the button causes the range to rollover to minimum or maximum range, respectively.

2 - TURBULENCE DETECTION FUNCTION BUTTON (P-880 Model Only)

- Alternate pressings turns on or off the radar's turbulence detection function.
- Function can be used only in WX or RCT mode, with selected range of 50 NM or less.

3 - STABILIZATION FUNCTION BUTTON

- When momentarily pressed, disables antenna stabilization function. The STAB OFF annunciator will illuminate on the control panel.
- On the ground, after warm-up period, pressing the STB button four times within 3 seconds will inhibit the forced standby (FSBY) function.

4 - SLAVE ANNUNCIATOR (Dual Control Panels Only)

- Illuminates to indicate that one controller is slaved to the other.

5 - TARGET ALERT CONTROL BUTTON

- Alternate pressing selects or cancels the target alert feature.
- Selectable only in the WX and FP Modes.

6 - SECTOR SCAN BUTTON (SECT)

- When momentarily pressed, selects either the radar's normal 12 sweeps per minute for a 120° full scan or the faster update 24 sweeps per minute for a 60° sector scan.

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7 - ANTENNA TILT CONTROL KNOB

- The TILT knob is a rotary control that allows manual control of the antenna's tilt angle. Clockwise rotation tilts the beam upward 0° to +15°. Counter-clockwise rotation tilts beam downward 0° to –15°. A digital readout of the antenna tilt angle is displayed on the MFD.
- The range between +5° and -5° is expanded for setting ease.

ALTITUDE COMPENSATED TILT (PULL ACT) (P-880 Model Only)

- Pulling out the TILT knob activates the auto tilt control, which automatically readjusts tilt between ± 2° based on changes in barometric altitude and/or selected range.

8 - RADAR MODES CONTROL KNOB

OFF - Turns off the weather radar.

SBY - Selects the weather radar standby operating mode.

WX - Selects the weather radar detection operating mode.

RCT - Selects the REACT function (P-880 Model only).

GMAP - Selects the weather radar ground mapping operating mode.

FP - Selects the weather radar flight plan operating mode.

TST - Selects the weather radar test mode.

9 - GAIN CONTROL KNOB

- Allows receiver gain control.
- When pushed in, receiver gain is preset and calibrated. Rotary function of the GAIN knob is disabled
- When pulled out, sets receiver gain to variable (VAR) mode.

10 - RAIN ECHO ATTENUATION COMPENSATION TECHNIQUE FUNCTION BUTTON (P-660 Model Only)

- When pressed (momentarily), enables the REACT.
- REACT is always selected in test mode.
- REACT is available in all modes except MAP.

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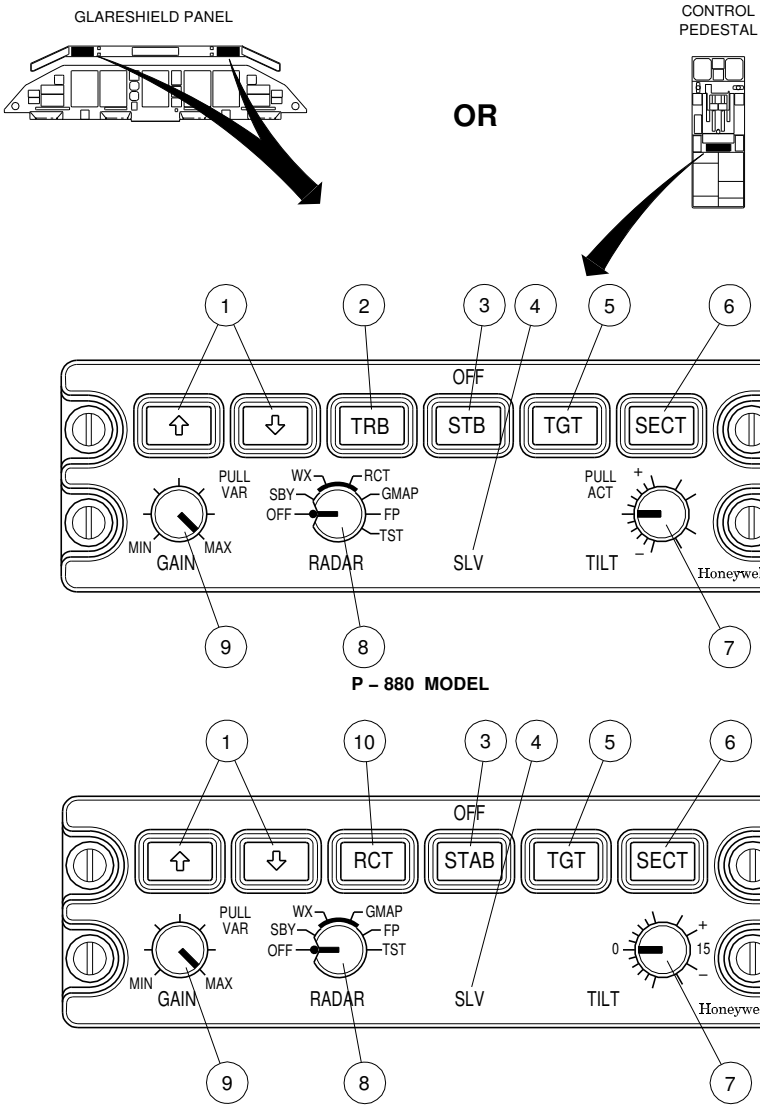

NOTE: THE AIRPLANE MAY BE OPTIONALLY EQUIPPED WITH TWO WEATHER RADAR CONTROL PANELS LOCATED ON THE GLARESHIELD PANEL.

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WEATHER RADAR CONTROL PANEL

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MFD BEZEL PANEL

1 - WEATHER RADAR DISPLAY SELECTOR BUTTON

- Alternate pressing of the weather radar display selector button allows the weather radar to be displayed or removed from the MFD. Control of all other weather radar functions is accomplished by the radar control panel. When the weather radar is selected, the WX label on the MFD menu, above this button, will be highlighted by a white box.
- The weather radar can only be selected for display in map format. If the weather radar is selected with plan format already selected on the MFD, it will force the display to revert to map format.

2 - MAP/PLAN FORMATS CONTROL BUTTON

- Alternate pressing of the map/plan formats control button will cause the MFD to toggle between map and plan formats. A white box around will highlight the selected MFD format.
- If the weather radar is displayed on the MFD and the plan format is selected, the weather radar will be removed from the display. However, if the MFD map format is selected again, the weather radar display will be restored on the MFD.

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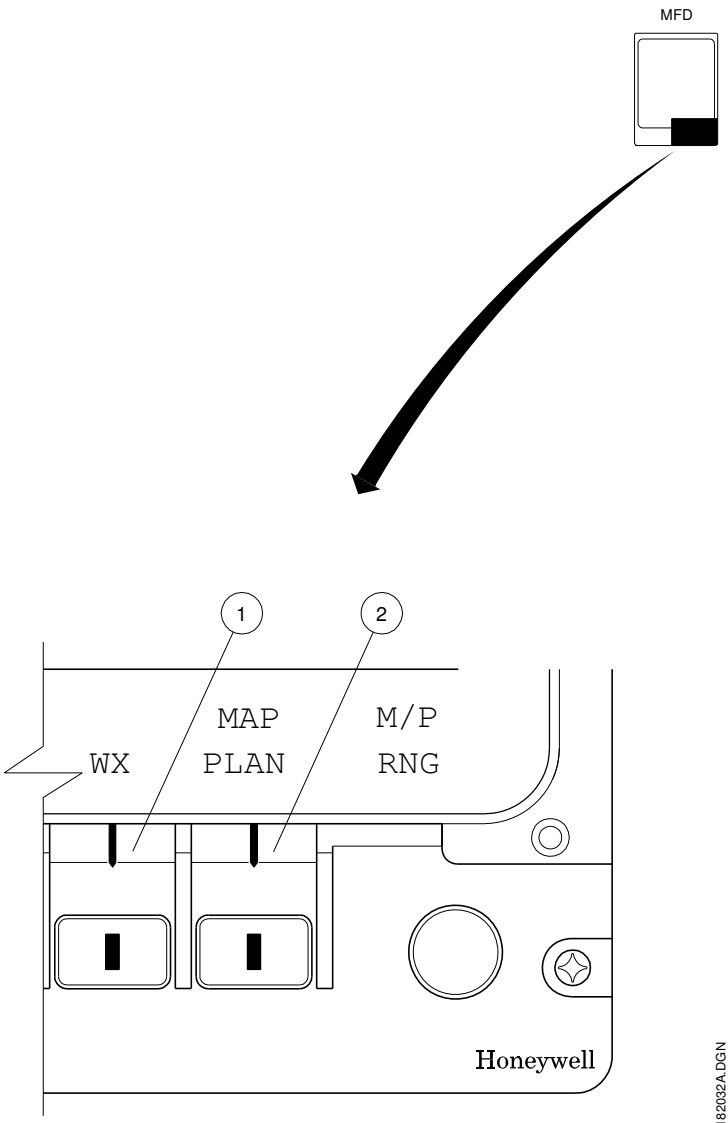

MFD BEZEL PANEL

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WEATHER RADAR DISPLAY ON THE PFD AND MFD

1 - ANTENNA POSITION INDICATOR (API)

- Color: Amber.
- The API is displayed as an arc at the current range outer limit.
- Indicates the radar antenna alternate sweep position and provides a picture bus activity indication.

2 - WEATHER RADAR PATCH

- Indicates an area of radar reflection.
- Color:
  - Magenta: high intensity reflection.
  - Red: medium-high intensity reflection.
  - Yellow: medium intensity reflection.
  - Green: low intensity reflection.

3 - WEATHER RADAR TURBULENCE INDICATION (P-880 Model Only)

- Indicates an area of detected turbulence.
- Color: white.

4 - WEATHER RADAR REACT INDICATION

- Indicates an area where radar receiver gain compensation has reached its maximum value.
- Color: cyan.

5 - WEATHER RADAR RANGE ARC VALUE

- Color: white.
- Indicates half of the radar range selected in the weather radar control panel.

6 - WEATHER RADAR ANTENNA TILT ANGLE DISPLAY

- Color: green.
- Range: –15 to +15°.
- Resolution: 1°.

7 - WEATHER RADAR TARGET MODE AND ALERT ANNUNCIATION

- Color:
  - TGT label: green or amber.
  - VAR label: amber.
- The VAR label will be displayed in the same field as that used for TGT annunciation to indicate a variable gain indication. Priority is given to TGT annunciation.

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8 - WEATHER RADAR MODES ANNUNCIATION DISPLAY

– Indicates the selected mode in the weather radar control panel.

DISPLAY		MODE DESCRIPTION
ANNUNCIATION	COLOR	
STAB	AMBER	Stabilization off.
TGT	GREEN	Target alert enable.
TGT	AMBER	Target alert enable and level 3 WX return detected in the forward 15° of antenna scan.
VAR	AMBER	Variable gain.
WX	GREEN	Normal WX ON and selected for display.
WX	AMBER	Invalid WX control bus.
TX	GREEN	WX is transmitting but not selected for display, or in STBY or FSTBY.
TX	AMBER	WX is transmitting and weight on wheels indicates on ground, but not selected for display, or in STBY and FSTBY.
WAIT	GREEN	Warm up period of approximately 40 to 100 seconds.
STBY	GREEN	Normal standby.
FSBY	GREEN	Forced standby.
TEST	GREEN	Test mode and no faults.
FAIL	AMBER	Test mode and faults.
RCT	GREEN	Normal WX with REACT.
FPLN	GREEN	Flight plan mode.
GMAP	GREEN	Ground map mode.
GCR	AMBER	Normal WX with ground clutter reduction.
R/T	GREEN	WX with REACT and turbulence.
WX/T	GREEN	Normal WX with turbulence.

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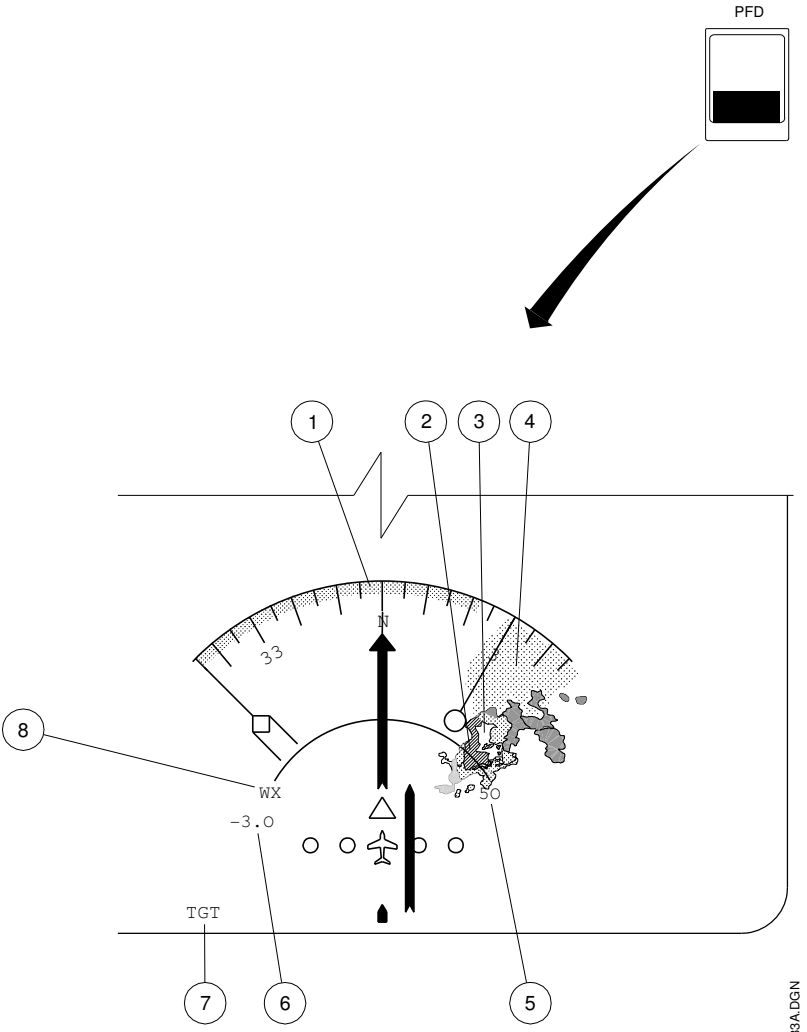

WEATHER RADAR DISPLAY ON PFD

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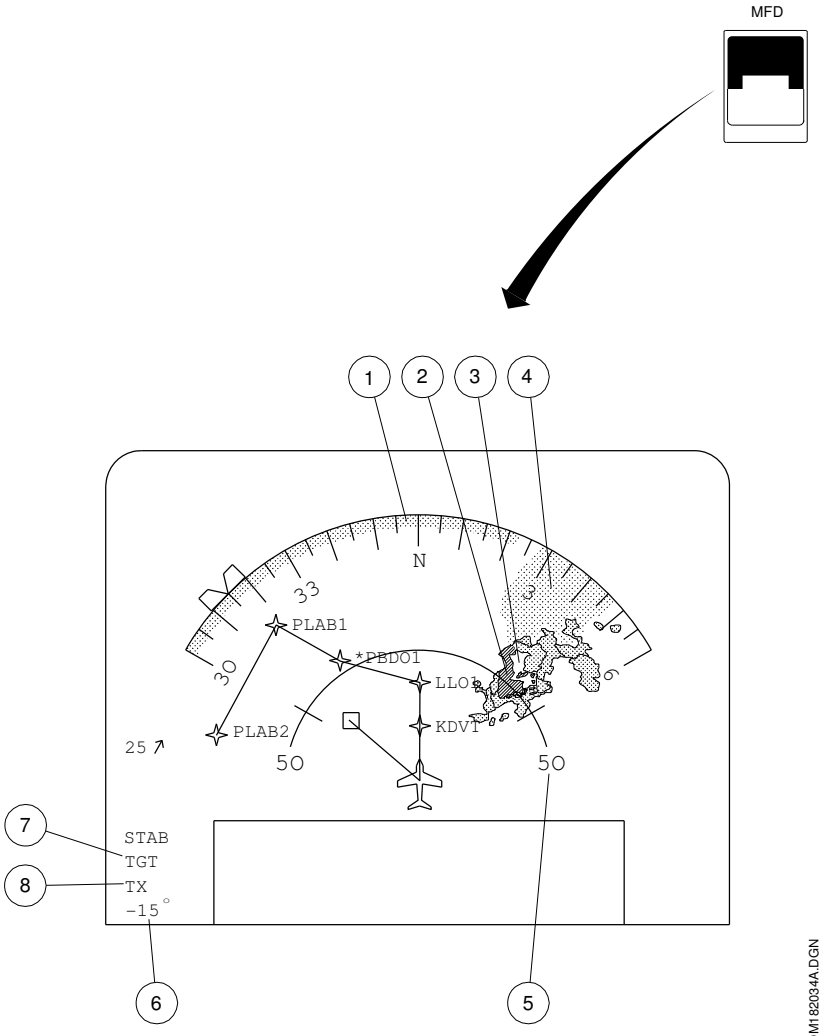

WEATHER RADAR DISPLAY ON MFD

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LIGHTNING SENSOR SYSTEM (LSS)

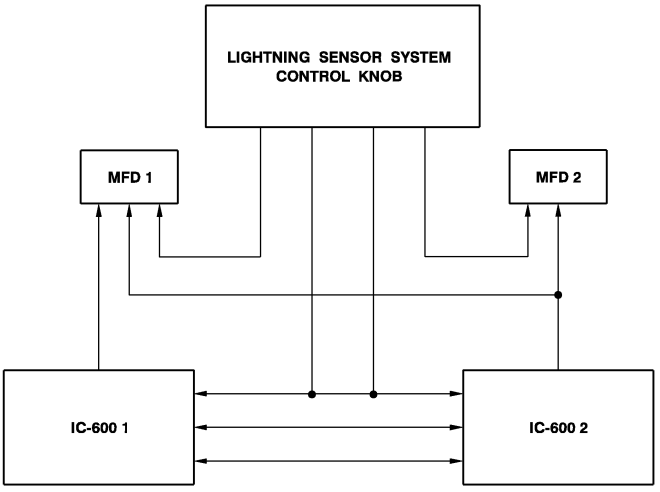
The P-880 Weather Radar Model may be optionally equipped with a Lightning Sensor System (LSS). For additional information on functions and operations, refer to the LSZ-850 Lightning Sensor System Pilot's Handbook.

The Lightning Sensor System is designed to detect and locate areas of lightning activity, in a 100-nautical-mile radius around the aircraft, and to give the operator a visual display of its position and rate-of-occurrence on the MFDs.

The Lightning Sensor System is inhibited on the ground and during HF transmission (HF PTT), being powered by one of the 28 V DC Avionics Switched DC Buses. Should a power supply failure occur, the Lightning Sensor System will be inoperative, as there is no backup power to it.

The Lightning Sensor System interfaces with other airplane systems and equipment as follows:

– MFDs - The LSS provides lightning activity data to the MFDs.
– IC-600s - Signals between the LSS and the IC-600s are transmitted through a Serial Data Bus.



LIGHTNING SENSOR SYSTEM SCHEMATIC

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LSS OPERATION

The Lightning Sensor System is controlled through a dedicated control knob, located on the Weather Radar Control Panel. The Lightning Sensor System Control knob provides control functions and operating modes management for proper Lightning Sensor System operation.

The Lightning Sensor System detects both visible and invisible high energy electromagnetic discharges (lightning), indicating areas of turbulent activity and displaying such information on the MFDs.

The Lightning Sensor System may be operated with the Weather Radar System turned on or off. If the Weather Radar is turned off, the LSS Range Selection is done through the MFDs knobs.

When power is first applied to the system, a self-test is automatically performed and, in the event of failure, an amber LX/F will be displayed on the MFDs. The LSS also performs self-calibration each time the system is turned on. The green LX/C annunciation is removed after calibration is completed. Strong interfering signals outside the aircraft, or equipment malfunction may prevent the calibration of the system, in which case the ¨C¨ will not be removed from the display. If the ¨C¨ is removed after takeoff, this means that only outside interference was preventing calibration. In this case the LSS should be switched off and set back to LX mode to force recalibration for greater accuracy. If the ¨C¨ persists after takeoff, a test should be performed.

LSS OPERATING MODES AND FUNCTIONS

STANDBY MODE (STBY)

When the Standby Mode is selected, no lightning data is shown on the MFDs. However, the receiving and processing equipment is active and lightning strikes are being counted and accumulated into areas.

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LIGHTNING DETECTION MODE (LX)

When operating in Lightning Detection Mode, the Lightning Sensor System is fully operational and lightning strikes are collected, processed, and displayed.

The LSS shows areas of lightning activity with white lightning symbols, which represents the center of a circular area with a radius of nine nautical miles. Three different lightning symbols are used to represent three different lightning rates-of-occurrence within each 18-mile diameter cycle.

Because of the large variation in lightning electromagnetic discharge, sometimes the system can not determine, within its occurring criteria, lightning bearing and distance. Rather, only the bearing is measured. Activity that only provides bearing information is presented in magenta lightning symbols near the outer range marks.

When operating the LSS with the Radar in STBY Mode, 360º of data is displayed.

A green LX will be displayed on normal operation.

Lightning Sensor Display symbology is as follows:

LEVEL	LIGHTNING CATEGORY
1	white headless lightning symbol
2	white single-headed lightning symbol
3	white double-headed lightning symbol
ALERT	magenta headless lightning symbol

CLEAR/TEST MODE (CLR/TST)

When the Clear/Test mode is selected, all lightning rate symbols are erased from the display and a special pattern is displayed to allow verification of the Lightning Sensor System operation.
The Test must be accomplished by selecting 50 NM or a greater display range and the CLR/TST Mode. The LSS CLR/TST Mode can be selected in any radar mode.
In the event of a failure, an amber LXmn will be displayed, where mn is a failure code, which will help the technician in troubleshooting the system.
When CLR/TST mode is selected, a green LX/CL is displayed on the MFDs and, after three seconds, LX/CL is replaced by LX/T.

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LSS CONTROLS AND INDICATORS

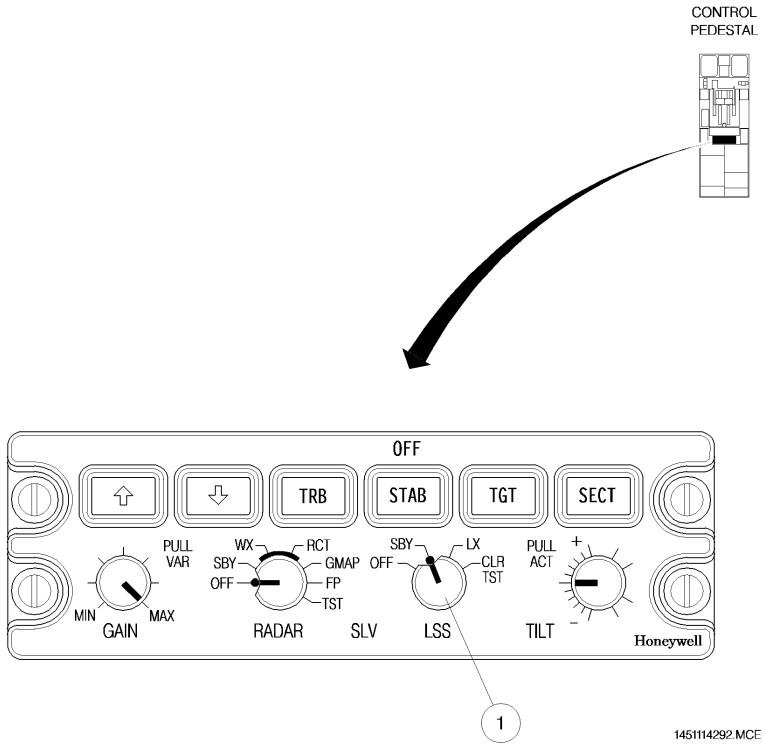
1- LIGHTNING SENSOR SYSTEM CONTROL KNOB

OFF - Turns off the Lightning Sensor System.

SBY - Selects the Lightning Sensor System Standby Mode.

LX - Selects the Lightning Sensor System Detection Operating Mode.

CLR/TST- Selects the Lightning Sensor System Test Mode.



WEATHER RADAR CONTROL PANEL WITH LSS

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LIGHTNING SENSOR SYSTEM DISPLAY ON THE MFD

1 - LEVEL 1 LIGHTNING ACTIVITY INDICATION

- Color: White
- Indicates the center of an 18-mile diameter area of lightning activity with 1 strike every 2 minutes.

2 - LEVEL 2 LIGHTNING ACTIVITY INDICATION

- Color: White
- Indicates the center of an 18-mile diameter area of lightning activity with 2 strikes every 2 minutes.

3 - LEVEL 3 LIGHTNING ACTIVITY INDICATION

- Color: White
- Indicates the center of an 18-mile diameter area of lightning activity with 3 strikes every 2 minutes.

4 - LEVEL 4 (ALERT) LIGHTNING ACTIVITY INDICATION

- Color: Magenta
- Indicates only the bearing of lightning activity, without determining the distance.

5 - LIGHTNING SENSOR SYSTEM MODES AND FAULTS ANNUNCIATION DISPLAY

- Indicates, above the Weather Radar annunciation display, the selected mode in the Lightning Sensor System Control Knob .

DISPLAY		MODE DESCRIPTION
ANNUNCIATION	COLOR	
LX/OFF	GREEN	LX Power is off.
LX	AMBER	LX Power is on and LX Communication Bus is Inactive.
LXmn	AMBER	LX Fault Code Enabled.
LX/F	AMBER	LX Fault
STBY	GREEN	LX Standby
LX/CL	GREEN	LX Clear
LX/T	GREEN	LX Test Mode
LX/I	GREEN	LX Antenna Inhibit
LX/C	GREEN	LX Auto Calibrate
LX	GREEN	LX Normal

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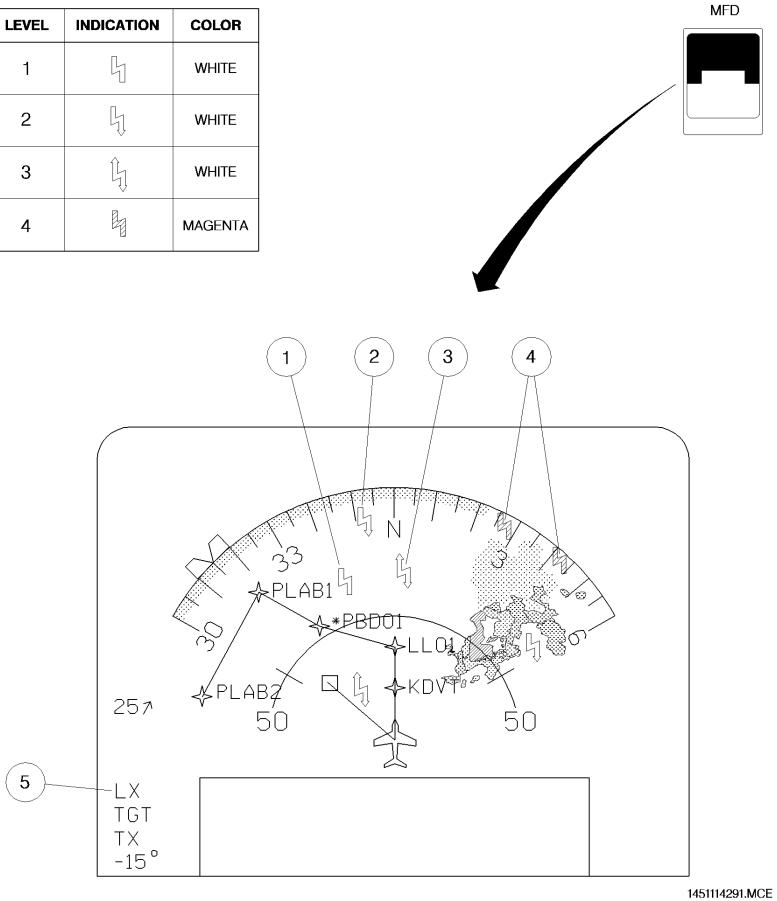
LEVEL	INDICATION	COLOR
1		WHITE
2		WHITE
3		WHITE
4		MAGENTA



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LIGHTNING SENSOR SYSTEM DISPLAY ON MFD

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BAROMETRIC VERTICAL NAVIGATION (BARO-VNAV) (AIRPLANES POST-MOD. SB145-34-0125)

Vertical Navigation is an advisory only function in the FMS to aid the pilot during descents. With Baro-VNAV, the VNAV is coupled to the autopilot and flight director and provides vertical navigation targets to the Flight Guidance Computer (FGC). The Baro-VNAV provides vertical guidance for all phases of flight.

The VNAV function activates when the following conditions are met:

- Each FMS Position initialized,
- Performance initialized,
- Flight plan closed by entering the destination waypoint as the last waypoint in the flight plan,
- Altitude Preselect set,
- FMS as the primary source of navigation, and
- VNV pushbutton pressed.

BARO-VNAV COMPONENTS

The main components of the VNAV feature are the following:

- Flight Guidance Controller (GC-550),
- Integrated Computer (IC-600), and
- Flight Management System (FMS).

The selection of VNV pushbutton on the Flight Guidance Controller, arms the VNAV and, when it is already engaged, disengages the VNAV. Selection of VS, ALT, or SPD vertical submodes and go-around also disengages the VNAV.

NOTE: The VNAV engages automatically if already armed and the conditions for engagement are satisfied.

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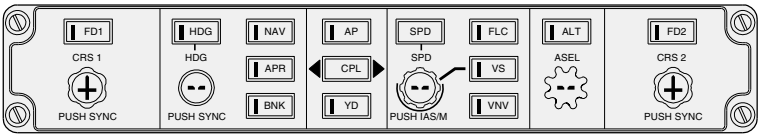

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GUIDANCE CONTROLLER PANEL (GC-550) WITH "VNV" BUTTON

The Flight Director uses the existing Flight Guidance Computer Vertical Mode control logic with the following targets and information supplied by the FMS:

- VNAV submode,
- Altitude targets,
- Airspeed/mach targets, and
- Vertical speed/angle targets.

The FMS determines which targets the FGC will fly. The FMS CDU and the PFD display the VNAV information.

For VNAV operation, at least one ADC and one IRS data must be valid.

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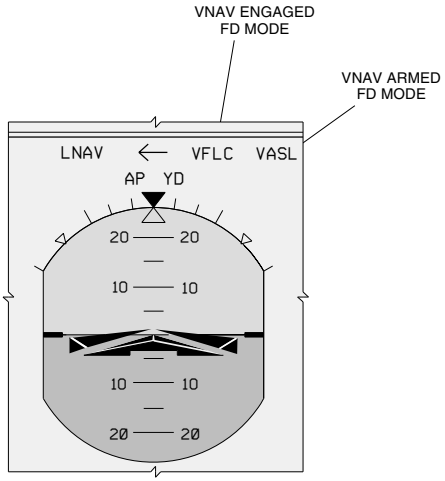
VNAV INDICATIONS

The indications related to VNAV are displayed on the PFD, MFD, EICAS, and CDU.

PFD INDICATIONS

The following figures show the indications on the PFD.



VNAV ARMED AND ENGAGED ON PFD

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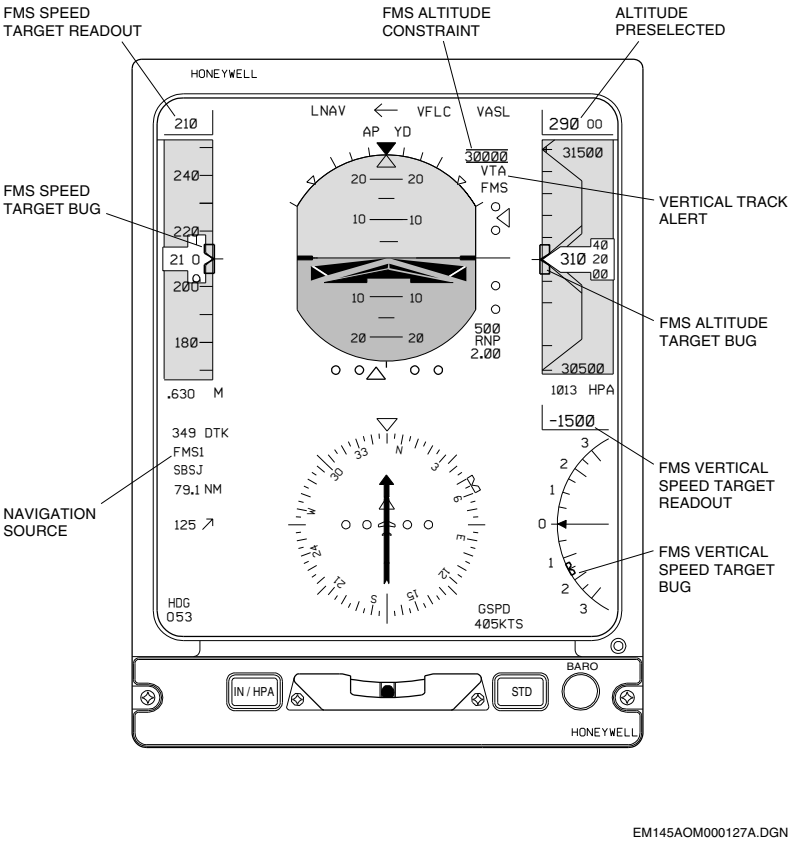

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FMS TARGET BUGS AND READOUTS

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The annunciation related to the VNAV on PFD is displayed in white for "VNAV Armed Mode" and magenta for "VNAV Engaged Mode". When VNAV is engaged, the speed target readout is also presented in magenta and its control is done by the FMS, not by the Speed Knob.

The altitude preselected is set via ASEL Knob on Guidance Controller Panel.

Altitude constraints are "AT", "AT or ABOVE", or "AT or BELOW". They are displayed in Magenta and in ft, with up to five digits and resolution of one foot. They are defined according to Navigation database procedures or flight crew commands on CDU. When the flight crew plan to be at a certain altitude or have a limitation at, below or above a certain altitude. The altitude constraint is not displayed in the PFD when it is equal to the preselector altitude.

A vertical track alert (VTA) is issued anytime the FMS commands a vertical track change. A VTA is issued 60 seconds before changing from level flight to either a climb or descent. When the airplane is completing a climb or descent, the vertical alert is issued 1000 ft before the level-off altitude. A vertical alert is not issued when the level-off altitude is equal to the preselected altitude. When the VTA (Amber) indication is displayed in the PFD, the VTA aural alert is also activated. The VTA aural alert consists in a single C chord.

The altitude alert is activated 1000 ft before the FMS altitude constraint, when this altitude is equal to the altitude constraint. The altitude alert consists in a double C chord.

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The following table contains the type of altitude constraints, descriptions, and indications on the PFD.

ALTITUDE CONSTRAINT	VNAV COMMAND	INDICATION ON PFD (I.E. 10000 ft)
AT	Fly to a specific altitude	10000
AT or ABOVE	Fly to a specific altitude or higher, not below	10000
AT or BELOW	Fly to a specific altitude or below, not higher	10000
WINDOW Constraint (during climb)	Fly to a specific range of altitude, not higher than upper limit, nor below lower limit	10000
WINDOW Constraint (during descent)		10000

NOTE: WINDOW Constraints can not be manually input on the flight plan, but they are present in specific departure procedures and SID, and also in specific approach procedures and STAR.

The FMS vertical deviation indication represents the deviation in feet from the airplane current position to the planned descent path. It has two dots above and two dots below the center mark. When the pointer is above the center mark, it indicates that the airplane is below the path. When the pointer is below the center mark, it indicates that the airplane is above the path.

The FMS Vertical Deviation Scale Factor changes as function to the FMS Phase on Flight Plan, according to the following table.

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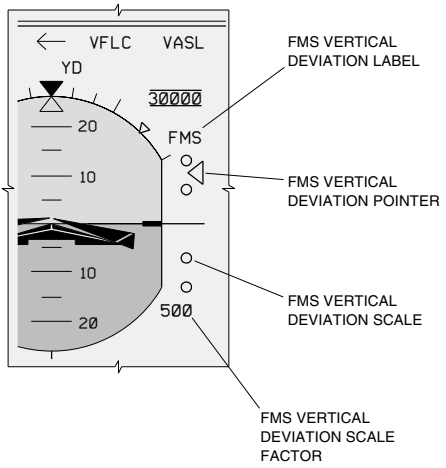
FMS PHASE ON FLIGHT PLAN	FMS VERTICAL DEVIATION SCALE FACTOR (ft)
Approach	150
Other Phases	500

The vertical deviation scale factor is the deviation related to two dots.

For instance, when the scale factor is 500 ft and the pointer is on the second dot above the center mark, the airplane is 500 ft below the planned descent path.



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FMS VERTICAL DEVIATION INDICATION

EICAS

In the condition of VNAV failure, the CAS message "VERTICAL MODE OFF" (caution) is displayed. If already on final approach, the flight crew needs to perform a missed approach procedure.

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CDU

The scratchpad messages related to the VNAV are shown in the following table:

SCRATCHPAD MESSAGE	CONDITION
PERF-VNAV NOT AVAILABLE	Any of the PERFORMANCE INIT data is incomplete and VNAV armed is attempted. This message is displayed only in air.
RESET ALT SEL?	The FMS is commanding a change of altitude, but the altitude selector has not been reset. The airplane cannot change altitude until the selector has been reset.
UNABLE NEXT ALT	If the airplane is unable to meet the altitude constraint.
VERT DIR OVER MAX ANG	The angle computed during a VERTICAL DIRECT TO exceeds the limit (6°).
VERT DIR UNDER MIN ANG	The angle computed during a VERTICAL DIRECT TO is under the limit (1°).

The altitude constraint indications on the CDU are the following:

- An entry of 10000A (letter "A" following the altitude) indicates AT or ABOVE,
- An entry of 10000B (letter "B" following the altitude) indicates AT or BELOW, and
- An entry of 10000 (no letter following the altitude) indicates AT.

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VNAV SUBMODES

VNAV ARM (VNAV)

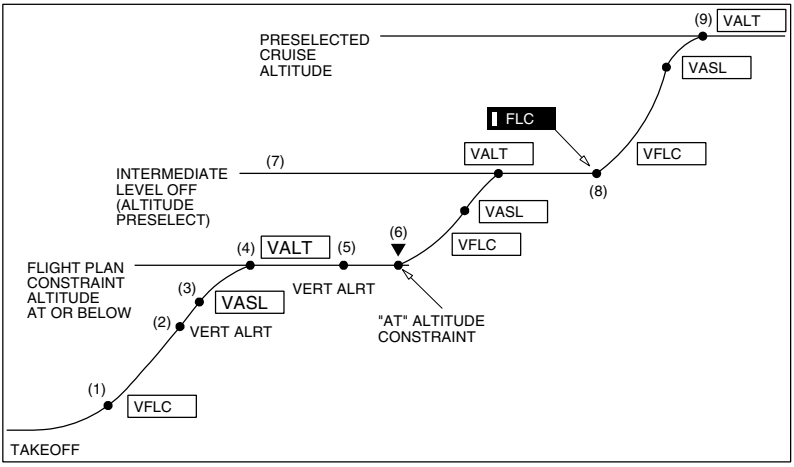
VNAV ARM becomes the active mode when the "VNV" button is pressed and the conditions for VNAV engagement are set. Using the position and altitude data, the FMS determines when to capture and which VNAV submode is correct. While in the armed mode, the FMS does not vertically control the airplane.

VNAV FLIGHT LEVEL CHANGE (VFLC)

In this mode, the Flight Guidance Computer (FGC) follows the FMS speed target readout, controlling the pitch of the airplane for both climb and descent.

When in other modes of VNAV, a transition to VFLC is made by setting the altitude preselector to other than current altitude and pressing the FLC button on the Guidance Controller Panel.

The elements of a VNAV climb profile are the following:



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VNAV CLIMB PROFILE

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An example of a VNAV climb profile consists of the following:

- VNAV is engaged in a VFLC airspeed climb after takeoff (1).
- 1000 ft before reaching the constraint altitude, a VTA is given (2).
- The flight guidance computer changes to VASL to capture the altitude constraint (3).
- The flight guidance computer changes to VALT at the constraint altitude (4).
- One minute before the constrained lateral waypoint is reached, a VTA is issued indicating an automatic climb begins at the waypoint.The altitude preselector is set higher than the constraint altitude (5).
- The FMS directs the Flight Guidance Computer to change to VFLC as the waypoint is passed (6).
- The flight guidance computer performs a normal level off at the intermediate altitude preselector changing from VFLC to VASL to VALT with the normal 1000 ft selector alert (7).
- ATC clearance is received to the cruise altitude and the selector is dialed to the cleared altitude. The "FLC" button is pushed to resume the climb (8).
- The flight guidance computer performs a normal level off at the cruise altitude changing from VFLC to VASL to VALT with the normal 1000 ft selector alert and the speed command changes to the cruise value (9).

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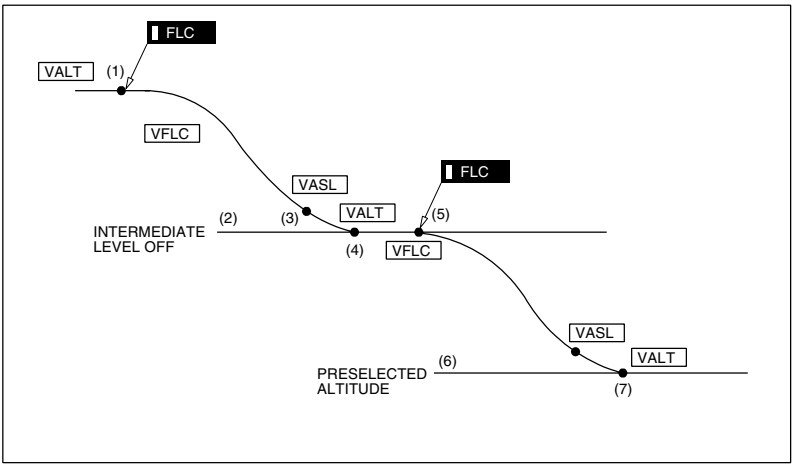
The elements of a VNAV FLC (IAS or MACH hold) descent profile are the following:



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VNAV FLIGHT LEVEL CHANGE DESCENT

A VFLC descent can be engaged at any time by using the following:

- From cruise altitude (1), dial down the altitude preselector to the ATC cleared altitude (2).
- Press "FLC" if already engaged in a VNAV mode or "VNV" if not already in VNAV. The flight guidance computer changes to VFLC and begins a descent (1).
- 1000 ft before the altitude preselected (2) is reached, the normal altitude alert is issued, and the flight guidance computer does a normal level off switching from VFLC to VASL (3) to VALT (4).
- An ATC clearance (5) is received to a lower altitude and the altitude preselector is lowered (6). "FLC" is pressed (5) and the airplane begins a descent.
- 1000 ft before the altitude preselector (6), the normal altitude alert is issued and the flight guidance computer does a normal level off switching from VFLC to VASL to VALT (7).

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– Excessive descent rate may be achieved if the programmed descent speed is higher than current cruise speed. Pilots must use the engine thrust to control the initial rate of descent.

VNAV ALTITUDE CAPTURE (VASL)

This mode is used to level the airplane at the VNAV supplied altitude target. The altitude target is either an altitude constraint or the altitude preselector setting. Preselector Altitude modification while in VASL results in a Flight Director Mode transition to VALT.

VNAV ALTITUDE HOLD (VALT)

This mode is the same as altitude hold. The FGC maintains altitude by controlling pitch. When VNAV is disengaged while in VALT, and lateral mode is not ROL, the flight director mode becomes PITCH HOLD, not altitude hold.

VNAV PATH (VPTH)

In this mode, VNAV controls the airplane along a geometric path downward to a waypoint altitude constraint. The path angle is either an FMS computed value, procedure specified, or pilot entered. The airplane is not going to fly below the altitude preselected.

VPTH default descent angle is part of performance initialization. However, after the angle is displayed for each waypoint, it is possible to the flight crew to change it as required, from 1 to 6 degrees.

The LNAV must be engaged for VPTH to be operational.

A VNAV path descent engages from VALT when the altitude preselector has been dialed down before the TOD point is reached.

The VNAV path descent mode is used to descend to a new flight level at a calculated or prescribed angle (from 1 to 6 degrees).

The VNAV angle is always displayed on CDU for path descents.

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The path is always followed, except when the airplane speed approaches the following:

- V_{MO}/M_{MO},
- Landing gear or flap placard speed, or
- V_{REF}.

VNAV tries to satisfy both the altitude preselector and the waypoint constraint altitude. However, VNAV never flies through the altitude preselector.

When using VPTH and a missed approach is executed, it is necessary to reset the altitude preselector to the missed approach altitude.

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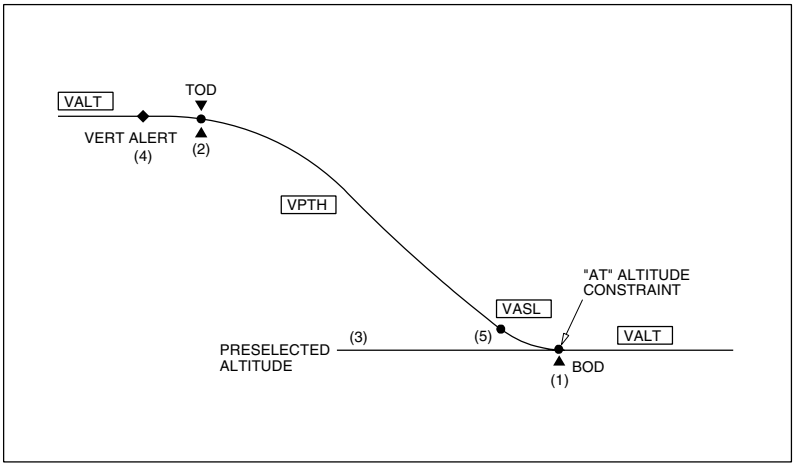
The steps of a VNAV path descent profile are the following:



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VNAV PATH DESCENT PROFILE

- An altitude constraint is entered at a waypoint (1).
- The FMS calculates an angle and TOD (2) for the path descent.
- The altitude preselector is set to the ATC cleared altitude (3).
- One minute before reaching the TOD, a VTA is issued (4) and the vertical deviation scale is displayed on the EFIS. If the altitude preselector is not at a lower altitude, the message "RESET ALT SEL?" is displayed on the FMS CDU.
- At the TOD, the flight guidance computer changes from VALT to VPTH and begins a descent (2).
- The flight guidance computer does a normal level off changing from VPTH to VASL (5) to VALT (1).

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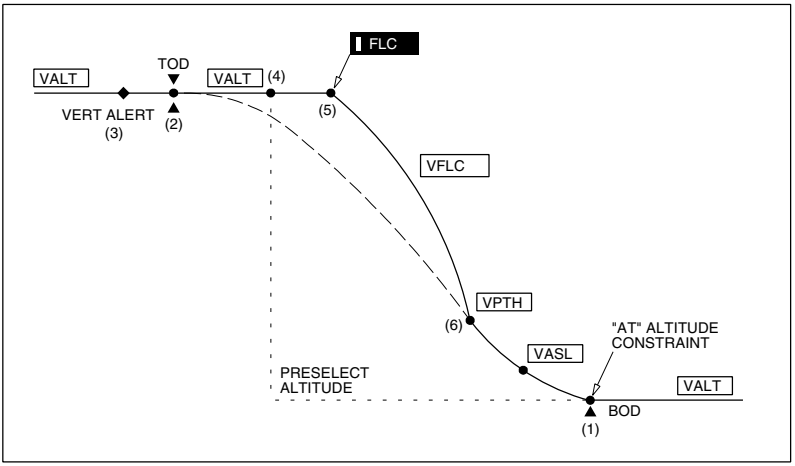
The scenario of a VNAV late path descent occurs when ATC has not given descent clearance by the time the TOD is reached. The steps are the following:



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VNAV LATE PATH DESCENT

- An altitude constraint is entered at a waypoint (1).
- The FMS calculates an angle and TOD (2) for the path descent.
- One minute before reaching the TOD, a VTA is issued (3) and the vertical deviation scale is displayed on the PFD.
- If the altitude preselector is not at a lower altitude, the message "RESET ALT SEL?" is displayed.
- When past the TOD and more than 500 ft above the path, the flight guidance computer remains in VALT.
- The altitude preselector is then set (4) to the ATC cleared altitude.
- Pressing the "FLC" button (5) begins descent.

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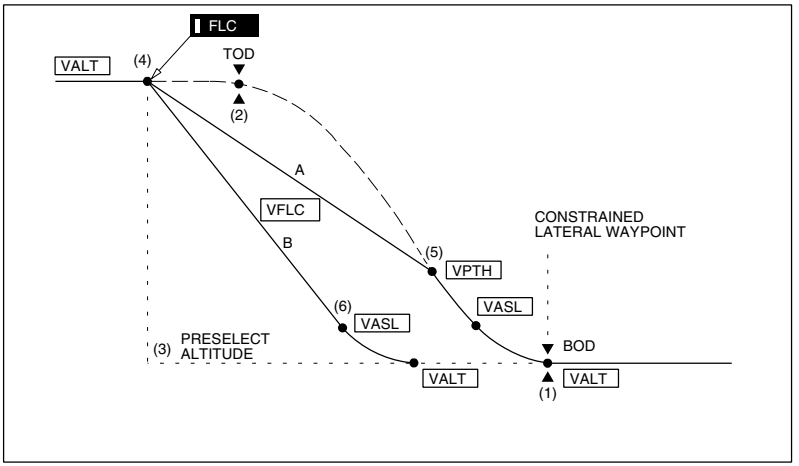
- The FMS issues a mode request to the Flight Director from to VALT to VFLC to begin the descent once engine thrust is reduced sufficiently. The descent rate in VFLC mode is governed by engine thrust and descent speed target (as specified in the Performance Initialization page). If the airplane is less than 500 ft from the path when the "FLC" button is pushed, the FMS switches directly to VPTH mode.
- When the path intercept criteria are satisfied the FMS issues a mode request to the flight director to change from VFLC mode to VPTH mode and continues the descent along the path (6).
- The flight guidance computer does a normal level off switching from VPTH to VASL and finally to VALT (1).

VNAV EARLY DESCENT TO CAPTURE PATH

An early descent to capture a path scenario occurs when ATC instructs a descent before the established TOD point is reached. The steps are the following:



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VNAV EARLY DESCENT TO CAPTURE PATH

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- An altitude constraint is entered at a waypoint (1).
- The FMS calculates an angle and TOD (2) for the path descent.
- The altitude preselector is set to the ATC cleared altitude (3).
- Pressing the "FLC" button (4) starts the descent.
- The FMS issues a mode request to the Flight Director from VALT to VFLC and begins to descend once engine thrust is reduced sufficiently. The descent rate in VFLC is governed by engine thrust and speed target (as specified in the Performance initialization pages).
- If the airplane is less than 500 ft from the path when the "FLC" button is pressed, the FMS changes directly to VPTH mode.
  - VFLC path "A" is followed when the airplane descent rate is relatively small (engine thrust is nearly proportional to the thrust required to maintain level flight at target airspeed).
    - Path intercept criteria are satisfied; the FMS issues a mode request to the flight director to switch from VFLC to VPTH mode and continues descending along the path (5).
  - VFLC path "B" is followed when the airplane descent rate is high (engine thrust is low relative to the thrust required to maintain level flight at target airspeed);
    - Path intercept criteria are not satisfied, the FMS continues descending in FLC mode until VASL is captured (6).
- A normal level off is performed changing from a VPTH or VFLC to VASL and finally to VALT (1).

VERTICAL DIRECT-TO

A vertical direct-to is performed to an altitude constraint at a waypoint in the flight plan and is used for climbs and descents. The altitude constraint must be in the flight plan before the vertical DIRECT-TO is executed. The airplane does not respond to the vertical DIRECT-TO unless the altitude selector is properly set above for climbs and below for descents.

When VNAV is engaged, the VNAV submode changes to VFLC for climbs or to VPTH for descents. All altitude constraints between the airplane and the selected constraint are removed from the flight plan. No lateral changes are made to the flight plan.

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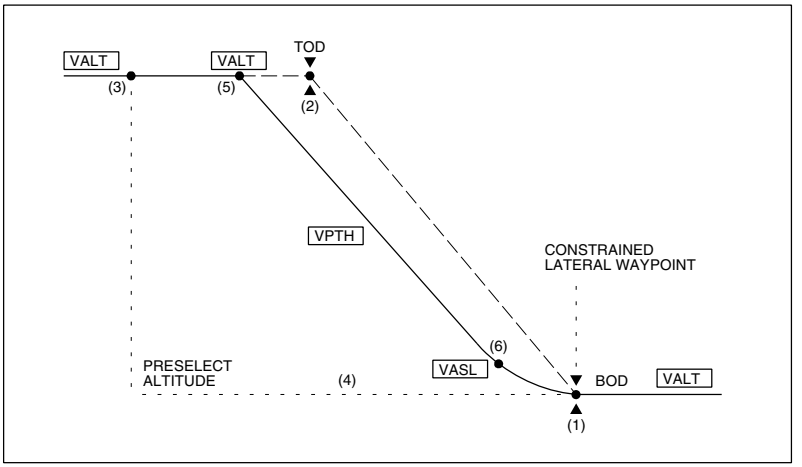
The steps for VNAV early path descent using vertical DIRECT-TO are the following:



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VNAV EARLY PATH DESCENT USING VERTICAL DIRECT-TO

- An altitude constraint is entered at a waypoint (1).
- The FMS calculates an angle and TOD (2) for the path descent.
- The altitude preselector is set (3) to the ATC cleared altitude (4).
- A vertical direct-to is performed (5) to the constrained waypoint (1).
- The FMS calculates the new descent path angle and the flight guidance computer transitions to VPTH.
- The calculated angle is limited from 1 to 6 degrees. When the actual angle is less than 1 or greater than 6 degrees, the FMS starts a descent to intercept the limiting angle of 1 or 6 degrees.
- The flight guidance computer does a normal level off, changing from VPTH to VASL (6) to VALT (1).

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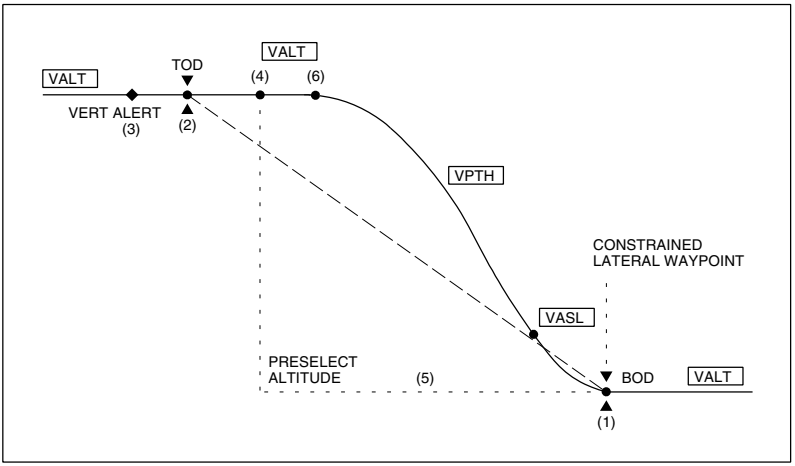
A VNAV late path descent using vertical DIRECT-TO scenario occurs when a descent clearance is not received before the TOD is reached. The steps are the following:



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VNAV LATE PATH DESCENT USING VERTICAL DIRECT-TO

- An altitude constraint is entered at a waypoint (1).
- The FMS calculates an angle and TOD (2) for the path descent.
- One minute before reaching the TOD, a VTA is issued (3) and the vertical deviation scale is displayed on the PFD.
- If the altitude preselector is not at a lower altitude, the message "RESET ALT SEL?" is displayed on the FMS CDU.
- At the TOD (2), the flight guidance computer remains in VALT and remains level through the TOD.
- The altitude preselector is set (4) to the ATC cleared altitude (5).
- A vertical DIRECT-TO is performed (6) to the constrained waypoint (1).
- The FMS calculates the angle and the flight guidance computer transitions to VPTH.
- The flight guidance computer does a normal level off, changing from VPTH to VASL to VALT (1).

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VNAV VERTICAL GLIDE PATH (VGP)

The Vertical Glide Path (VGP) permits crew management of the altitude preselector during FMS managed non-precision approaches. Lateral and Vertical guidance are provided to the runway threshold or missed approach point, whichever occurs first.

VGP mode is armed by pressing the approach "APR" button on the Flight Guidance Controller Panel and the following conditions occur:

- FMS1 or FMS2 selected as the primary navigation source on the Master Flight Director,
- An FMS-based approach has been selected in the active flight plan,
- The FMS is not in dead reckoning (DR) mode,
- A NDB angle to the MAP exists,
- Altitude and angle constraint values from the NAV DB have not been changed,
- When there is an altitude constraint on the Final Approach Fix (FAF), the airplane must be in ALT HOLD at the FAF altitude,
- No DIRECT-TO the MAP has been executed,
- FMS is not in degraded state of operation,
- Vertical path intercept occurs, and
- The airplane is within 50 NM of the destination.

VGP mode is captured when the following conditions occur:

- The VGP mode is armed,
- LNAV is active,
- The airplane, when holding, must be established on the inbound course to the FAF,
- The active waypoint is the FAF or along track distance to the FAF is less than 5 NM,
- The airplane is able to capture the final approach slope, and
- With a course reversal hold leg (HF) on the FAF, the airplane must be established inbound to the FAF and be exiting the hold.

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VGP is not captured until LNAV and VNAV are captured.

Preselector Altitude modification is permitted while "VGP" is captured. When it is modified while "VGP" is armed, it results in a transition to VASL (VNAV equivalent of ASEL) and ultimately VALT.

While VNAV respects the altitude preselector and levels off appropriately at the value set in the altitude preselector window, when "VGP" is engaged and the airplane descends, the FD ignores the preselected altitude (if below current altitude) and continues the descent to the runway. Then it is possible to set the preselector altitude to the missed approach altitude.

Descents in the VGP mode allow the flight crew to set the altitude preselector to the missed approach altitude without affecting the descent path.

VGP mode is automatically canceled when any of the VGP arming conditions is no longer true. A scratchpad message "VGP UNAVAILABLE" is displayed when the "APR" button is pressed and the arming criterion mentioned previously is not met. The message is self-clearing when the FAF is sequenced.

VNAV AND HOLDING OR ORBIT PATTERNS

There are some special considerations for holding and orbits during VNAV operation:

- When the holding or orbit pattern is entered while in VFLC, the airplane remains in VFLC and continues the climb or descent.
- When the holding or orbit pattern is entered while in VALT, the airplane remains in VALT.
- When a present position (PPOS) holding pattern is entered while in a path descent (VPTH), the VNAV changes to VFLC while in holding.

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- Path descents are not used during holding pattern operations. When the hold is entered while in VPTH, VNAV changes to VALT. To continue the descent, the pilot must manually select VFLC.
- If VNAV is engaged while executing a holding pattern course reversal on an approach, VNAV operates with VS targets (VPTH or VGP) to satisfy altitude constraints.
- Once established inbound on the final approach course, VNAV disregards the holding altitude constraint.
- VNAV guidance is provided in holding patterns and procedure turns to arrive at the Final Approach Fix (FAF) on the final approach descent path.

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GO-AROUND OPERATIONS (MISSED APPROACH PROCEDURE)

The Go-Around is initiated through the TO/GA buttons on the throttles. If either button is pushed, the following sequence occurs:

- FMS outputs the missed approach waypoints to the EFIS.
- The FD vertical engaged mode cancels VNAV mode and transitions to the GA mode.
- The FD lateral engaged mode transitions to ROL (Wings Level) and LNAV arm unless:
  - Radar Altitude < 200 ft (LNAV arm is delayed until RA > 200 ft), or
  - LNAV is already the active lateral mode (if LNAV is previously engaged, it remains engaged upon GA activation).
- Once engaged, the ROL mode remains as the active mode until the LNAV captured logic is satisfied. If the current heading is divergent to the FMS flight plan, the pilot must change the airplane heading manually to intercept the FMS flight plan.

NOTE: When LNAV arms and the FMS is set or it is manually set as the primary source of navigation, the LNAV engages as soon as the engagement criteria are satisfied.

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SPEED COMMAND

The FMS is capable of controlling the airplane speed during departure, climb, cruise, descent, approach, and go-around.

The Speed Command manages the airplane speed under the following methods:

- Automatic: The FMS automatically changes the speed command throughout the flight to accommodate airplane configuration and phase of flight,
- Waypoint Speed Constraint: The FMS changes the speed command to cross a waypoint at a specified speed constraint, and
- Speed Intervention: Allows the pilot to enter into the FMS a specified speed to fly. While flying the specified speed, the FMS continues to provide Speed Protection.

SPEED PROTECTION

The FMS provides two types of speed protection:

- Speed Reversion: Automatic transition from VPTH to VFLC.
- Latched Speed: Automatic transitions from one submode of VNAV to another.

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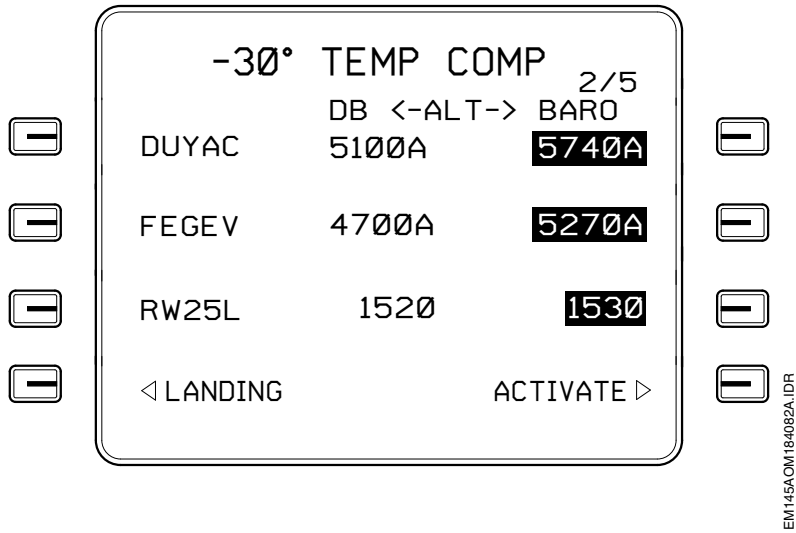
TEMPERATURE COMPENSATION

With Baro-VNAV, the FMS includes the Temperature Compensation function. It provides temperature compensated VNAV altitudes during operations in nonstandard temperatures. When a vertical path is defined using barometric altitude, the FMS supplies temperature compensation capability for the altitude constraints. It is available for all the waypoints in departure, approach, approach transitions, and missed approach segments of the flight plan.

The flight crew must compensate for temperature effects on minimum altitude or decision altitude. If temperature compensation is not activated, the flight crew must adhere to temperature limits of the procedure.

NOTE: Before employing temperature compensation, the flight crew must coordinate the use of the feature with ATC. Failure to do so could result in a loss of vertical separation with other traffic.



TEMP COMP PAGE

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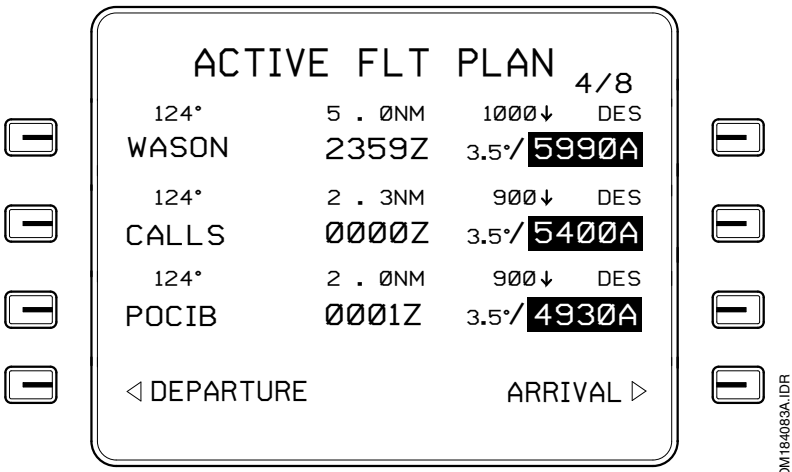
The TEMP COMP page list the waypoints in the flight plan that has altitude temperature correction applied. All the waypoints in departure, approach, approach transitions, and missed approach segments of the flight plan are included on this page.

The altitudes in the BARO column lists the corresponding temperature compensated altitude values. If a waypoint does not have a navigation database altitude constraint, the DB and BARO fields are blank. Temperature compensation is activated by pushing 4R (ACTIVATE) on the TEMP COMP page. When temperature compensation is active, the temperature compensated altitudes are displayed in reverse video on the ACTIVE FLT PLAN pages.



ACTIVE FLT PLAN PAGE WITH TEMPERATURE COMPENSATED ALTITUDE CONSTRAINTS

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REQUIRED NAVIGATION PERFORMANCE (RNP)

RNP operation is the ability of the airplane navigation system to monitor the navigation performance it achieves and inform the crew if the requirement is not met during an operation. The FMS receives navigation data from various sensors on board the airplane and chooses the sensors providing the most accurate airplane position. The sensors used by the FMS are listed in priority order as follows: GPS, DME-DME, and VOR-DME. In case of sensor failure, the FMS will automatically switch to the next available sensor following the priority order as described.

The FMS includes pages where the flight crew can set and/or monitor the progress of RNP parameters and new messages for RNP operations, which will be displayed on CDU scratchpad together with an amber annunciation "MSG" on the PFD.

The user interface is achieved through system controls (CDU scratchpad), alerting functions (PFD, CDU)), and for airplanes Post-Mod. SB145-34-0125 also indications on PFD. These functions provide the means for system initialization, flight planning and progress monitoring, active guidance control, and presentation of navigation data for flight crew situational awareness.

RNP INDICATIONS

The RNP functionality includes indications on FMS CDU scratchpad. For airplanes Post-Mod. SB145-34-0125 there are indications also on the PFD.

FMS CDU INDICATIONS AND ALERTS

The FMS provides the following RNP alerts and advisories on the CDU scratchpad and triggers the MSG annunciation on PFD:

– DEGRADE Alert – The degrade annunciation will be triggered when the EPU reaches a value higher than the RNP. The indication DGRAD is lit on CDU. For airplanes Post-Mod. SB145-34-0125 the PFD displays the DGR indication in amber.

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– UNABLE RNP Alert – The UNABLE RNP message is displayed and the DEGRADE annunciator is lighted when EPU is higher than RNP or when horizontal integrity limit (i.e., RAIM) receiver autonomous integrity monitoring is higher than the integrity alarm limit.

The maximum time required for the FMS to annunciate Degrade and Unable RNP alerts is based on the phase of flight. These times are described on the following table:

PHASE OF FLIGHT	TIME TO ALARM
Approach	6 seconds
Departure/Arrival/Missed Approach	6 seconds
Enroute	24 seconds
Remote	54 seconds

– UNABLE RNP NEXT WP Alert – This message alerts the crew that the current EPU exceeds the RNP required at the next waypoint.

– PILOT RNP CANCEL NEXT WP Alert – The alert PILOT RNP CANCEL NEXT WP is displayed when the pilot entered (i.e., manual) RNP is automatically canceled. This occurs when the airplane is within the waypoint sequence alert distance and the RNP on the next leg is less than the current, pilot entered RNP.

– PILOT RNP CANCELED Alert – The alert PILOT RNP CANCELLED is displayed when the active waypoint has a smaller RNP than the pilot entered RNP.

– GPS RAIM ABOVE LIMIT Alert – The alert GPS RAIM ABOVE LIMIT is displayed when global positioning system (GPS) is required and the RAIM value is above the limit.

NOTE: The FMS does not provide an indication to the crew of an excessive lateral (cross-track) deviation. Lateral deviation is not considered in the display of the RNP integrity alert. It is the pilot's responsibility to monitor lateral deviation and take appropriate action to ensure the airplane follows the flight plan with minimal error.

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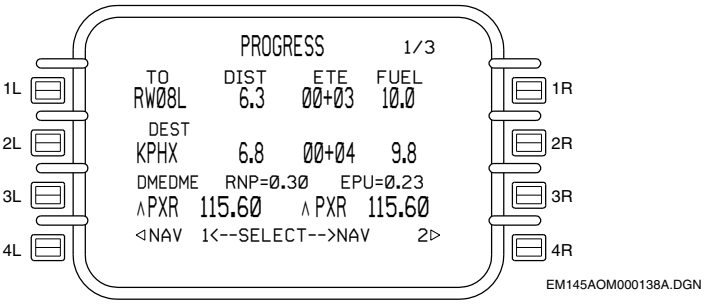

FMS PROGRESS WITH RNP INFORMATION

RNP OPERATION

The RNP value used by the system is based on the following priority order:

- Manual entry,
- Navigation database specified, or
- Phase of flight default.

The RNP number can be manually entered on FMS by accessing the SET RNP page. If a valid manually entered RNP value is higher than the RNP value for the current phase of flight results in display of the CONFIRM ENTRY reverse video prompt at CDU.

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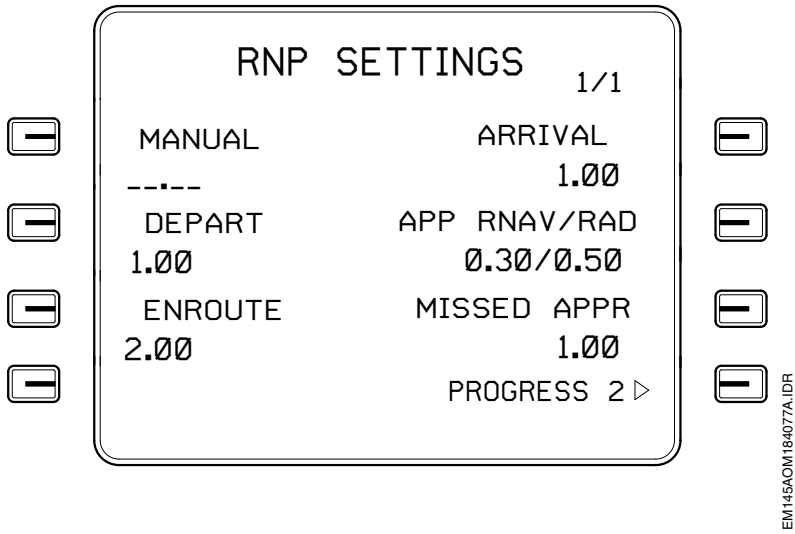

RNP SETTINGS PAGE

The default values for each phase of flight are:

- Departure = 1.0
- En route = 2.0
- Arrival = 1.0
- Approach = 0.3
- Missed approach = 1.0
- Oceanic/remote = 2.0

When the crew entries a manual override RNP value, it is retained until the flight plan is cleared, or completed, unless automatically canceled or manually deleted. When there is no entry, dashes are displayed.

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PFD INDICATIONS (AIRPLANES POST-MOD. SB145-34-0125)

RNP Label: The RNP label is displayed always in white on PFD whenever the RNP indications are displayed.

Lateral Deviation Scale Factor: The Lateral Deviation Scale Factor (RNP value) represents a designation for the navigational performance accuracy required (for example, RNP 0.3, RNP 1.0, and so on) at any given time. It is displayed in magenta on PFD under normal conditions. The Lateral Deviation Scale Factor is provided by the FMS or entered manually. When the Lateral Deviation Scale factor is invalid, it is displayed as four amber dashes.

Lateral Deviation Scale: The lateral deviation scale consists of one centered tick mark and two dots on each side of the center tick mark and is displayed in white under normal conditions. The center tick mark represents the center of the airplane desired track. The two dots represent the lateral deviation in NM in relation to the lateral deviation scale factor (for instance, 2x dots = 1x RNP).

Lateral Deviation Pointer: The Lateral Deviation Pointer represents the current airplane lateral deviation in relation to the central tick mark. The pointer is displayed as a magenta "triangle" that moves in relation to the center tick mark to the right or to the left corresponding to the airplane lateral deviation. The FMS also sets the course deviation indicator (CDI) sensitivity based on the RNP value. The CDI is set such that two dots of cross track deflection are equal to the RNP value.

Estimated Positioning Uncertainty (EPU): The EPU is a measure in NM which conveys the current position estimation performance. The EPU is not an estimate of the actual error, but a defined statistical indication of potential error. The EPU is displayed graphically on PFD as magenta horizontal lines and winglets attached to the lateral deviation pointer. The initial position of the winglets is the center of the lateral deviation pointer and it expands to the left and right or retracts as the EPU value increases or decreases. The Lateral Deviation Pointer and EPU move as a group to the left or right in accordance to the airplane lateral deviation in NM. If EPU is invalid, the Lateral Deviation Pointer is displayed as a red X.

Vertical Deviation Scale Factor: The Vertical Deviation Scale Factor indicates the airplane vertical current position relative to the desired track and is displayed in magenta every time the vertical deviation scale is displayed.

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Vertical Deviation Scale: The Vertical Deviation Scale is displayed in magenta on the PFD in feet. It is only displayed when the airplane enters into any path descending modes. With engaged VNAV mode the vertical deviation scale reference is displayed in amber and flash in the condition of deviation exceedance. Vertical scaling changes according to the phase of flight, according to the following table.

PHASE OF FLIGHT	VERTICAL DEVIATION SCALE
Approach	75 ft/dot
Ground Departure Airborne Enroute Oceanic/Remote Arrival Missed Approach	250 ft/dot

FMS POS Monitor: The FMS position comparison monitor provides an indication to the flight crew that there is a difference between the pilot and copilot FMS present position. The FMS position monitor is activated when the FMS position difference in nautical miles exceeds the RNP value. The FMS POS annunciation is displayed in amber on PFD.

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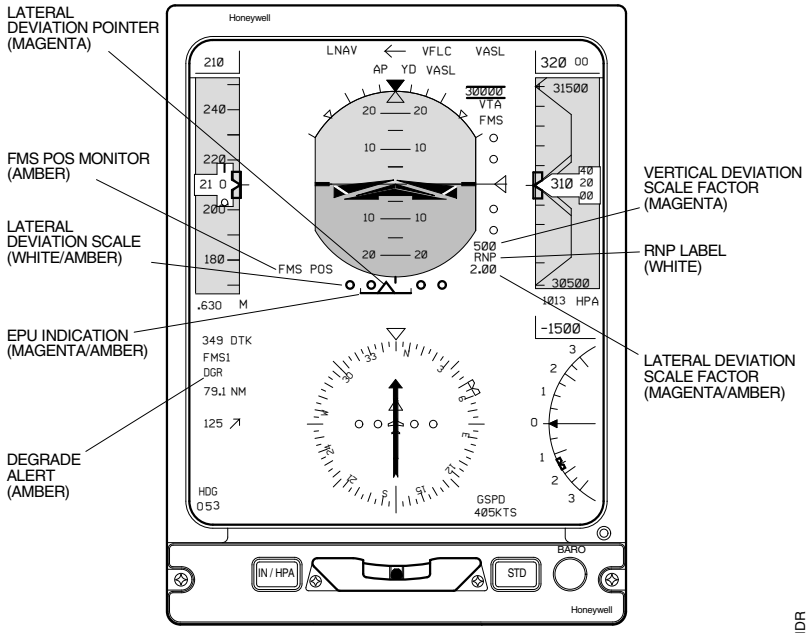
The RNP indications on PFD are illustrated in the following figure:



RNP INDICATIONS ON PFD

Exceedance Indications: When the EPU value is higher than the current applicable RNP value, the Lateral Deviation Scale, Lateral Deviation Scale Factor, EPU, and Lateral Deviation Pointer turn into amber and flashes for 5 seconds than become steady on PFD.

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An example of exceedance condition and indication in the following figures:

RNP = 1.0, EPU = 0.5, LAT DEV = 0.3

RNP = 1.0, EPU = 1.0, LAT DEV = 0

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RNP SYMBOLOGY IN NORMAL AND EPU EXCEEDANCE CONDITIONS

The same indications return to the original colors when the exceedance condition is not present anymore.

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LOCALIZER PERFORMANCE WITH VERTICAL GUIDANCE (LPV) (AIRPLANES POST-MOD. SB145-34-0125)

Localizer Performance with Vertical Guidance (LPV) are approach procedures based on SBAS (Satellite-Based Augmentation System), also known by WAAS (Wide Area Augmentation System).

SBAS is intended to enable airplane to rely on GPS for all phases of flight, including precision approaches to any airport within its coverage area.

When LPV approach mode is active, the SBAS-enabled GPSs calculate the path deviations (lateral and vertical axes) which are displayed on the PFD.

The lateral and vertical deviation data for LPV approaches are the angular deviations of the airplane from the glide path for the approach defined by the Final Approach Segment (FAS) data block. The angular deviation is calculated from the Runway Threshold to simulate the angular deviation provided by an ILS glideslope. The FMS uses the lateral and vertical deviation data provided by the GPS to compute the lateral and vertical steering commands necessary for the guidance to capture and track the LPV path.

LPV APPROACH LOADING

The LPV approach information is stored in the FMS Navigation Database (NDB) and is selected through FMS CDU.

When an LPV approach is available for a runway, the FMS indicates the SBAS/LPV approach in the CDU ARRIVAL page by displaying:

- The SBAS Channel,
- The Selected Approach Reference ID, and
- The ACTIVATE prompt.

The flight crew shall load the LPV approach to be flown and press the VNV button then press the APR button on guidance controller (GC-550) to arm and perform the LPV approach.

Once active, the LPV indications (status, lateral and vertical deviations) are removed only by performing a Go-Around or proceeding to land.

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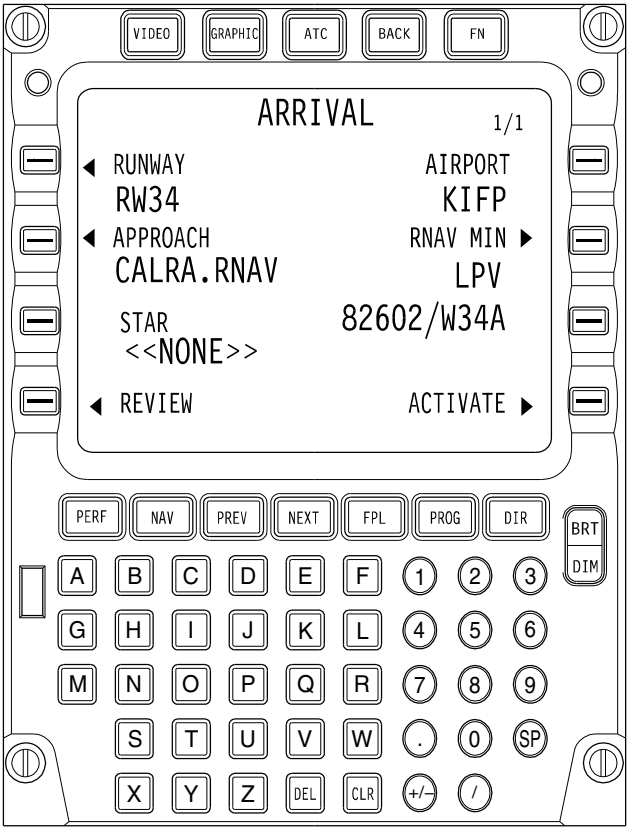

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CDU ARRIVAL PAGE

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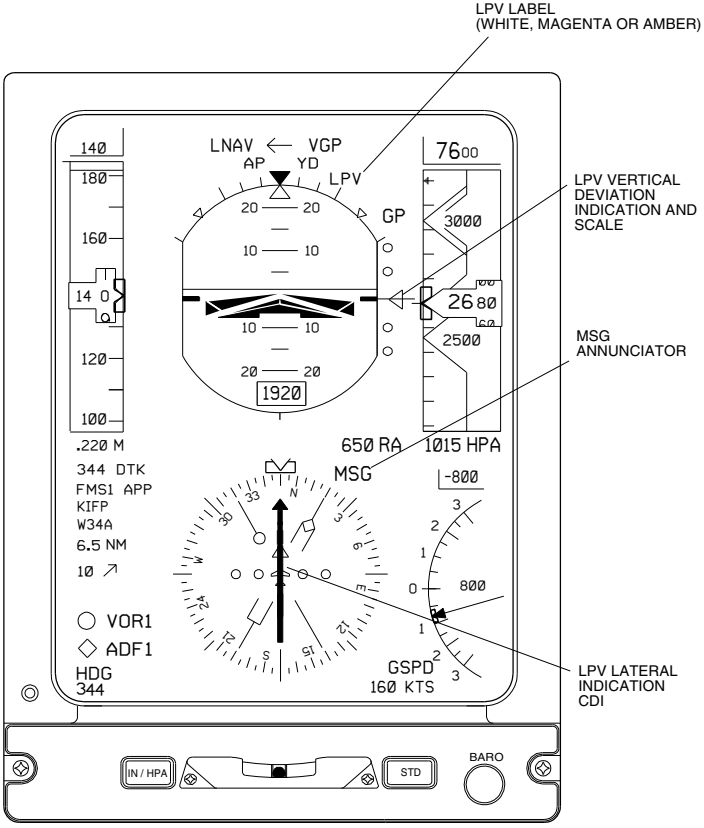
LPV INDICATIONS



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LPV INDICATIONS ON PFD

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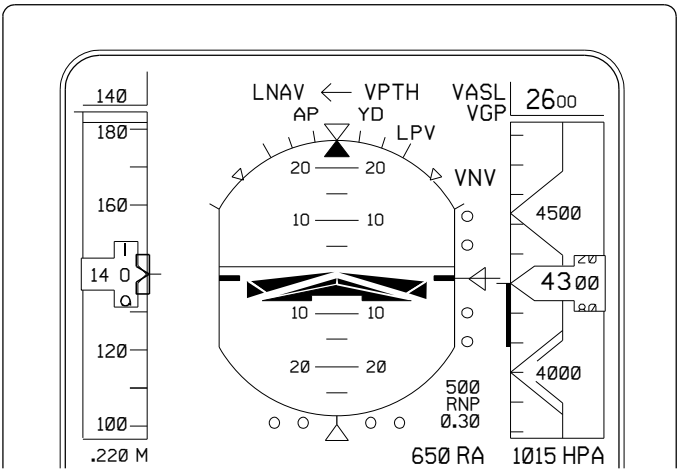
LPV ARMED ANNUNCIATION

The LPV Approach Annunciation "LPV" is displayed in White, indicating LPV Armed, when the airplane is within 30 NM of the destination. No crew action is required in this mode.



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LPV ARMED ANNUNCIATION

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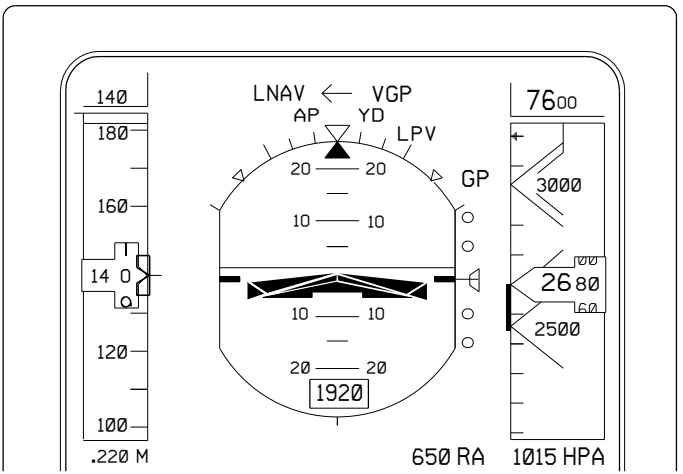
LPV ACTIVE ANNUNCIATION

The LPV Approach Annunciator "LPV" is displayed in magenta, on PFD indicating LPV is active when the FMS sets the Approach annunciator approximately 2 NM before the Final Approach Fix (FAF). The magenta "LPV" annunciation flashes for 5 seconds and then remains steady.The LPV active indication alert the flight crew that the computed lateral and vertical deviations for the final approach segment are provided by the SBAS sensor.

When the LPV is Active, all RNP symbology (when applicable) is removed from the PFD.



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LPV ACTIVE ANNUNCIATION

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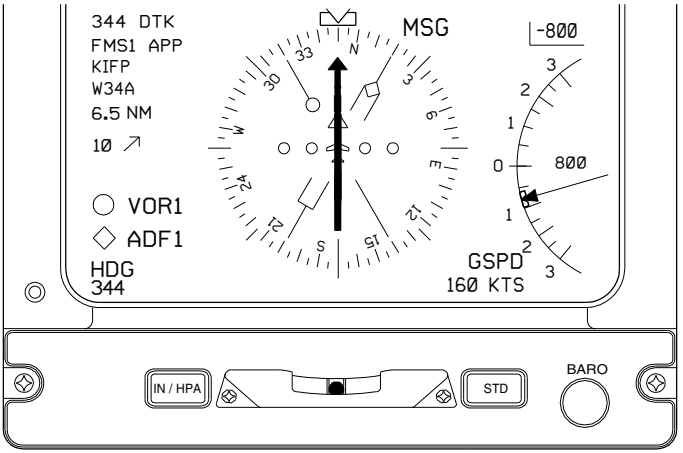
FINAL APPROACH SEGMENT (FAS) DATA BLOCK

The Airport Identifier, Approach Reference ID, and the distance to the Runway Threshold are displayed in magenta when LPV is active, and positioned below the FMS APP annunciation in the lower left portion of the PFD.

The Channel Identifier is not displayed on the PFD. It is only presented in the arrival page in the CDU.



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FAS APPROACH AND AIRPORT IDENTIFIER

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LPV UNAVAILABLE ANNUNCIATION

The LPV Approach Annunciator "LPV" is displayed in Amber on the PFD to indicate that the LPV approach is unavailable. When the LPV mode is unavailable, the annunciator turns Amber and flashes for 10 seconds and then remains steady. The Flight Director changes to basic mode (ROL and PIT).

If LPV status transitions to "Unavailable", the system displays the vertical deviation scale with a red-X, regardless of FMS vertical deviation data validity.

NOTE: Due to the system architecture, when the LPV becomes unavailable, the LPV amber indication and vertical deviation with Red-X may not be displayed (LPV indication is removed and Vertical deviation shows the Baro-VNAV linear deviations), however the flight director changes to basic mode.

If LPV is Unavailable on the Coupled PFD, AFCS disallows guidance panel selection of the APR or VNV buttons by the flight crew in order to prevent re-entry into VNAV.

When the "LPV" is unavailable, the flight crew needs to reload an approach with non-LPV minima. If already on approach, the flight crew needs to perform a missed approach.

It is possible to select the FMS1/GPS1 or FMS2/GPS2 as source for the Flight Director Guidance using the CPL pushbutton on the Guidance Controller Panel (GC-550). However, LPV indications will not be displayed if the navigation source is copied (FMS2 is selected on PFD1 or FMS1 is selected on PFD2).

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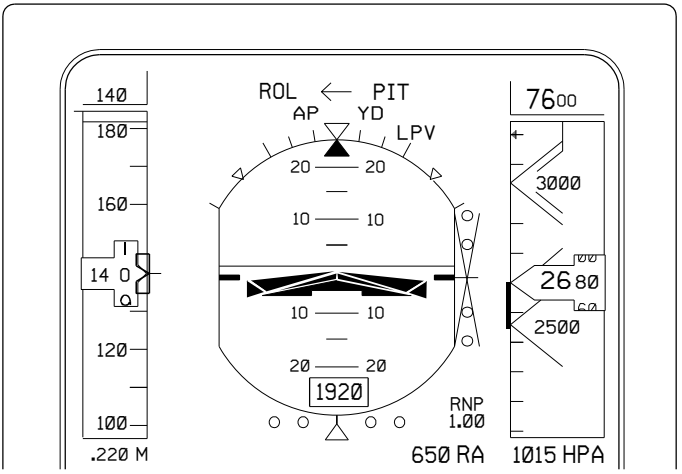

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LPV UNAVAILABLE ANNUNCIATION ON PFD

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LPV ALERTS AND ADVISORY MESSAGES

The following LPV Alerts/Advisory CDU scratchpad messages illuminate the "MSG" annunciator on the PFD. The conditions that generate the scratchpad messages are the following:

- **LPV UNAVAIL-USE LNV/VNV:** The LPV UNAVAIL-USE LNV/VNV message is displayed in white in the CDU scratchpad when:
  - The Approach Mode is "LPV Approach", and
  - All GPS are reporting SBAS invalid.

  The flight crew must select and use an approach with non-LPV minimum. If already on approach, perform a missed approach.

- **LPV UNAVAIL-LPV LOAD-1:** The LPV UNAVAIL-LPV LOAD-1 message is displayed in white in the CDU scratchpad when all the following conditions are met:
  - FAS data block message from FMS is not received by GPS (FAS data block transmission from FMS not successful).

  The flight crew must select and use an approach with non-LPV minimum. If already on approach, perform a missed approach.

- **LPV UNAVAIL-LPV LOAD-2:** The LPV UNAVAIL-LPV LOAD-2 message is displayed in white in the CDU scratchpad when either of the following conditions are met:
  - The SBAS Service Provider ID in the FAS Data Block does not match the SBAS Service Provider ID from the source selected GPS receiver, and
  - The Channel ID in the FAS Data Block does not match the Channel ID from the source selected GPS receiver.

  The flight crew may try to reload the approach a second time. If second try is not successful, select and use an approach with non-LPV minimum. If already on approach, perform a missed approach.

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MISSED APPROACH FOLLOWING AN LPV APPROACH

During an LPV approach, a missed approach is selected by pressing the GA button or selecting the missed approach prompt on the CDU.

The following takes place when a missed approach is initiated:

- The FMS becomes the source for lateral and vertical deviation indications,
- The LPV approach status display is removed and;
- The FAS data block is cleared from memory.

LPV INACTIVE STATUS

When an LPV approach is inactive, no "LPV" annunciation is displayed on the PFD. LPV inactive provides indication to the crew that the LPV approach is either not loaded (if an LPV approach was not selected on the CDU), or that the distance to destination for the loaded LPV approach is greater than 30 NM.

If, for any reason, the LPV is operationally not available or operationally not allowed to be used, the pilot will need to select RNAV MIN at Line Select Key (LSK) 2R, and then select a different type for the approach with non-LPV minima.

EGPWS MODE 5 ALERTING

An EGPWS Mode 5 alerting for the LPV Approach is also generated in case of an excessive downward vertical deviation within the mode 5 alerting window.

LPV MISCOMPARE MONITORS

The LPV system incorporate lateral and vertical deviation miscompare monitor that will check for miscomparisons between displayed deviation data on each PFD, where a miscompare results in an amber alert message on the PFD.

If either the LPV lateral deviation or the LPV vertical deviation miscompare monitor trip, the annunciation GPS in amber will be displayed in the same location as the existing LOC/GS/ILS indications on the PFD (for the localizer/glideslope comparison monitors).

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HEAD-UP GUIDANCE SYSTEM (HGS)

The HGS is an electronic and optical system that generates and displays information in the pilot's forward field of view. This displayed information is derived from the airplane's instruments and sensors. The system provides information during all flight phases, including low visibility takeoff, approach and landing in Category IIIa limits. For additional information on functions and operations, refer to the manufacturer's manual.

HGS symbology has been optimized for full flight routine use and provides speed, altitude, heading, navigation data, wind speed and direction, flight path and other information to the pilot, in symbolic format, that is superimposed on the pilot's view. The HGS also provides guidance cues for low-visibility takeoff and CAT IIIa approach and landing operations, reducing delayed takeoffs and/or landing diversions due to reduced visibility conditions.

The HGS provides the following display functions:

- Primary Flight Display (PFD), which is similar in form and function to the existing PFD on the airplane's main panel;
- Category IIIa approach display which provides HGS-calculated approach and flare guidance;
- Approach display that repeats the airplane Flight Director guidance during CAT I and CAT II approaches;
- Visual approach display for use during a VFR approach;
- Low-visibility takeoff display, with all the symbology required for this mode of operation;
- Test display available for Test Mode.

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The HGS interfaces with the following airplane systems and equipment:

- Inertial Reference System (IRS 1) for primary attitudes, heading, body acceleration, body rates, vertical speed and ground speed;
- Attitude and Heading Reference System (AHRS 2) or IRS 2 for comparison with IRS 1 data;
- One or two Global Positioning Systems (GPS) for ground speed and true track data;
- Two Air Data Computers (ADC) for barometric altitude and airspeed data;
- Two VHF/NAV receivers for ILS data plus a third (ILS 3) to serve as a monitor;
- Two Radar Altimeters (RA) for altitude above ground data and decision height selection;
- Flight Guidance System (FGS) for Flight Director command signals from the Honeywell PRIMUS 1000 system;
- FGS Control Panel for selected course, heading, airspeed, vertical speed and altitude settings;
- Distance Measurement Equipment (DME) for distance from station data;
- One or two Automatic Direction Finding (ADF) sensors for bearing to station;
- Traffic Alert and Collision Avoidance System (TCAS) for resolution advisory data;
- Ground Proximity Warning System (GPWS or EGPWS) for windshear and terrain warning data;
- One or two Flight Management Systems (FMS) for LNAV and VNAV data;
- Stall Protection Computer (SPC) for AOA data.

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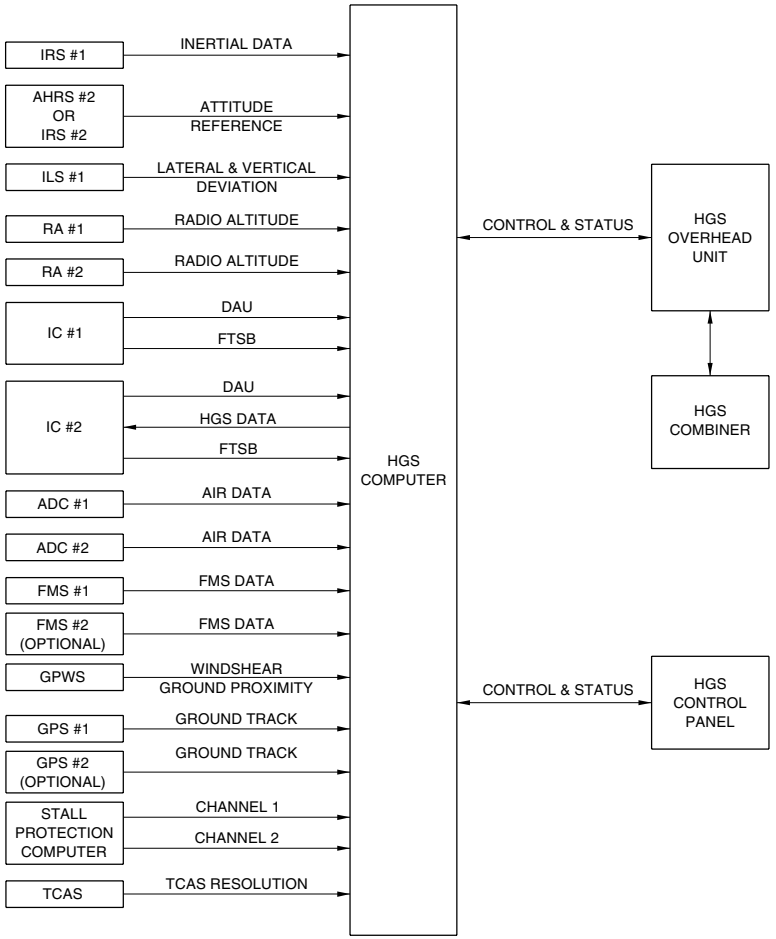

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HGS INTERFACES WITH OTHER SYSTEMS

HGS COMPONENTS

HGS COMPUTER

The HGS Computer receives input signals from other airplane sensors and generates a symbology set that is transmitted to the Overhead Unit. The displayed symbology depends on the selected mode of operation. During AIII mode approaches, the HGS Computer monitors the approach performance and displays appropriate messages to the pilot and on the Primary Flight Displays (PFD).

The HGS Computer is located in the forward avionics bay and is powered by the DC Bus 1.

HGS CONTROL PANEL (HCP)

The HCP is used for setting glideslope angle, runway length and elevation, and for selecting HGS active and standby modes of operation. It also provides an indication of the system's ability to provide Cat IIIa guidance.

Powered by the DC Bus 1, the HCP is located in the center pedestal and is available to both pilots.

Display luminescence is controlled automatically and based on existing ambient light. An ambient light sensor mounted on the front panel of the HCP measures the ambient light conditions and provides the necessary input to the internal circuits that control the display luminescence.

OVERHEAD UNIT (OHU)

The OHU generates flight symbology on a cathode ray tube (CRT) and optically projects the symbology onto the Combiner. The OHU is located above the pilot's head in a position that provides the proper spatial relationship in relation to the Combiner and the airframe. This relationship permits various symbols, such as the artificial horizon, to overlay the corresponding features of the outside scene.

The OHU is powered by the DC Bus 1.

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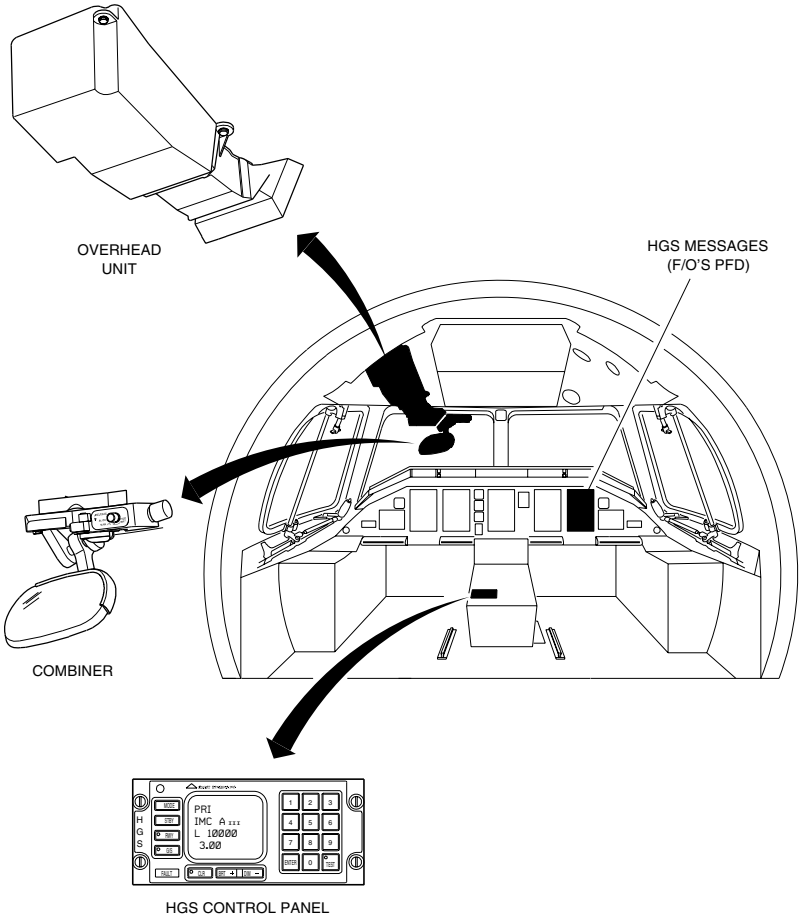

HGS CONTROL PANEL

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HGS COMPONENTS

COMBINER

The Combiner is a reflective optical element which visually combines displayed flight symbology with the pilot's view through the airplane windscreen by reflecting the symbology image projected from the OHU, permitting the system symbols to overlay the corresponding features of the outside world.

It is provided with the means to adjust symbology brightness and selecting a manual or automatic mode of brightness control. The Combiner is attached to upper sill beam structure of the left forward windscreen.

The Combiner has three positions: stowed, operating, and breakaway:

- Stowed: when the HGS is not in use, the Combiner may be stowed out of the pilot's field of view. To stow the Combiner, press the release lever, grasp the Combiner by the edges and rotate it aft and up to the stow position.
- Operating: when conducting HGS operations, the Combiner is placed in the detented operating position. Press the release lever and rotate the Combiner to the operating (detent) position.
- Breakaway: when in the operating position, the Combiner has a breakaway feature that allows the Combiner to rotate toward the windscreen if there is a sudden deceleration of the airplane. To move the Combiner from the breakaway position, press the release lever and pull the Combiner back to the operating or stow position.

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HGS MODES OF OPERATION

The HGS has four operational modes: Primary (PRI), Instrument Meteorological Conditions (IMC), Visual Meteorological Conditions (VMC) and AIII approach (used for CAT IIIa operations).

These modes can be selected at any time with the exception of AIII which is available only after ILS capture.

PRIMARY MODE

The HGS Primary (PRI) mode can be used during all flight phases, from takeoff to landing. This mode allows low-visibility takeoff operations, all enroute operations, and approaches to CAT I or II minimums using FGS Flight Director guidance.

The HGS Primary mode display is very similar to the Primary Flight Display (PFD) thus easing the Pilot's transition from flying under head-down instruments condition to head-up flying. The Primary mode display includes the following symbolic information:

- Airplane Reference (boresight) symbol;
- Pitch - scale and horizon relative to boresight;
- Roll - scale and horizon relative to boresight;
- Heading - horizon, HSI and digital heading display;
- Speeds - CAS (tape), vertical speed, ground speed, speed error tape;
- Altitudes - barometric altitude (tape), digital radio altitude;
- Flight Path (inertial);
- Flight Path acceleration;
- Slip/Skid Indicators;
- FGS Flight Director (F/D) guidance cue and modes;
- Flight Director armed and capture modes;
- Navigation data - ILS, VOR, DME, FMS, marker beacons;
- Wind - speed and direction;
- Selected parameters - course, heading, airspeed and altitude;
- Miscompare Annunciations and Failure Flags.

When the airplane is on the ground, several symbols are removed or replaced in order to provide guidance for the Low Visibility Takeoff. After takeoff rotation has been reached, the full, in-flight set of symbols is restored.

The Primary mode can be selected at the HCP or by pressing the throttle go-around button during any mode of operation.

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LOW-VISIBILITY TAKEOFF

The Primary mode includes special symbology used for a low-visibility guided takeoff that provides guidance information that supplements visual runway centerline tracking and enhances situational awareness.

The low-visibility takeoff display and Ground Roll Guidance Cue are automatically provided to the pilot once the following conditions have been established:

- Primary mode selected;
- IRS in NAV mode;
- All NAV receivers tuned to same ILS frequency;
- Runway length set between 6000 and 13500 ft;
- Selected heading bug set to runway heading;
- Selected course set to runway heading or approach course.

NOTE: Misleading/removal of the guidance is not annunciated. Safe operation in this condition was demonstrated and is predicated on the pilot's ability to see external visual references.

AIII MODE

The HGS AIII mode is designed for precision, manual ILS approach and landing operations to CAT IIIa minimums. Additionally, the AIII mode can be used for CAT II approaches.

During a Category IIIa approach, the HGS monitors its capability to provide accurate guidance and airplane deviation from the desired approach path. If this monitor indicates that the system is incapable to provide accurate guidance, it is removed from the display and a capability loss indication is annunciated. If the monitor indicates that the airplane is on an unacceptable approach path, the HGS displays a clear indication that a go-around should be performed.

The AIII display is de-cluttered by removing the altitude and airspeed tape displays and replacing with digital values in order to maximize visibility. The HSI is also removed, with raw ILS data (localizer and glideslope deviation) being displayed in proximity to the flight path group around the center of the display. In the AIII mode, guidance information is shown as a circular cue whose position is calculated by the HGS.

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Prior to an ILS capture, the ability of the HGS to calculate and display AIII approach guidance is indicated when "AIII" is displayed on the right half of the HCP Standby display line. This display indicates that the HGS' equipments and related sensors are operating normally and in the correct mode, with the flight deck configuration ready for the approach. The system conditions that must be met in order to achieve AIII capability include:

- IRS in NAV mode;
- AHRS 2 in Full Performance mode;

  NOTE: AHRS is not applicable in case of dual IRS installation.
- All reversion selections in NORMAL position;
- All NAV receivers tuned to same ILS frequency;
- Basic attitude (pitch, roll, heading) data from dual sources within defined limits;
- All sensors/input data valid and no HGS BIT faults present.
- Radio altitude greater than 500 ft;
- Glideslope set between -2.50° and -3.00°.

AIII mode becomes available for selection when the above listed conditions are satisfied and the Approach On Course (AOC) logic law is met. Approach On Course logic depends on the following conditions:

- Flight Director Lateral Capture Mode indicates LOC and FD Vertical Capture mode indicates GS;
- No Localizer and Glideslope deviation for a period of 5 seconds;
- Difference between IRS Magnetic Track and the Selected Course 1 less than 15°.

When AOC logic is satisfied and all required systems are operating properly, the HGS will automatically annunciate on the Combiner and HCP that the AIII mode is available for selection. This is indicated by "AIII" flashing on the Combiner in the upper left portion and an "AIII" displayed on the left half of the HCP Standby line.

The AIII mode must be selected before the airplane descends below 500 ft above the runway elevation. If not selected, the "AIII" indication will be reverted to "IMC". The flashing "AIII" on the Combiner will disappear.

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Once AIII mode is active, any sensor or equipment condition that results in a loss of AIII capability causes a boxed "NO AIII" status to flash for five seconds on the Combiner and on the HCP MODE line. An amber “AIII” indication is displayed on the F/O’s PFD.

If either the AIII capability is lost ("NO AIII" status) or the airplane approach or flare performance does not ensure a safe touchdown within the required touchdown zone, the HGS provides an "APCH WARN" (Approach Warning) annunciation on the Combiner and a red “APCH WARN” indication on the F/O's PFD. An approach out-of-tolerance condition by itself will result in the "APCH WARN" annunciations, but will not cause the loss of AIII status. If a "APCH WARN" annunciation is displayed in low-visibility conditions, a missed approach procedure must be performed.

Flare initiation is indicated with the FLARE annunciation on the Combiner display and on the F/O’s PFD. The flare maneuver is designed to transition the airplane from approach attitude to touchdown attitude while maintaining positioning and performance requirements that meet touchdown criteria for CAT IIIa landings. This includes continuing to track the runway localizer and establishing an acceptable touchdown sink rate while refraining from long landings. In order to reduce the longitudinal touchdown distance, an “IDLE” annunciation is displayed on the Combiner while the F/O’s PFD alerts the crew to adjust thrust settings.

Following touchdown, the display changes to remove unnecessary symbology in order to assist the landing rollout. This includes changing the localizer symbol to the Ground Localizer Scale and Index. The centerline is tracked while the airplane is decelerated to exit the runway.

IMC MODE

The IMC mode allows FGS Flight Director approaches to be flown in the same approach display format as the HGS AIII approach mode. Altitude and airspeed data are displayed as digital values and raw navigation data is displayed in close proximity to the Flight Path group.

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For an IMC approach, the display information is the same as in the AIII mode except:

- The guidance cue is derived from the FGS and is removed from the display at 90 feet Radio Altitude (CAT II) or 150 feet AGL (CAT I);
- Flight director modes are displayed;
- The IMC mode is annunciated;
- No approach monitoring or flare guidance is provided by the HGS. However, flare cues (" + + ") are displayed to alert the pilot.

The IMC mode may be used during any conventional Flight Director approach that is approved for the basic airplane or the operator's Operations Specification (e.g., a CAT I Flight Director ILS approach).

The IMC mode is an alternate approach mode primarily intended for autopilot flight director approaches. Flight director guidance is displayed in IMC mode as long as the flight director pitch and roll commands are valid.

Once on the ground, the Ground Localizer Scale and Index is displayed as in the Primary mode.

VMC MODE

The VMC mode is intended for visual approach operations. No guidance is displayed in this mode. The VMC mode is intended to enhance the visual approach operation by allowing the pilot to establish and maintain the airplane on the proper glide path to the runway without reference to a ground based landing system (ILS, VASI, etc.). In a VMC mode approach, Flight Path is used to control the approach to the runway visually. This is particularly beneficial during nighttime approaches or approaches with poor visual cues.

The VMC mode provides approach symbology in the same format as the AIII and IMC modes, however, navigation data is not displayed.

Flare and landing in the VMC mode is accomplished by using normal visual procedures. Between 55 feet and 10 feet, the flare cue symbols " + " are displayed above the Flight Path symbol wings.

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COMBINER ALIGNMENT

During an IMC or VMC approach, it is expected that the final approach will be completed visually. The proper mechanical alignment of the Combiner is critical during visual operations. The Combiner's operating position is monitored by a Combiner Alignment Detector (CAD) to determine if the Combiner is within allowable position tolerances while in the IMC or VMC mode. If its position is outside specified tolerances, an "ALIGN HUD" annunciation is displayed on the Combiner. For Combiner alignment, push it forward slightly out of the operating position and allow the Combiner to return to its position. Alternatively, apply slight pressure either fore or aft on the Combiner until the annunciation is removed.

UNUSUAL ATTITUDE

The HGS Unusual Attitude display is designed to aid the pilot in recognition of and recovery from unusual attitude situations. The Unusual Attitude (UA) symbology is automatically activated or deactivated based upon the attitude of the airplane. When activated, the UA display replaces the currently selected operation mode symbology. The UA display is not annunciated on the HCP, that continues to display the currently selected operational mode which will be re-activated once the airplane is returned to a normal attitude.

The UA symbology is automatically activated under any of the following conditions.

- The FGS changes to the unusual attitude display mode;
- Pitch angle less than -20º or greater than +30º;
- Roll angle less than -65º or greater than +65º.

TCAS RESOLUTION ADVISORY

TCAS Resolution Advisories (RA) alert the pilot regarding conflicting air traffic by indicating a potential threat (Preventive Advisory) or threats that require a vertical evasive maneuver (Corrective Advisory) in order to maintain safe vertical separation. The HGS provides TCAS Resolution Advisories from the TCAS computer that correspond with the indications displayed on the head down Traffic Advisory/Vertical Speed Indicator (TA/VSI).

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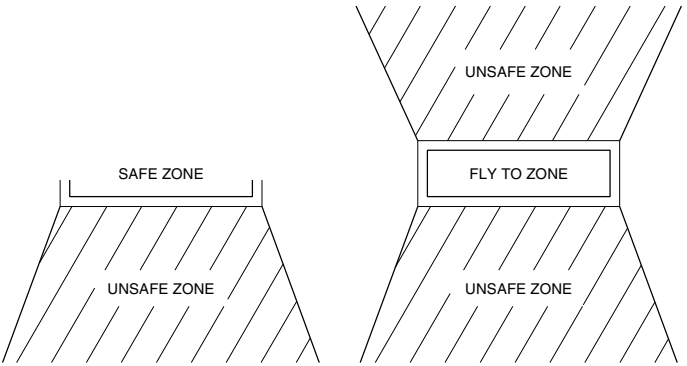
TCAS Resolution Advisory symbols are added to the symbology set defined by the HGS active mode. A double-line bracket or box, laterally aligned with the Flight Path symbol, identifies the safe (fly to) zone. Angled lines extending from the corners of the unsafe side of the bracket or box identify the unsafe zone. Whenever the airplane flight path is in an unsafe zone, the angled lines flash on and off until the Flight Path is positioned within the safe zone.

Preventive Advisories are displayed on the HGS as a double-line bracket with two angled lines extending from the corners on the unsafe side of the bracket. The Preventive Advisories do not require any action be taken by the crew to alter the flight path of the airplane, but indicate an unsafe zone.

Corrective Advisories are displayed on the HGS as a double-line box and require as immediate vertical evasive maneuver. The advisory command is to climb or descend until the Flight Path is positioned within the box (fly to zone) or remains on the safe side of the box.



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TCAS SAFE/UNSAFE ZONES

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HGS EICAS MESSAGES

TYPE	MESSAGE	MEANING
CAUTION	HGS FAIL	Failure in the HGS system.
ADVISORY	AIII NOT AVAIL	The AIII approach mode is not available.

HGS CAPABILITY TEST

This test verifies the HGS capability to perform the AIII mode.

To execute this test, press the TEST button on the HCP and select the first option “HGS CAPABILITY” in the HGS TEST MENU displayed on the Combiner. In case of no AIII capability detected, the faults will be displayed on the Combiner.

If the system is capable of performing the AIII mode, “AIII” is displayed on the left side of the Combiner while “NO CAPABILITY FAULTS DETECTED” is displayed on the right side.

HGS CONTROLS AND INDICATORS

HGS CONTROL PANEL (HCP)

1 - NUMERICAL KEYPAD

- Used to enter runway (length, elevation) and glideslope data.

2 - DISPLAY SCREEN

- Displays, from the top to bottom:
  - The active HGS (PRI, IMC, VMC or AIII) mode.
  - The selected standby mode.
  - The selected runway length or elevation.
  - The selected angle for approach.

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3 - AMBIENT LIGHT SENSOR

- Senses the lighting conditions around the control panel and maintains the display screen intensity set by the BRT+ and DIM- keys.

4 - HGS OPERATIONS MODE SELECTOR BUTTON

- Selects the mode of operation shown on the standby display line as the active mode.

5 - STANDBY MODE SELECTOR BUTTON

- Shows available modes.

6 - RUNWAY DATA ENTRY SELECTOR BUTTON

- Activates Runway Data Entry mode to enter the runway elevation or length.

7 - GLIDESLOPE DATA ENTRY SELECTOR BUTTON

- Activates the Glideslope Data Entry mode to enter the glideslope angle.

8 - FAULT ANNUNCIATOR LAMP

- Indicates a fault in the critical processing path detected by the HGS' built-in test (BIT) function.

9 - CLEAR FUNCTION SELECTOR BUTTON

- Press to clear symbology from Combiner display. Press again to display symbology. During data entry, button is used as backspace and in the TEST mode, used to navigate the displayed menus.

10 - DISPLAY SCREEN INTENSITY CONTROLS

- The BRT+ button increases display intensity and the DIM- button decreases intensity.

11 - ENTER BUTTON

- Used to enter desired runway and glideslope values. In TEST mode, selects items in the Test Menu.

12 - HGS TEST BUTTON

- With the airplane on the ground, starts or stops HGS test functions and displays.

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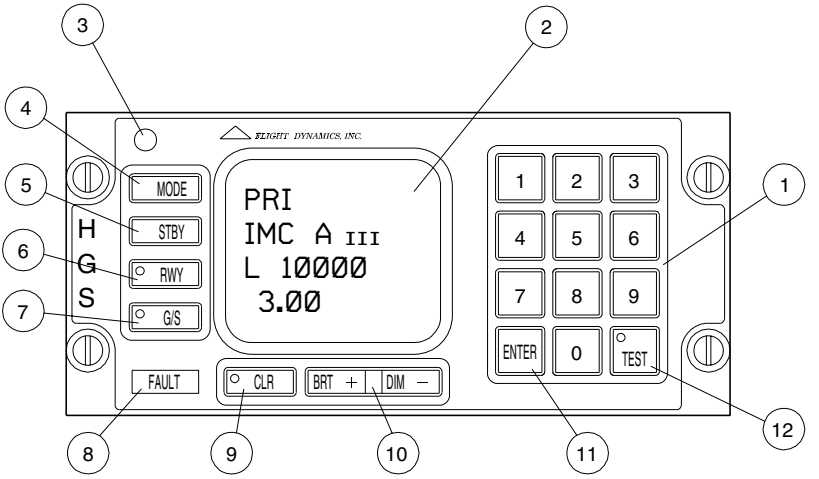

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HGS CONTROL PANEL (HCP)

COMBINER

1 - BRIGHTNESS CONTROL KNOB

- Press the knob in to select MANUAL brightness mode.
  - Rotating the knob clockwise increases display intensity. Rotating counterclockwise decreases display intensity. In this mode the intensity remains constant at the level selected by the pilot.
- Pull the knob out to select AUTOMATIC brightness mode.
  - The pilot adjusts display to desired brightness level as described above and OHU automatically changes it to maintain a constant contrast ratio.

2 - RELEASE LEVER

- Press the Release Lever to unstow Combiner.

3 - AMBIENT LIGHT SENSOR

- Monitors the external lighting conditions to the Automatic Brightness Control.

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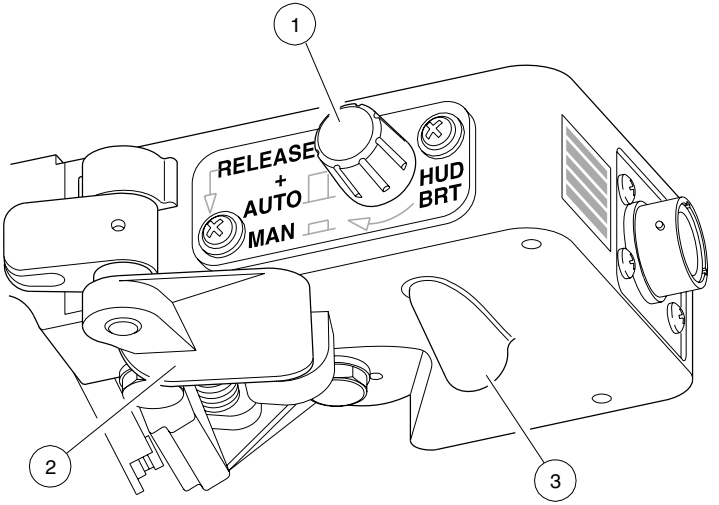

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COMBINER CONTROLS AND SENSORS

FAULTS AND ANNUNCIATIONS

Failure Flags are displayed for invalid sensor statuses and miscompares between certain similar parameters. These are generally indicated by boxed annunciations for the affected parameters, and in the case of a failure, the removal of all symbols related to the fault.

Flags are provided for the following failures, miscompares or alternate data sources:

NOTE: For dual IRS system configuration, the AHRS2 references below would be replaced by IRS2.

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ADC1 (2) - Indicates the selected ADC source. “ADC1” indicates that ADC1 is selected as both Pilot’s and Copilot’s ADC source. “ADC2” indicates that ADC2 is selected as the Pilot’s ADC source. Positioned in upper left portion of the display.

ALT - **Horizontal Indication**. Indicates Barometric Altitude failure. Indicated by boxed characters replacing the Altitude Scale in Primary Mode, and replacement of Digital Altitude readout in digital modes.

ALT - **Vertical Indication**. Indicates Barometric Altitude miscompare. Indicated by boxed characters vertically positioned at the upper right portion of the altitude scale in Primary Mode. In all other modes, boxed “ALT” is vertically positioned at the right side of the display.

ATT/ROL/PIT - Indicates IRS / AHRS2 Pitch or Roll miscompare, or a AHRS1 / AHRS2 Attitude miscompare. Indicated by boxed “PIT”, “ROL”, or “ATT” characters respectively, beneath the left side of the roll scale.

ATT FAIL - Indicates IRS Pitch or Roll (Attitude) failure or AHRS2 Pitch/Roll failure. Indicated by boxed characters on the upper portion of the display.

FD FAIL - Indicates Flight Director failure. Positioned in the top center portion of the display.

G/S - Indicates Glideslope Deviation failure. Indicated by boxed characters vertically aligned, replacing the Vertical Deviation Scale and Index.

GS - Indicates Glideslope miscompare. Indicated by boxed characters to the right of the display center.

HDG - Indicates IRS / AHRS2 Heading miscompare or AHRS1 / AHRS2 Heading miscompare. Indicated by boxed characters in the lower left portion of the display.

HDG FAIL - Indicates IRS Heading failure or AHRS2 Heading failure. Indicated by boxed characters in the lower center portion of the display. In Primary mode, this flag is positioned in the center of the HSI.

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IAS - **Horizontal Indication**. Indicates Computed Airspeed failure. Indicated by boxed characters replacing the Airspeed Scale in Primary Mode, and replacing the Digital Airspeed in digital modes.

IAS - **Vertical Indication**. Indicates Computer Airspeed miscompare. Indicated by boxed characters vertically positioned at the top left portion of the airspeed scale in Primary Mode. In all other modes, boxed “IAS” is vertically positioned at the left side of the display.

LOC/FMS/VOR - Indicates Lateral Deviation failure. Indicated by boxed characters “LOC”, “FMS”, or “VOR”, corresponding to the selected navigation source, in the lower center of the display.

LOC COMP - Indicates Ground Roll Localizer miscompare, during a low-visibility takeoff. Indicated by boxed characters and removal of the ground localizer pointer.

LOC/ILS - Indicates Localizer miscompare. Indicated by boxed characters in the lower left portion of the display.

RA - **Center**. Indicates all Radio Altitude failure.

RA - **Lower Left Portion**. Indicates Radio Altitude miscompare. Indicated by boxed characters in the lower left portion of the display.

RA1 - Radio Altitude source is RA1 and RA2 is failed. Indicated by boxed characters in the lower left portion of the display.

RA2 - Radio Altitude source is RA2 and RA1 is failed. Indicated by boxed characters in the lower left portion of the display.

RWY LEN - Indicates Runway Length Out of Range. Indicated by boxed characters displayed beneath the Runway Length for five seconds.

SG1 (2) - Indicates the Symbol Generator Source selected. “SG1” indicates that SG1 is selected as both Pilot’s and Copilot’s SG source. “SG2” indicates that SG2 is selected as the Pilot’s SG source. Positioned in upper left portion of the display.

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TCAS FAIL - Indicates TCAS failure. Indicated by boxed characters displayed in the lower center portion of the display.

NOTE: In case the operating Transponder fails, the "TCAS FAIL" flag will not be displayed on the Combiner.

VNAV - Indicates Vertical Deviation failure. Indicated by boxed characters "VNAV" (Vertical Navigation) replacing the vertical deviation scale.

VS - Indicates Vertical Speed failure. Indicated by boxed characters replacing the Vertical Speed Data.

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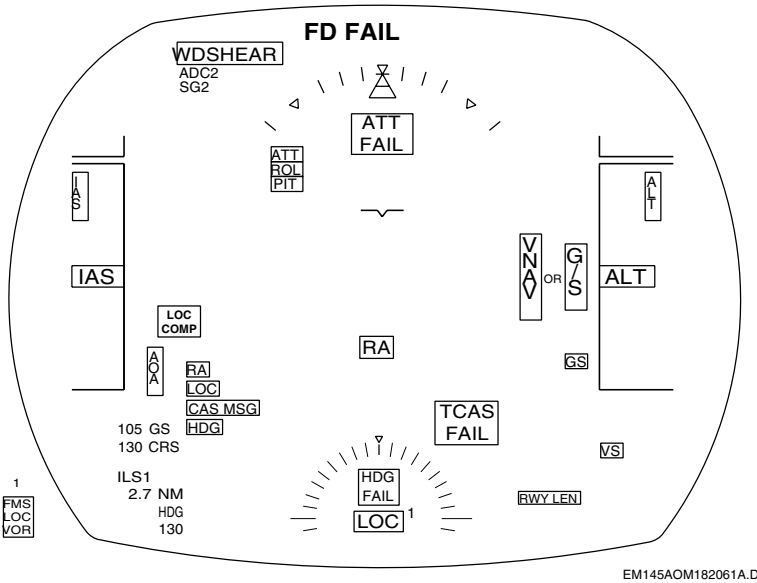

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FAILURE FLAGS AND DATA MISCOMPARE INDICATIONS

IDENTIFICATION FRIEND OR FOE SYSTEM (IFF)

The Mode-S/IFF Transponder System integrates military IFF functions and civilian Mode-S/ATCRBS surveillance functions into a single system.

The IFF system is a cooperative surveillance system designed to classify airborne targets as friendly or hostile. It employs ground-based and airborne interrogations and transponders.

A key feature of the Mode-S system that distinguishes it from ATCRBS is that each airplane is assigned a unique address code. Using this unique code, interrogations can be directed to a particular airplane and replies can be positively identified. Channel interference is minimized because a sensor can limit its interrogations to targets of interests. By proper timing of interrogations, replies from closely spaced airplane can be received without mutual interference.

The Mode-S/IFF Transponder System consists of the following major components: one Mode-S transponder, one Mode-S/IFF transponder, Mode-S/IFF control panel, one selector panel and top and bottom antennas.

The transponder is capable of receiving/transmitting signals through any one antenna, thus inhibiting the shadow effect caused by the airplane structure while maneuvering. The reply signal provides an identity, an altitude, an identification position, or an emergency message. The Mode-S/IFF transponder operates in Mode 1, 2, 3/A, C and S, the system receiving interrogations on 1030 MHz and transmitting on 1090 MHz.

Avionics Master DC Bus 2A powers the Mode S/IFF transponder and there is a 7.5 A circuit breaker for power wiring protection. The Mode-S/IFF Transponder System will not operate in the event of either a failure in the control panel or in the event of an electrical/generator failure.

The transponder reply-transmit capability is disabled when the system is in STANDBY mode. The Weight-On-Wheels (WOW) circuitry disables the ATCRBS' transponder reply capability while the airplane is on the ground. However, the air/ground switch does not disable Mode-S transponder replies and airplane status is included in the Mode-S/IFF transponder reply data.

For airplanes Post-Mod. SB 145-34-0089 or SB 145BAF-34-0006 or equipped with an equivalent modification factory incorporated, the Mode S Elementary Surveillance Transponder transmits the following parameters:

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- Airplane Identification (Call Sign);
- Transponder Capability Report;
- Flight Status (airborne/on the ground);
- Pressure Altitude (minimum resolution: 100 ft (Gillham's code) or 25 ft as provided by the source).

This facilitates an increase in the safety and efficiency of the ATM (Air Traffic Management) operations.

For airplanes equipped with Mode S Enhanced Surveillance Transponder (Post-Mod. SB 145-34-0096 or Post-Mod. SB 145BAF-34-0007 or equipped with an equivalent modification factory incorporated), in addition to the characteristics of the Mode S Elementary, the following Downlink Airplane Parameters (DAP) are transmitted automatically to be used by the ground Air Traffic Management:

- Magnetic Heading;
- Indicated Airspeed and/or Mach Number;
- Vertical Rate;
- Roll Angle;
- True Airspeed;
- True Track Angle;
- Ground Speed;
- Selected Altitude.

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SELECTOR PANEL

The selector panel, on the main control panel, provides the means for the flight crew to select either the Mode-S on transponder 1 or the Mode-S/IFF transponder, according to mission requirements at that particular moment.

The Mode-S/IFF transponder will be used normally in the mission area.

1 - IFF POSITION

Selects the Mode-S/IFF transponder. All indications on the RMU pages are related to the transponder 1 system and TCAS functions will be dashed. In this case all TCAS II operations is made through the Mode-S/IFF control panel.

2 - XPDR POSITION

Selects the Mode S transponder. Both Mode-S/IFF transponder unit and Mode-S/IFF control panel are turned off.

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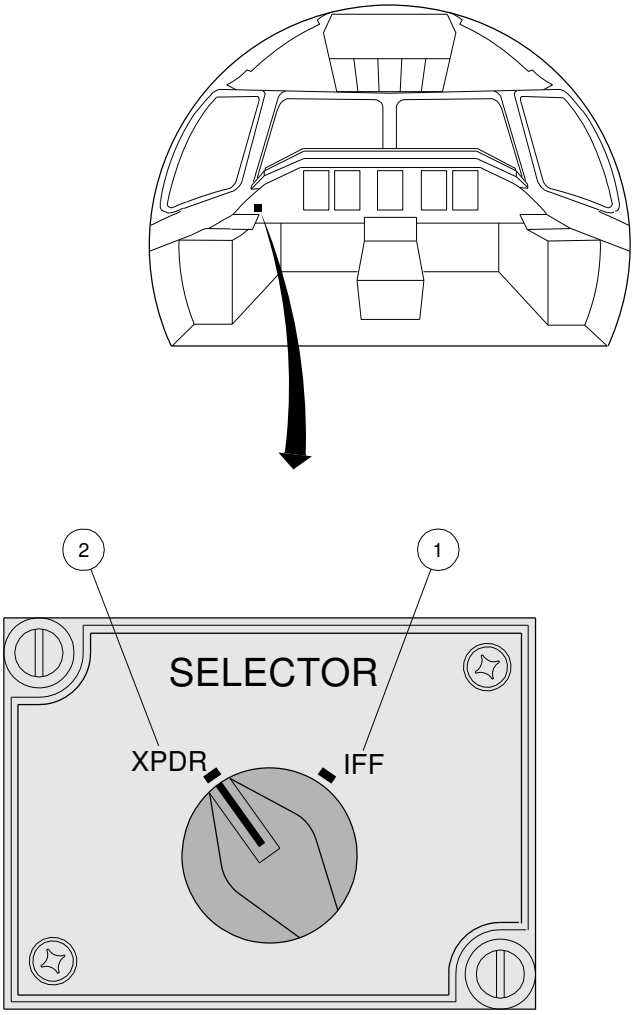

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TRANSPONDER SELECTOR KNOB

IFF TRANSPONDER CONTROLS AND INDICATORS

The Mode-S/IFF control panel is located on the control pedestal and allows the selection of the Mode-S/IFF transponder operation modes (Off, Standby, Normal and Emergency), selection of interrogation and reply modes (1, 2, 3/A, C and S), and selection of codes.

1 - DISPLAY SELECT ROTARY KNOB

The Mode-S/IFF control panel has a six position rotary knob to select the different display modes.

MODE 1: Selecting “1” with the DPL SEL knob enables Mode 1 display and keypad entry mode.

MODE 2: Selecting “2” with the DPL SEL knob enables Mode 2 display and keypad entry mode.

MODE 3/A: Selecting “3A” with the DPL SEL knob enables the Mode 3/A display and keypad entry mode.

MODE S: Selecting “S” with the DPL SEL knob enables the Mode S display and keypad entry mode.

FLIGHT ID: Selecting “FLT ID” with the DPL SEL knob enables FLIGHT ID display and keypad entry mode.

The Mode-S Airplane Identification Subfield (AIS) allows the operator to select the airplane Flight ID to be downlinked as part of Downlink Format (DF) message 20 and 21 from the control panel. The Mode S Flight ID is typically the airplane flight number or airplane registration number.

STAT: Messages from the transponder are displayed on the LCD only if the STAT position in the DPL SEL knob is selected. Transponder messages have he lowest priority after transponder failure indications. When a new transponder message is received by the control panel, the “GO” annunciator illuminates.

2 - ALPHA-NUMERIC CHARACTER LCD

The Mode-S/IFF control panel has an eight alphanumeric character, liquid crystal display. The display has white characters on a black background.

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3 - GO ANNUNCIATOR

The Mode-S/IFF control panel has a dead front green light GO annunciator to indicate no failures in the system or to indicate a new transponder message has been received by the control panel.

4 - NO-GO ANNUNCIATOR

The Mode-S/IFF control panel has a dead front amber light NO-GO warning annunciator to indicate system failure.

5 - TEST BUTTON

The TCAS/IFF control panel is provided with a momentary push-button test to activate the System Functional Test.

The Mode-S/IFF Transponder System test may be accomplished with the Mode/TCAS rotary knob in the TA or TA/RA position and pressing the TEST push button. In addition, the TCAS is tested when the test is performed.

Pressing the TEST push button the Mode-S/IFF control panel starts a lamp test, turning all front panel's LCD indicators segments on. Additionally, a control panel self-test is performed when the TEST push button is pressed for more than five seconds.

6 - MASTER CONTROL KNOB

The Master Control knob has OFF, STBY, NORM, and EMER positions. A mechanical interlock prevents inadvertent switching to either EMER or OFF positions.

OFF: In the OFF position all primary power supplies are removed from the system, except control and lighting circuits.

STANDBY: In the STBY position the system disables the transponder reply transmit (Modes 1, 2, 3/A, C, and S). STBY is typically engaged on the ground to prevent unnecessary RF traffic. It is disengaged just prior to takeoff and engaged again upon landing.

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NORMAL: The NORM position enables the transponder to respond to all proper modes (1, 2, 3/A, C, and S), as well as TCAS TA and TA/RA interrogations, if selected.

EMERGENCY: The EMER position enables transponder modes 1, 2, 3/A, and S to reply with an emergency code automatically, irrespective of settings of the MODE/TCAS rotary knob. Modes 1, 2, and 3/A automatically respond with a military emergency. Mode 3/A replies is changed to code 7700.

7 - MODE/TCAS ROTARY KNOB

The MODE/TCAS rotary knob has six positions (OFF, 3A, C, S, TA, and TA/RA) that enables the different modes of operation and allows for selection of TCAS functions.

OFF: Disables the Modes 3/A, C and S.

MODE 3/A: When Mode 3/A is enabled, replies to Mode 3/A interrogations and Mode C framing pulses are enabled.

Mode 3/A control is provided for pilot or operator selection of 4096 response codes. Code selection range is 0000 to 7777, inclusive. When the EMER mode is enabled, the Mode 3/A military emergency code 7700 shall be displayed. The Mode 3/A code remains at 7700 as long as the Master Control knob is in EMER position.

MODE C: When Mode C is enabled, the system replies to valid Mode C interrogations. The mode C control disables or enables the Air Data Source input to the transponder.

MODE S: This control function enables/disables Mode S operation. When mode S is enabled, the system replies to valid ATCRBS/Mode S All-call and mode S interrogations.

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TCAS TA: This TCAS control function enables TA operation only. The TA ONLY Mode-S enables the TCAS computer, in conjunction with the Mode S/IFF transponder, to provide traffic advisories. The TA Mode is electrically tied to the Mode S enable (ON) mode. The system automatically selects this mode when the airplane is flying under 1000 feet above ground level.

TCAS TA/RA: The TCAS TA/RA Mode S enables the TCAS computer, in conjunction with the mode-S/IFF transponder, to provide traffic and resolution advisories. TA/RA is electrically tied to the Mode S enable (ON) mode. This is the normal operation mode, supplying full TCAS coverage.

8 - CODE ENTRY KEYPAD

There are 12 push-button keys in the keypad.

9 - TCAS HORIZONTAL RANGE ROTARY KNOB

The TCAS range control allows the pilot to select traffic advisory horizontal display range in nautical miles. This control function gives the pilot the option of selecting four possible ranges: 6, 12, 20, 40 NM.

10 - TCAS VERTICAL RANGE ROTARY KNOB

This knob provides the operator with the capability to select an altitude range, in relation to the airplane, for traffic display on the MFD.

ABV Mode: Range limits are 9900 ft above and 2700 ft below airplane.

BLW Mode: Range limits are 9900 ft below and 2700 ft above airplane.

NORM Mode: The display range is 2700 ft above and below the airplane.

NOTE: If the TCAS does not receive the altitude limit information from the transponder, the default altitude limit presented will be 7000 ft instead of 9900 ft.

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11 - IDENT MIC/OFF SWITCH

The Mode-S/IFF control panel has a two-position locking lever toggle switch. The control provides the means to activate Ident function remotely by keying the operator's microphone (MIC position) or pressing the front panel IDNT push-button switch (OFF position).

12 - IDNT PUSH-BUTTON

A control panel function is supplied for enabling Identification of Position (I/P) operation, either directly by the operator or remotely by keying the operator's microphone. Momentarily pressing the IDNT button control causes the ATCRBS reply and/or Mode S Uplink (UF)-4 and UF-5 replies to contain a Special Position Identifier (SPI) as an identifier to the ground. The SPI supplies the ground station with more positive identification of airplane position. This is typically activated upon verbal command of the Air Traffic Controller. The IDNT control is a momentarily activated button to inhibit continuous selection. When pressure is removed from the momentary button, the IDNT control returns to the OFF position.

13 - LOAD PUSH-BUTTON

The LOAD push-button is used to transmit a completed code display on the LCD.

14 - MODE 1/2 ROTARY KNOB

OFF: Disables Modes 1 and 2.

MODE 1: Enables Mode 1 operation. Mode 1 control is provided for pilot or operator selection of 32 response codes. Code selection range is 00 to 73, inclusive.

MODE 2: Enables Mode 2 operation. Mode 2 control is provided for pilot or operator selection of 4096 response codes. Code selection range is 0000 to 7777, inclusive.

MODE 1+2: Enables Modes 1 and 2 operation.

15 - MODE 4 CONTROL SWITCHES AND KNOB

The Mode 4 operation controls are disabled for this airplane.

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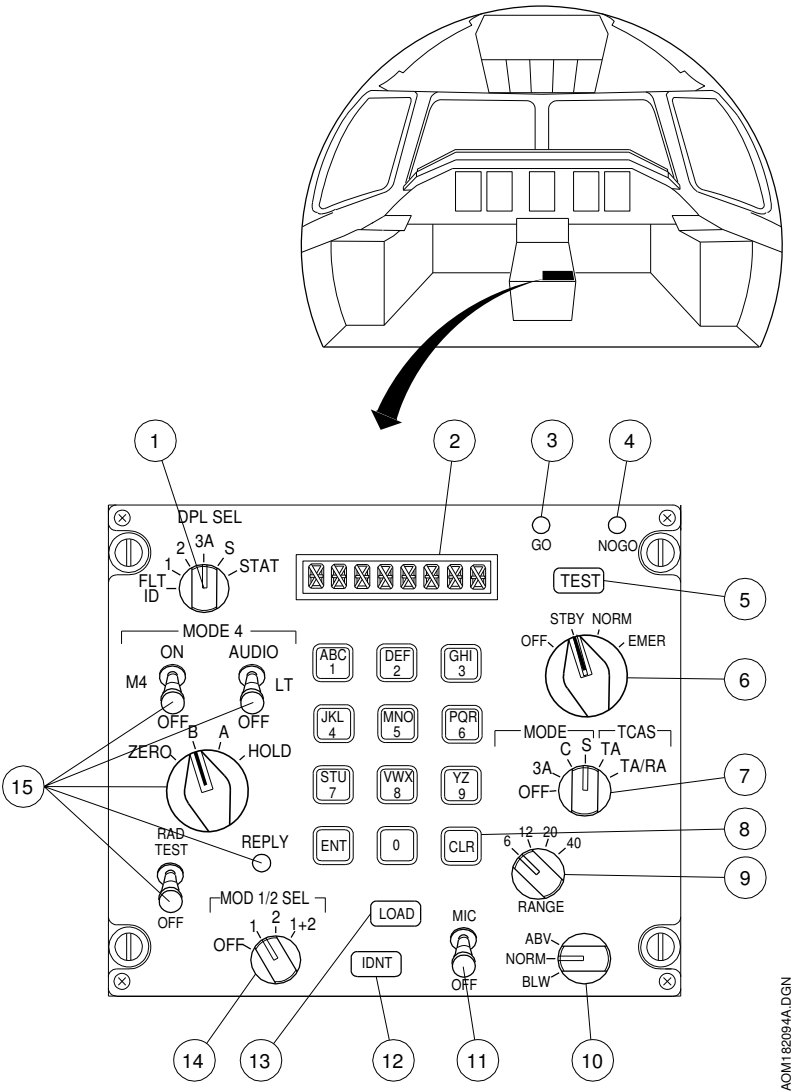

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MODE S/IFF TRANSPONDER CONTROL PANEL

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AUTOMATIC DEPENDENT SURVEILLANCE - BROADCAST (ADS-B) OUT

INTRODUCTION

NOTE: ADS-B OUT information is applicable only to airplanes Post-Mod. SB 145-34-0118 or Post-Mod. SB 145DGR-34-0002 or equipped with an equivalent modification factory incorporated.

The use of ADS-B Out provides accurate information and frequent updates to airspace users and controllers. It supports improved use of airspace, reduced ceiling restrictions, visibility restrictions, improved surface surveillance, and enhanced safety through the conflict management.

ADS-B Out is a function of the transponder that allows broadcast of information provided by the following sources:

- ADC: Airspeed, Barometric Pressure Setting and Altitude, Vertical Rate;
- GPS: Latitude, Longitude, East and North Velocity, GNSS Altitude and Track angle (Compliant with TSO-C145 and TSO-C146);
- IC-600: Selected Altitude;
- IRS: Magnetic Heading;
- TCAS: Active Resolution Advisories, Multiple Threat Encounter, TCAS Operational Status, Threat Identity Data (Altitude, Bearing, Range and Identifier);
- RMU: Call Sign/Flight ID, Emergency Code, Surveillance Status;
- Strap Module: Emitter Category, ICAO address, Aircraft Length and Width;
- Transponder: Navigation Accuracy Category (Position and Velocity), Altitude and Vertical Rate Sources, Airspeed Type (IAS or TAS), Track Angle or Heading, TCAS Resolution Advisory Active.

The ADS-B Out is automatically active whenever the transponder is not in standby mode or not failed.

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The ADS-B Out functionality does not change the existing transponder functions, such as Mode A/C, Mode S, Mode S Elementary Surveillance, and Mode S Enhanced Surveillance. The flight crew interfaces with the transponder remain unchanged with the addition of ADS-B Out function.

The ADS-B OUT function may be degraded or unavailable in case of GPS outages, GPS fail or transponder fail. The RMU ATC/TCAS CONTROL page and MAIN TUNING page provide the ADS-B OUT function status.

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CONTROLS AND INDICATORS

RMU ATC/TCAS CONTROL PAGE

1 - ADS-B STATUS

- NORMAL (white): GPS data is received on the active transponder.
- FAIL (yellow): No GPS data is received on the active transponder.
- DEGRADED(yellow): GPS navigation integrity or accuracy parameters do not meet ADS-B standards, as recognized by the active transponder.

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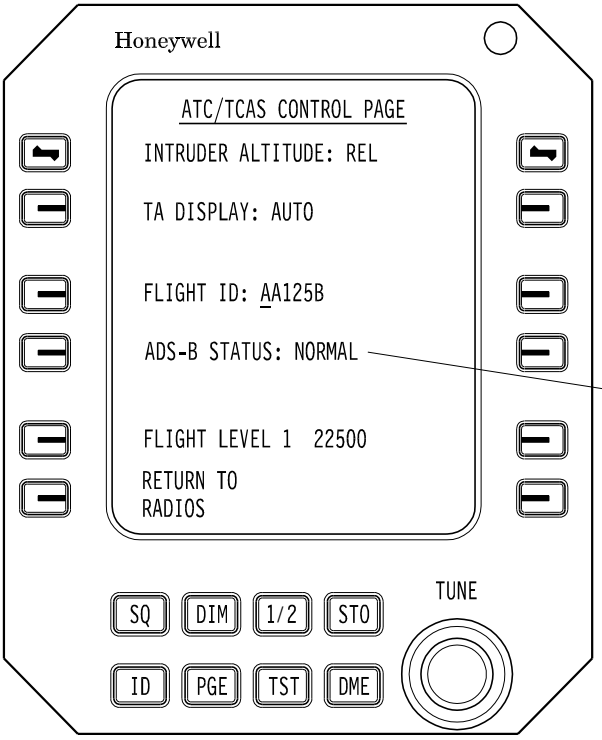

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RMU ATC/TCAS CONTROL PAGE

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RMU RADIO PAGE - ATC/TCAS WINDOW

1 - ADS-B STATUS

- ATC ERR (yellow): Annunciation of transponder squitter failure, which indicates that it has an impaired or failed Mode S ability to function in an airborne TCAS.
- ADS-B FAIL (yellow): No GPS data is received on the active transponder.
- ADS-B DGR (yellow): GPS navigation integrity or accuracy parameters do not meet ADS-B standards, as recognized by the active transponder.

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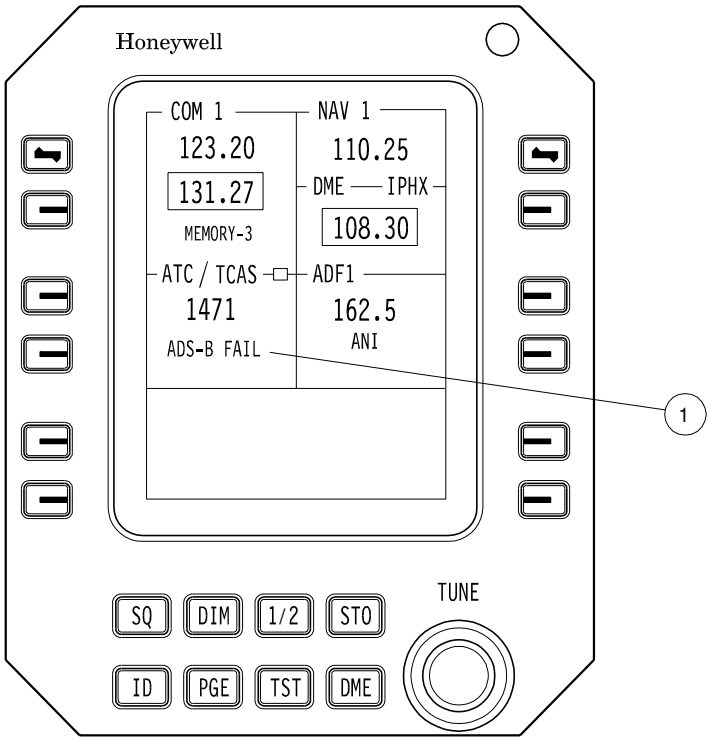

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RMU RADIO PAGE

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SECTION 2-19

AUTOPILOT

	Block	Page
General	2-19-05	01
Automatic Flight Control System	2-19-05	02
Flight Guidance System	2-19-05	04
Flight Director	2-19-05	04
Autopilot	2-19-05	04
Flight Director Modes	2-19-10	01
Lateral Modes	2-19-10	01
Heading Hold Mode	2-19-10	01
Heading Select Mode (HDG)	2-19-10	02
VOR NAV Mode (VOR)	2-19-10	03
VOR Approach Mode (VAPP)	2-19-10	04
Localizer Mode (LOC/BC)	2-19-10	04
LNAV Mode	2-19-10	05
Vertical Modes	2-19-10	06
Pitch Hold Mode	2-19-10	06
Altitude Hold Mode (ALT)	2-19-10	06
Altitude Preselect Mode (ASEL)	2-19-10	07
Flight Level Change Mode (FLC)	2-19-10	07
Speed Hold Mode (SPD)	2-19-10	11
Vertical Speed Hold Mode (VS)	2-19-10	12
Glide Slope Mode (GS)	2-19-10	13
Go Around Mode	2-19-10	13
Windshear Escape Guidance Mode	2-19-10	15
Autopilot Disengagement	2-19-10	16
EICAS Messages	2-19-15	01
Controls and Indicators	2-19-15	01
Flight Guidance Controller	2-19-15	01
Pitch and Turn Controller	2-19-15	05
Control Wheel	2-19-15	07
Thrust Levers	2-19-15	09
Display Controller (DC-550)	2-19-15	10
PFD Indicators	2-19-15	13
EICAS Indicators	2-19-15	19

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Category II Approach 2-19-20 01
Category II Conditions 2-19-20 01
Localizer Excessive Deviation Warning 2-19-20 02
Glideslope Excessive Deviation Warning 2-19-20 02
Controls and Indicators 2-19-20 03
PFD Indicators 2-19-20 03

User: fhherna0f - Printed By myTechCare - Nov 21/24 - 00:36:37

GENERAL

The Primus 1000 (P-1000) Automatic Flight Control System (AFCS) is a fully integrated, fail passive three-axis flight control system which incorporates lateral and vertical guidance, yaw damper and automatic pitch trim functions.

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AUTOMATIC FLIGHT CONTROL SYSTEM

The Automatic Flight Control System (AFCS) consists of dual IC-600s, autopilot servos, a flight guidance controller (GC-550), a pitch and turn controller (PC-400) and a display controller (DC-550), as follows:

– IC-600 computer - The primary component of the Automatic Flight Control System (AFCS). Controls the symbol generator, monitors, flight director and autopilot. Only the IC-600 #1 incorporates the autopilot functions.

– FLIGHT GUIDANCE CONTROLLER (GC-550) - Consists of a panel that allows control of both Flight Director systems and autopilot functions. The GC-550 provides means for engaging the autopilot and the yaw damper, selecting the flight director modes and the flight director coupling. The Flight Guidance Controller also provides the means for the remote selection of course, heading, vertical speed target, indicated airspeed target, Mach targets and preselected altitude.

– PITCH AND TURN CONTROLLER (PC-400) - Consists of a panel with a Turn Control Knob and a Pitch Control Wheel. These controls allow the pilot to manually maneuver the airplane with the autopilot engaged.

– DISPLAY CONTROLLER PANEL (DC-550) - The DC is used to select various features on the PFD. These include Horizontal Situation Indicator (HSI) formats, navigation sources, weather display and bearing pointer selection.

The Automatic Flight Control System interfaces with the following systems:

– ATTITUDE AND HEADING REFERENCE SYSTEM (AHRS): provides pitch, roll and acceleration information to the autopilot system via IC-600-1.

– INERTIAL REFERENCE SYSTEM (IRS): provides pitch, roll and acceleration information to the autopilot system via IC-600-1.

– RADIO MANAGEMENT SYSTEM: provides navigation data to the IC-600, including short range navigation data, VOR bearings, ILS approach data, marker beacon tone detection and transmission, DME features and ADF.

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- AIR DATA COMPUTERS (ADCs): supply pressure altitude, barometrically corrected altitude, true airspeed, calibrated airspeed, vertical speed, Mach number, static air temperature and total air temperature to both IC-600.
- RADIO ALTIMETER SYSTEM: provides radio altitude, low altitude awareness and decision height information on the PFD.
- STALL PROTECTION SYSTEM: provides sensitive, visual and aural indications of an impending stall. If a stall condition is near to occur, the system actuates the stick shaker, disengages the autopilot and, if necessary, actuates the stick pusher.
- ENHANCED GROUND PROXIMITY WARNING SYSTEM (EGPWS/GPWS): receives, from IC-600-1, the glideslope deviation, localizer deviation, selected decision height, selected course, packed discrete and selected terrain range.
- ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS): present information to the flight crew. Consists of two Primary Flight Displays (PFD), two multi function displays (MFD) and one EICAS display.
- HORIZONTAL STABILIZER CONTROL UNIT (HSCU): provides, to both IC-600 #1 and #2, the horizontal stabilizer position. It also receives, from IC-600 #1, the autopilot command, when the autopilot is engaged, and the amount of trim demanded.
- AURAL WARNING UNIT (AWU): receives signal from the autopilot, generates the appropriate messages and tones and send the audio signal to the Audio Digital System, which routes the messages to the speakers.
- FLAP ELECTRONIC CONTROL UNIT (FECU): moves the inboard and outboard flap panels and sends flap position signal to the autopilot system.
- FLIGHT MANAGEMENT SYSTEM (FMS): provides high accuracy in long range lateral navigation.

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FLIGHT GUIDANCE SYSTEM

The Flight Guidance System may perform three separate functions: the Flight Director, Autopilot and Autopilot Monitoring.

FLIGHT DIRECTOR

The Flight Director function provides pitch and roll attitude commands based on data from a variety of sensors, including attitude, heading, air data, radio altimeter, navigation and pilot inputs. These attitude commands are sent to the PFD for pilot display, to the autopilot for automatic airplane control and to the autopilot monitors.

AUTOPILOT

The autopilot provides yaw stabilization and follows pitch and roll attitude commands from the flight director.

The autopilot/yaw damper monitors continuously check autopilot functions and operation. In case of failure, they are capable of disengaging the autopilot and yaw damper, independent of the autopilot processor hardware.

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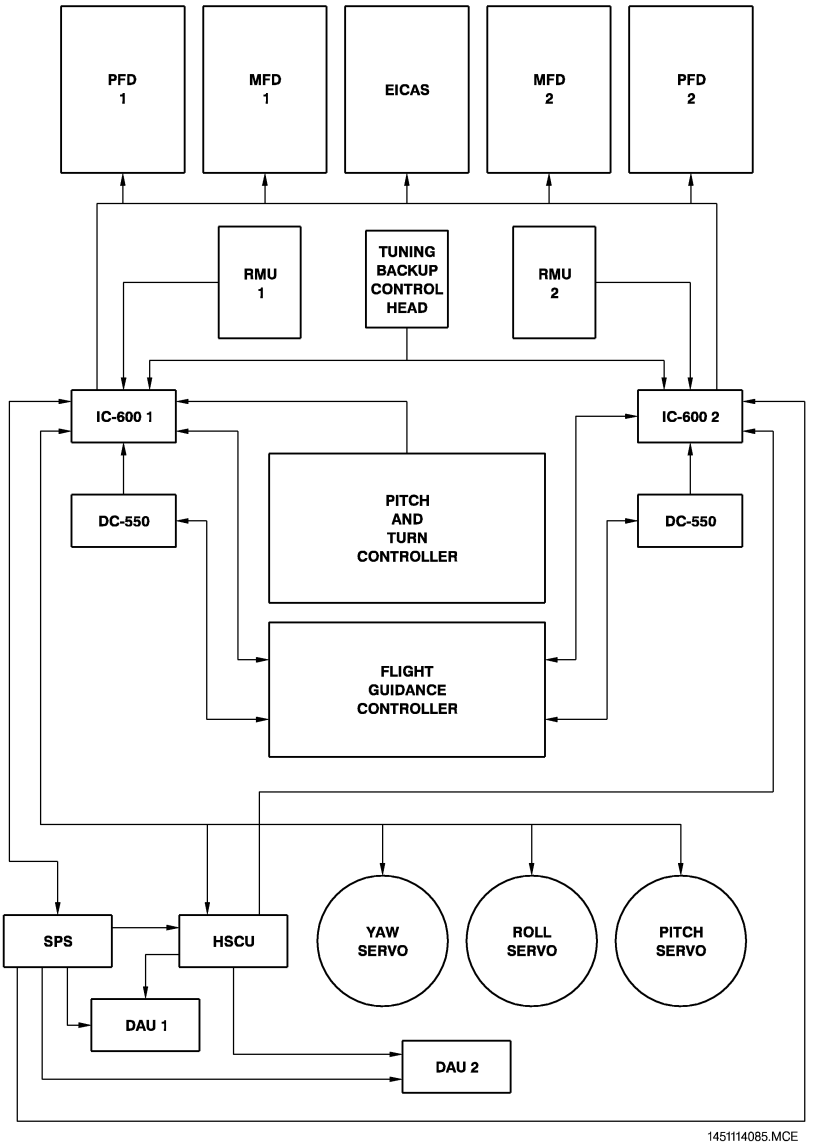

AUTOFLIGHT SYSTEM SCHEMATIC

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FLIGHT DIRECTOR MODES

Flight Director mode selection is accomplished through the Flight Guidance Controller. Each mode selector button is illuminated for the armed and captured mode. Also, each active mode is annunciated on the PFD display and this annunciation makes the distinction between armed and captured modes. The various modes may be divided into two categories: Lateral and Vertical modes.

LATERAL MODES

Lateral modes are those modes related to heading or roll control. They normally provide commands based on navigation sources.

HEADING HOLD MODE

Heading Hold mode is the default Flight Director mode when no other lateral mode is selected. The Heading Hold mode provides roll commands to maintain the heading at the moment of mode engagement. Once this mode is selected, the heading reference is established one second after the system detects a bank angle of less than 6º. A bank angle command of 0° is used (wings level) until the heading reference is established.

The ROL green label is displayed on the PFD to indicate the mode is engaged. Only the pilot's side primary heading is used by this mode. If this data is invalid, the Wings Level submode is used.

The Heading Hold mode is divided into Roll Hold submode, Turn Knob submode and Wings Level submode.

ROLL HOLD SUBMODE

The Roll Hold submode is entered from Heading Hold mode, with the autopilot engaged, by using the Touch Control Steering Button (TCS) to manually fly the airplane to a bank angle greater than 6°. The system maintains the bank angle at the time the TCS button is released. Roll Hold submode may be canceled by either manually flying the airplane to less than 6° with the TCS button, by moving the Turn Control Knob out of detent or by selecting another lateral mode. This mode is annunciated on the PFD by the ROL green label.

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TURN KNOB SUBMODE

The Turn Knob submode allows the pilot to generate a roll attitude command manually with the Turn Control Knob. Moving the Turn Control Knob out of detent, with the autopilot engaged, cancels all other lateral modes including Heading Hold mode in both Flight Directors.

When the Turn Control Knob is out of detent, the autopilot will maintain a roll attitude proportional to the displacement of the knob. The autopilot will revert back to Heading Hold mode when the turn knob is placed in the detent position. Turn Knob submode is annunciated on the PFD by the ROL green label when out of detent and the autopilot is engaged. When the autopilot is disengaged and the Turn Control Knob is out of detent, the TKNB label is displayed in the PFD and the autopilot engagement is inhibited.

WINGS LEVEL SUBMODE (Airplanes equipped with EICAS 16 and on)

The Wings Level submode provides a roll command of 0º. This mode is active in the Go Around mode, Windshear mode or if the primary heading data is invalid. Therefore, this mode is available even if either attitude source is invalid. This mode is annunciated on the PFD by the ROL green label.

HEADING SELECT MODE (HDG)

The HDG mode is selected by pressing the HDG button on the flight guidance controller or by arming LOC, VOR, VAPP, or BC. This mode allows the Flight Director to track the EHSI heading bug, as set by the heading select knob. The Heading Select mode is annunciated on the PFD by the green HDG label.

The mode will be inhibited by the following conditions:

- Turn Control Knob out of detent with autopilot engaged.
- Displayed heading invalid.

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The mode will be canceled if any of the following conditions occur:

- Pressing the HDG button.
- Changing the displayed heading source on the PFD.
- LOC & BC mode capture.
- VOR & VAPP capture.
- Pressing the Go Around button.

LOW BANK MODE

The Low Bank mode allows the pilot to select reduced bank angle for the HDG mode. Bank angle limit will be reduced from 27° to 14° whenever this mode is active. The mode is selected by pressing the BNK button in the Flight Guidance Controller. This mode is annunciated only while the Heading Select mode is active, but remains selected if Heading Select mode is deactivated, being reactivated and annunciated if Heading mode is selected again. The Low Bank mode is automatically selected when climbing above 25000 ft and automatically canceled when descending below 24750 ft.

VOR NAV MODE (VOR)

The VOR NAV mode allows automatic capture and tracking of both inbound and outbound VOR radials. The VOR mode is selected by pressing the NAV button in the Flight Guidance Controller, with VOR selected on the PFD. Upon selection of VOR NAV mode, the HDG select mode will automatically be engaged. This triggers the green HDG annunciation on the PFD in conjunction with an armed white VOR NAV annunciation, also on the PFD.

At the proper time, based on course error and beam deviation, the capture of VOR mode will cancel the HDG selected mode.

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The mode will be canceled or inhibited if any of the following conditions occur:

- Pressing the NAV button.
- Selecting VAPP or HDG modes.
- Changing the displayed NAV source on the PFD.
- Changing the displayed heading source on the PFD.
- When the displayed heading is invalid.
- When the displayed NAV source is invalid for more than 5 seconds.
- Pressing the Go Around Button.
- Turn Control Knob out of detent with autopilot engaged.

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VOR APPROACH MODE (VAPP)

The VOR Approach mode provides the same capabilities as the VOR NAV mode, with higher gain for operation close to the station.

It is recommended to select VAPP mode only on the final approach segment. Therefore, the outbound segment should be flown using some other mode.

This mode is selected by pressing the APR button on the Flight Guidance Controller, with VOR displayed on the PFD. This mode is canceled or inhibited by the same conditions as the VOR NAV mode.

Selecting VOR Approach mode, the HDG select mode will automatically be engaged providing the green HDG annunciation on the PFD in conjunction with the armed VOR approach and white NAV annunciation, also on the PFD.

LOCALIZER MODES (LOC/BC)

The Localizer Modes allow automatic capture and tracking of localizer transmitters. Both front course (LOC) and back course (BC) approaches are supported.

The back course approach operates similar to the front course approach, except that the beam deviation is inverted, allowing the system to approach the runway 180° from the front-course.

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Select the Localizer mode by pressing the NAV or APR buttons on the flight guidance controller with ILS as the selected navigation source. In this case, the HDG select mode is automatically selected and the localizer is armed. On an ILS approach, when the localizer is armed and the APR button is pressed, the Glide Slope is also armed.

The localizer mode captures are based on course error and beam deviation. At the point of capture, the current armed mode (LOC or BC) is selected and locked, while HDG select mode is canceled. The LOC mode capture or BC mode capture is annunciated on the PFD by a green LOC or green BC label, respectively.

After captured, the mode will be canceled or inhibited if any of the following conditions occur:

- Pressing the NAV or APR buttons.
- Selecting HDG mode.
- Changing the displayed NAV source on the PFD.
- Changing the displayed heading source on the PFD.
- When the displayed heading is invalid.
- When the displayed NAV source is invalid for more than 5 seconds.
- When the displayed Glide Slope deviation is invalid for more than 5 seconds, with GS mode captured.
- When the on-side attitude is invalid.
- When the selected air data source is invalid.
- Pressing Go Around button.
- Turn Control Knob out of detent with autopilot engaged.

LNAV MODE

The LNAV mode allows the Flight Director to capture and track the roll steering signal from the long range navigation system (FMS/GPS).

With FMS selected on the PFD, select LNAV mode by pressing the NAV button on the Flight Guidance Controller. This mode will automatically engage HDG select mode, triggering a green HDG annunciation on the PFD in conjunction with a white LNAV annunciation, also on the PFD.

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The mode will be canceled or inhibited if any of the following conditions occur:

- Pressing the NAV button.
- Selecting HDG mode.
- Changing the displayed NAV source on the PFD.
- Changing the displayed heading source on the PFD.
- When the displayed heading is invalid.
- When the lateral steering command is invalid.
- Pressing the Go Around button.
- Turn Control Knob out of detent with autopilot engaged.

VERTICAL MODES

Vertical modes are those modes related to pitch control. Due to the necessity of maintaining the wings leveled during Go Around, this vertical maneuver may also be considered as a lateral mode.

PITCH HOLD MODE

The Pitch Hold mode is the default mode that controls the airplane when no other Flight Director mode is selected.

The Pitch Hold mode is synchronized to the existing pitch attitude and provides an error signal to the command bars and autopilot function.

By pressing the Touch Control Steering Button (TCS), the pilot may manually change the pitch attitude and then allow the system to resynchronize to the new attitude when the button is released.

Should the autopilot be engaged and the Flight Director is in the pitch hold mode, pitch attitude reference can be changed by rotating the pitch control wheel on the pitch and turn controller.

The pitch control wheel allows continuous variable rates and amplitudes of the pitch reference. A PIT label is displayed on the PFD to indicate mode engaged.

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ALTITUDE HOLD MODE (ALT)

The Altitude Hold mode generates an altitude error signal from a reference altitude and provides a pitch command, which allows the autopilot to maintain altitude.

The Altitude Hold mode is selected by pressing the ALT button on the Flight Guidance Controller or can also be activated automatically by the altitude preselect mode. This mode is annunciated on the PFD by the ALT label.

The mode will be canceled or inhibited if any of the following conditions occur:

- Pressing the ALT button.
- Selecting VS, FLC, or SPD modes.
- Glide slope capture.
- When the air data is invalid.
- Pressing the Go Around Button.
- Pitch control wheel moved with autopilot engaged.

ALTITUDE PRESELECT MODE (ASEL)

The Altitude Preselect mode provides means for the system to climb or descend to a predetermined altitude and then level off and maintain the preselected altitude.

Preselected altitude is set through the ASEL knob on the Flight Guidance Controller and is displayed on the top right corner of the PFD. This mode is annunciated by the white ASEL label on the PFD.

Pitch Hold, Speed Hold or Vertical Speed Hold must be used to climb or descend towards the preselected altitude or Flight Level Change (FLC).

The ASEL mode will arm automatically if the airplane climbs or descends towards a preselected altitude. The ASEL mode will automatically capture and cancel any existing mode at the appropriate point based on preselected altitude error and vertical speed. The system will automatically switch to altitude hold mode after the airplane has leveled off at the selected altitude.

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The mode will be canceled and/or inhibited if any of the following conditions occur:

- Changing the preselected altitude.
- Selecting ALT, VS, FLC, or SPD modes.
- Glide slope capture.
- When the air data is invalid.
- Pressing the Go Around Button.

FLIGHT LEVEL CHANGE MODE (FLC)

The Flight Level Change mode (FLC) provides means of climbing or descending to a preselected altitude at a pre-programmed schedule.

When the preselected altitude is above the current altitude and the flight level change mode is selected, the Flight Director provides a speed command at the predetermined climb speed schedule. When the preselected altitude is below the current altitude and FLC is selected, the FD provides a command to descend at a determined rate of descent. The PFD will display the current IAS, Mach or vertical speed bug as appropriate and the target speed can be adjusted only by deselecting the flight level change mode.

As the airplane approaches the preselected altitude, the Flight Director will cycle among ASEL ARM, ASEL CAP, and ALT HOLD to capture the preselected altitude.

The following protections are provided with this mode:

- Maximum normal and longitudinal acceleration: 0.1 G.
- Maximum airspeed: V_{MO} or M_{MO}.
- System will maintain the preselected altitude.

The Flight Level Change mode may be activated by selecting an altitude and pressing the FLC button in the Flight Guidance Controller. This mode is annunciated on the PFD by the CLB label, when following the IAS/MACH climb profile, or by the DES label when following a vertical descent profile of –2000 ft/min.

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The mode will be canceled or inhibited if any of the following conditions occur:

- Pressing the FLC button.
- Changing the preselected altitude.
- Selecting ALT, VS, FLC, or SPD modes.
- Glide slope capture.
- When the air data is invalid.
- Pressing the Go Around Button.

DESCENT RATE SCHEDULE:

For EICAS versions up to 13:

The descent rate schedule is –2000 ft/min.

For EICAS versions 14 and on:

From 37000 ft to 12000 ft, the descent rate schedule is –2000 ft/min.

From 12000 ft to 10000 ft the descent rate schedule is –2000 ft/min to –1000 ft/min.

From 10000 ft and below the descent rate schedule is –1000 ft/min.

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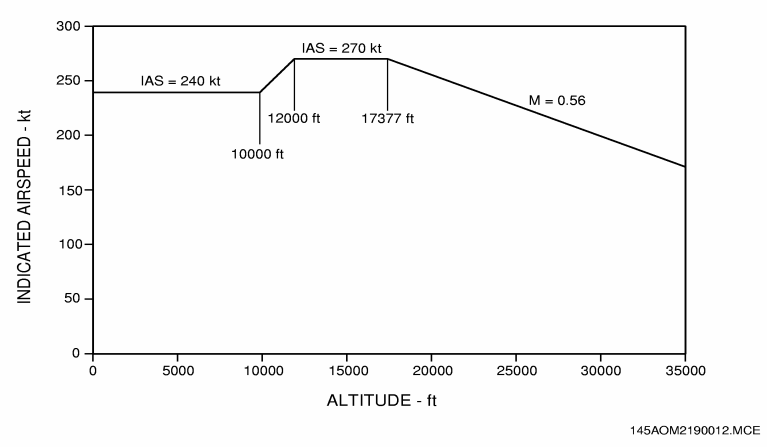
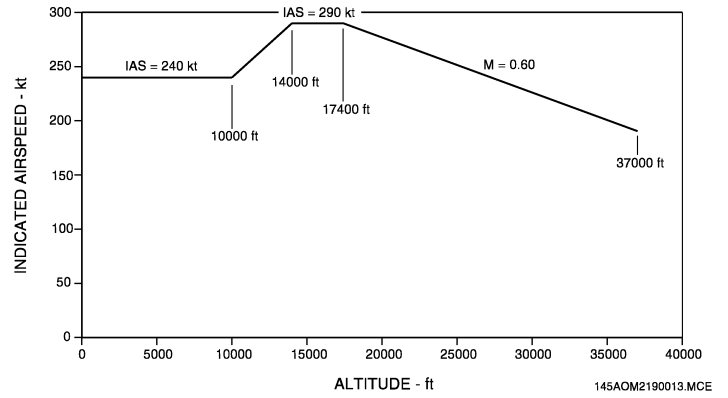
CLIMB RATE SCHEDULE:

For climb rate schedule see the chart below:

EMB-145 (All models except EMB-145 XR)



EMB-145 XR Model



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SPEED HOLD MODE (SPD)

The Speed Hold mode is used to maintain airspeed or Mach number while flying to a new altitude. Indicated airspeed should be used below 25000 ft and Mach number above 25100 ft.

The Speed Hold mode is also designed to provide overspeed and underspeed protections.

Speed hold mode is selected by pressing the SPD button on the Flight Guidance Controller. This mode is annunciated on the PFD by the SPD label, when maintaining IAS, or by the MACH label when maintaining Mach number. Selection of Speed Hold mode cancels other vertical modes, except the altitude preselect arm mode and Glide Slope arm mode.

Speed Hold mode is automatically selected when the FLC button is pressed and the preselected altitude is above the current altitude.

Different Speed Target can be selected by using the Speed Set knob in the Flight Guidance Controller. Pressing the SPD knob allows the pilot to toggle between IAS target and MACH target to set airspeed.

The following protections are provided with this mode:

- Maximum normal acceleration: 0.1 G.
- Maximum normal acceleration on entering overspeed: 0.3 G.
- Maximum airspeed: V_{MO} or M_{MO}.
- Minimum airspeed: Shaker actuation speed.
- System will maintain the preselected altitude and airspeed.

The mode will be canceled or inhibited if any of the following conditions occur:

- Pressing the SPD button.
- Selecting ALT, VS, or FLC modes.
- Altitude preselect capture.
- Glide slope capture.
- When air data is invalid.
- Pressing the Go Around Button.

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An altitude pre-selector overshoot may occur when the following conditions are applied:

- SPD mode engaged and;
- Autopilot disengaged and;
- Relative delay to follow the Flight Director at initial descent and;
- Descent rate greater than 6000 ft/min.

VERTICAL SPEED HOLD MODE (VS)

The Vertical Speed hold mode is used to maintain or to make changes to the vertical speed. The Vertical Speed hold mode ranges from –6000 to +6000 ft/min, with a resolution of 100 ft/min.

The Vertical Speed Hold mode is selected by pressing the VS button on the Flight Guidance Controller or automatically, when FLC button is pressed and the preselected altitude is below the current altitude. This mode is annunciated on the PFD by the VS label.

Selection of this mode cancels other vertical modes, except the altitude preselect arm and Glide Slope arm.

Vertical speed may be changed by using the Speed Set knob, on the flight guidance controller.

The following protections are provided with this mode:

- Maximum airspeed: V_{MO}.
- Minimum airspeed: Shaker actuation speed.

The mode will be canceled or inhibited if any of the following conditions occur:

- Pressing the VS button.
- Selecting ALT, SPD, or FLC modes.
- Altitude preselect capture.
- Glide slope capture.
- When air data is invalid.
- Pressing the Go Around Button.

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GLIDE SLOPE MODE (GS)

The Glide Slope mode allows automatic capture and tracking to Glide Slope transmitters. Select Glide Slope mode by pressing the APR button with ILS as a navigation source.

Selecting Glide Slope mode automatically arms GS (in conjunction with LOC). The PFD will display a white localizer LOC and a white Glide Slope GS annunciation. The localizer mode capture will occur with a green LOC annunciation on the PFD. The Glide Slope mode capture, with a green GS annunciation on the PFD, will occur only after Localizer mode has been captured.

After captured, the GS mode will be canceled or inhibited if any of the following conditions occur:

- Pressing the APR or NAV buttons.
- Lost Localizer mode.
- Selecting ALT, SPD, VS, or FLC modes.
- Glide slope deviation invalid for a period greater than 5 seconds.
- Pressing the Go Around Button.

GO AROUND MODE

The Go Around mode may be engaged only at radio altitudes below 2500 ft, or below 15000 ft pressure altitude for an invalid Radio Altimeter signal. This feature is provided to protect against inadvertent Go Around selections during cruise.

While this mode is engaged, the Speed knob is inhibited.

The airspeed bug is displayed on the airspeed tape on the PFD and a pitch limit indicator is displayed on the EADI. If the Stall Protection Computer signal becomes invalid, the pitch limit indicator is removed.

The Go Around mode is divided into two submodes. The Takeoff Submode is engaged by pressing the Go Around button when the airplane is on the ground (weight on wheels), or in flight up to 400 ft Radio Altitude after the takeoff. Anytime after this, pressing the Go Around button engages the Go Around Submode.

The Go Around submode, as well as the Vertical Speed Control knob, is inhibited while Takeoff Submode is engaged.

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TAKEOFF SUBMODE

The Takeoff submode provides Wings Level and fixed pitch up attitude command indicated by the Flight Director command bars on the EADI. The pitch angle is the same as described in Takeoff - Normal Procedures (1-02-40).

This submode is annunciated by the ROL label and TO label, both on the PFD, and it is canceled if any of the following conditions occur:

- The TCS button is pushed.
- The ALT, SPD, VS, or FLC mode is selected.
- Transition to capture Altitude Preselect mode occurs.
- Air data computer source selection is changed.

If the autopilot is selected with the Takeoff submode engaged, this submode drops into Pitch Hold mode and synchronizes to the current attitude. This submode does not couple to the autopilot, which may be used after climbing above the airplane Minimum Engagement Height (MEH).

A Pitch Limit Indicator (PLI) is displayed on the EADI sphere when the margin prior to the stick shaker set point is lower than or equal to 10°. In the case of an invalid Stall Protection Computer signal, the PLI will be biased out of view and an amber AOA annunciation is displayed on the PFD.

GO AROUND SUBMODE

The Go Around Submode should be selected once the decision to discontinue the approach has been taken. Although commanding a nose up attitude, the need to maintain wings leveled causes this submode to incorporate both lateral and vertical modes features.

The autopilot may be coupled to the Go Around Submode above the Minimum Use Height (MUH). However, the crew is not alerted in case of coupling this submode below the MUH.

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This submode is annunciated by the ROL label and GA label, both on the PFD, and it is canceled if any of the following conditions occur:

- Glide slope capture.
- The ALT, SPD, VS, or FLC mode is selected.
- Transition to capture Altitude Preselect mode occurs.
- Air data computer source selection is changed.

Once a positive rate of climb has been achieved, this submode commands a pitch angle of 10° nose up. If transition to Speed Hold Mode occurs, IAS mode annunciator replaces the GA mode annunciator.

Transition from Go Around Submode to Speed Hold Mode automatically occurs:

- If, at anytime, the speed is lower than 1.23 VS. In this case, 1.23 VS is targeted, replacing the pre-selected speed target. If this speed can not be maintained, altitude is held.
- If, 20 seconds after Go Around engagement, the speed is higher than 170 KIAS. In this case, 170 KIAS is targeted, replacing the pre-selected speed target.
- If, 20 seconds after Go Around engagement, the speed is up to 5 kt higher or lower than the pre-selected speed target, which, in this case, is maintained.

The Go Around Submode ignores a pre-selected altitude below the airplane, and a pre-selected altitude above the airplane is captured if it is higher than the Go Around submode engagement altitude plus 400 ft (pressure altitude). This feature is provided to avoid the airplane leveling off if the pilot has not readjusted the pre-selected altitude to the new missed approach altitude.

WINDSHEAR ESCAPE GUIDANCE MODE

The Windshear Escape Guidance mode is provided in order to recover from a windshear situation.

For further information on windshear detection and escape guidance system, refer to Section 2-4 – Crew Awareness.

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AUTOPILOT DISENGAGEMENT

The autopilot is intentionally disengaged through the Autopilot Engage/Disengage button or through the quick disconnect button on the control wheel (normal disengagement). It may also disengage due to an autopilot failure (abnormal disengagement).

A voice message "AUTOPILOT" is generated when the autopilot disengages. It may be canceled according to the following associated conditions, when pilots intentionally disconnect the autopilot (normal disengagement):

Associated Conditions	Cancellation
Above 2500 ft radio altitude with a valid Radio Altimeter signal.	Self canceled.
Below 2500 ft radio altitude with a valid Radio Altimeter signal.	Pressing the Autopilot Quick Disconnect Button twice.
Invalid Radio Altimeter signal.	Pressing the Autopilot Quick Disconnect Button twice.

The autopilot abnormal disengagement triggers the voice message "AUTOPILOT" in all altitudes. The crew may cancel it by pressing the Autopilot Quick Disconnect Button twice.

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EICAS MESSAGES

TYPE	MESSAGE	MEANING
WARNING	AUTOPILOT FAIL	Autopilot has failed and has been automatically disengaged.
CAUTION	AUTO TRIM FAIL	Automatic pitch trim has failed.
	AP ELEV MISTRIM	A pitch mistrim condition exists.
	AP AIL MISTRIM	A roll mistrim condition exists.
	LATERAL MODE OFF	Inadvertent loss of the Lateral Flight Director mode.
	VERTICAL MODE OFF	Inadvertent loss of the Vertical Flight Director mode.
	YAW DAMPER FAIL	Yaw Damper has failed and has been automatically disengaged.

CONTROLS AND INDICATORS

FLIGHT GUIDANCE CONTROLLER

NOTE: All the mode selector buttons described below are illuminated to indicate whether the associated mode is armed or captured.

1 - FLIGHT DIRECTOR BUTTON

- Allows the Flight Director bars to be displayed on the associated PFD.

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2 - LATERAL MODE SELECTOR BUTTONS

- Select lateral operating modes of the autoflight system, as follows:
  - HDG: selects heading hold and heading select modes.
  - NAV: selects VOR NAV mode and allows selection of LOC/BC and LNAV modes.
  - APR: selects VOR approach mode and allows selection of LOC/BC and GS modes.
  - BNK: selects Low Bank submode.

3 - AUTOPILOT ENGAGE BUTTON

- Pressed once engages the autopilot and the yaw damper. Pressed again, disengages the autopilot only, keeping the yaw damper engaged.

4 - VERTICAL MODE SELECTOR BUTTONS

- Select vertical operating modes of the autoflight system, as follows:
  - SPD: selects Speed Hold mode.
  - FLC: selects Flight Level Change mode.
  - VS: selects Vertical Speed hold mode.
  - ALT: selects Altitude Hold mode.

5 - ALTITUDE PRESELECT KNOB

- Allows preselection of altitude in 100 ft increments.

6 - COURSE SELECTOR KNOB

- Allows selection of course in 1° increments.
- Pressing the knob synchronizes the selected course to the VOR bearing.

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7 - VERTICAL SPEED CONTROL KNOB AND IAS/M SELECTOR BUTTON

- Pressing the knob toggles between the speed modes MACH and IAS.
- When in SPD mode, rotation of this knob allows selection of indicated airspeed in one-knot increments or Mach Number in 0.01 increments.
- When in VS mode, rotation of this knob allows selection of vertical speed in 100 ft/min increments.

8 - YAW DAMPER ENGAGE BUTTON

- Pressed once, engages only the Yaw Damper. Pressed again disengages the yaw damper and the autopilot, if it is engaged.

9 - AUTOPILOT COUPLE BUTTON

- Allows the pilot's or copilot's Flight Director commands to control the autopilot. The couple button can be pressed with the autopilot engaged or disengaged. However, if the Flight Director is switched, the modes will drop out and the autopilot will remain engaged (if already engaged) and revert to basic autopilot mode (pitch and roll).

10- HEADING SELECT KNOB

- Allows selection of heading in 1° increments.
- Pressing this knob synchronizes the heading selection to the current displayed heading.

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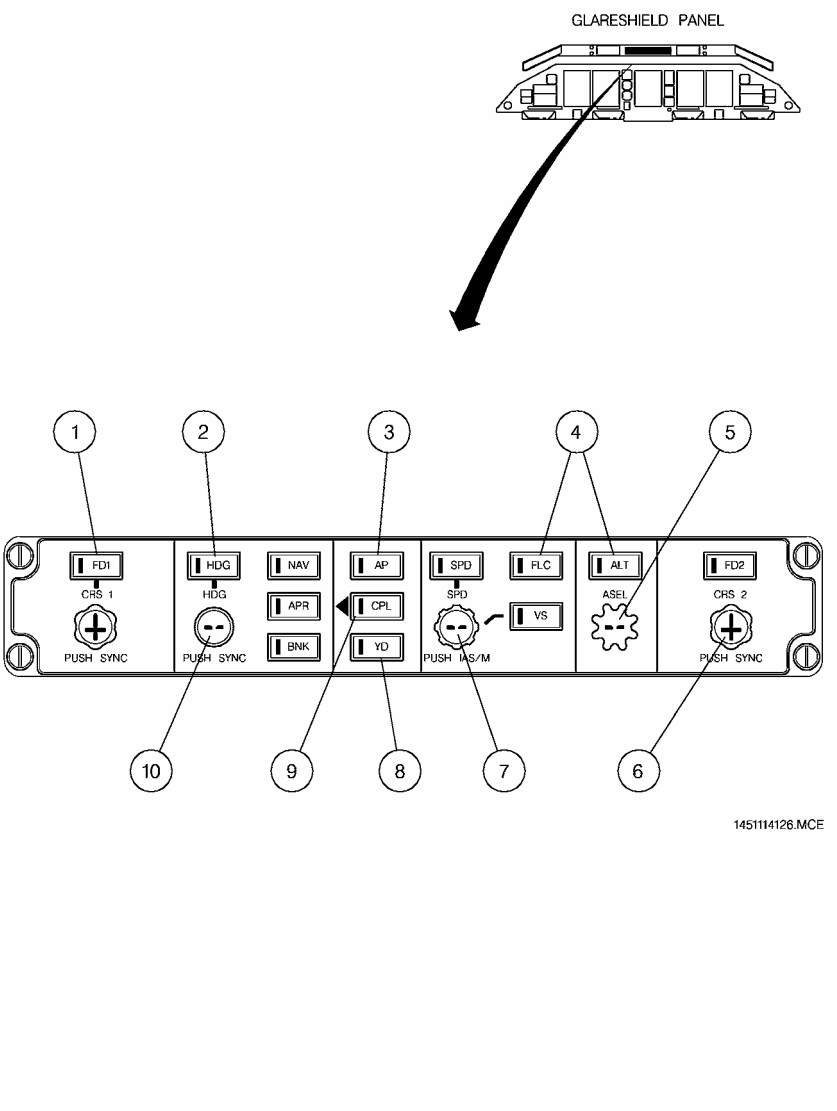

FLIGHT GUIDANCE CONTROLLER

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PITCH AND TURN CONTROLLER

1 - PITCH CONTROL WHEEL

- Manually controls the pitch when the autopilot is engaged and the Pitch Hold mode is selected.
- Pitch control wheel operation is inhibited if any vertical mode, except the Pitch Hold mode, is selected in the Flight Director.

2 - TURN CONTROL KNOB

- Manually controls the roll attitude when the autopilot is engaged.
- The control has a center detent position at the wings leveled position. The control remains at the current position when released.

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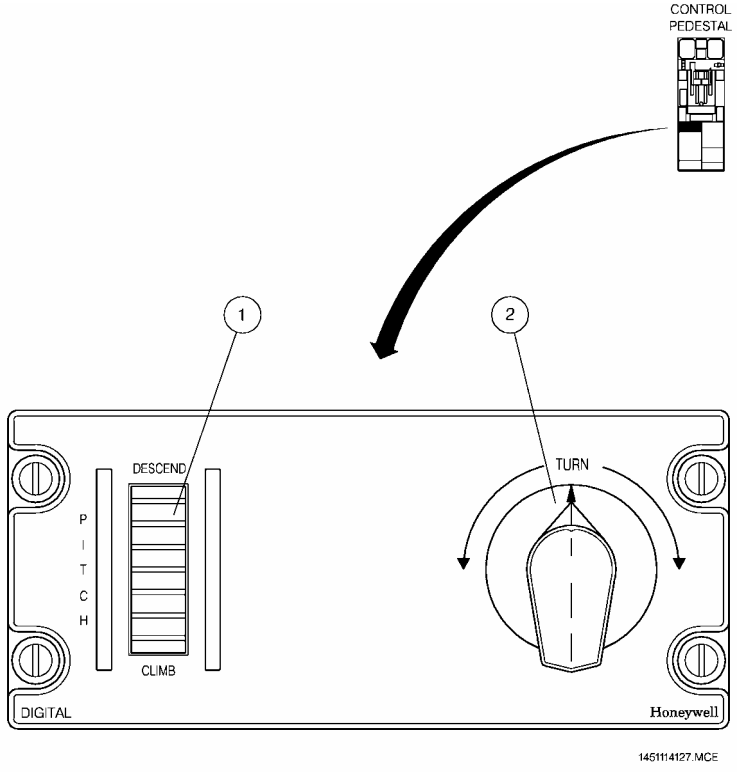

PITCH AND TURN CONTROLLER

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CONTROL WHEEL

1 - TOUCH CONTROL STEERING BUTTON (TCS)

- Allows manual maneuvering of the airplane without disengaging the autopilot. The airplane may be maneuvered to any desired pitch attitude while the TCS button is pressed. When the button is released, the following occurs:
  - Primary servos reengage.
  - The computer synchronizes itself to the new pitch attitude and vertical mode and maintain it.
  - Lateral control is returned to the previously selected lateral mode (return to the lateral mode is filtered to prevent rapid maneuvers).
- After glide slope capture in APR mode with the autopilot engaged, if the TCS button is pressed and released, the autopilot will resume the controls and turn the airplane to the ILS center beam.

2 - QUICK DISCONNECT BUTTON

- Provides the means to disengage autopilot and yaw damper.
- The pilot's and copilot's buttons are interconnected to allow autopilot cancellation from either seat.
- For Post-Mod. SB 145-22-0001 airplanes or airframes S/N 145001 through 145003, 145041 and on, if the autopilot is disengaged and the button is pressed, the voice message AUTOPILOT will be canceled in 2 seconds.

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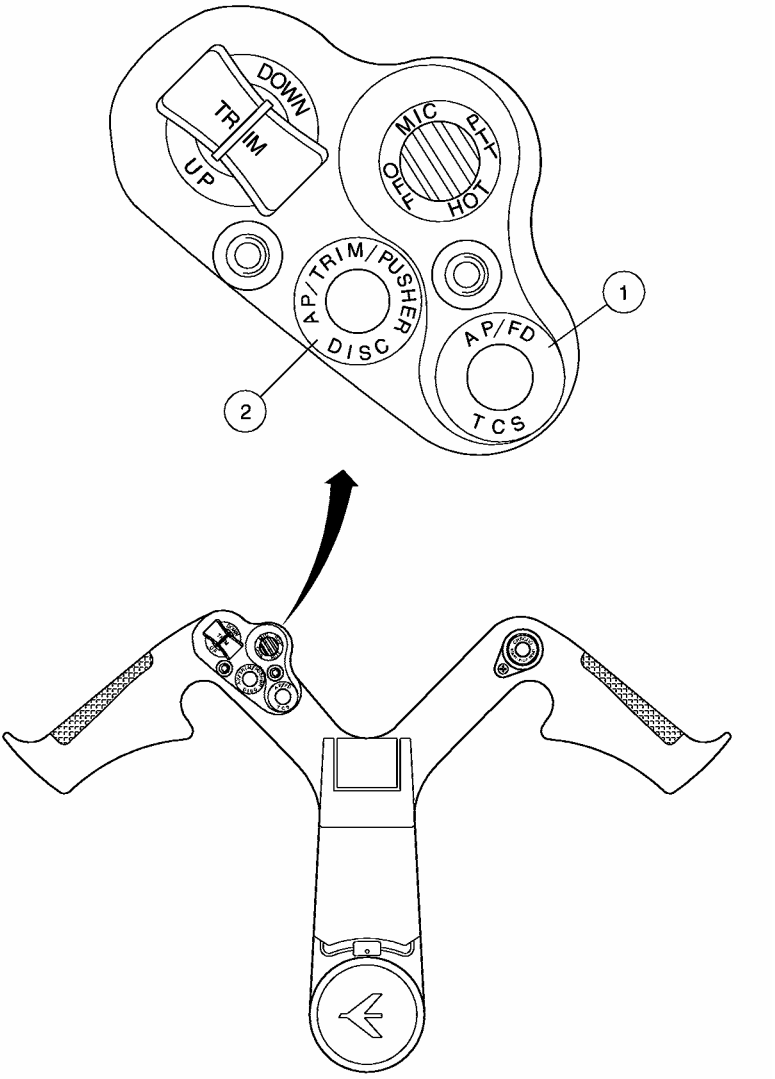

CONTROL WHEEL

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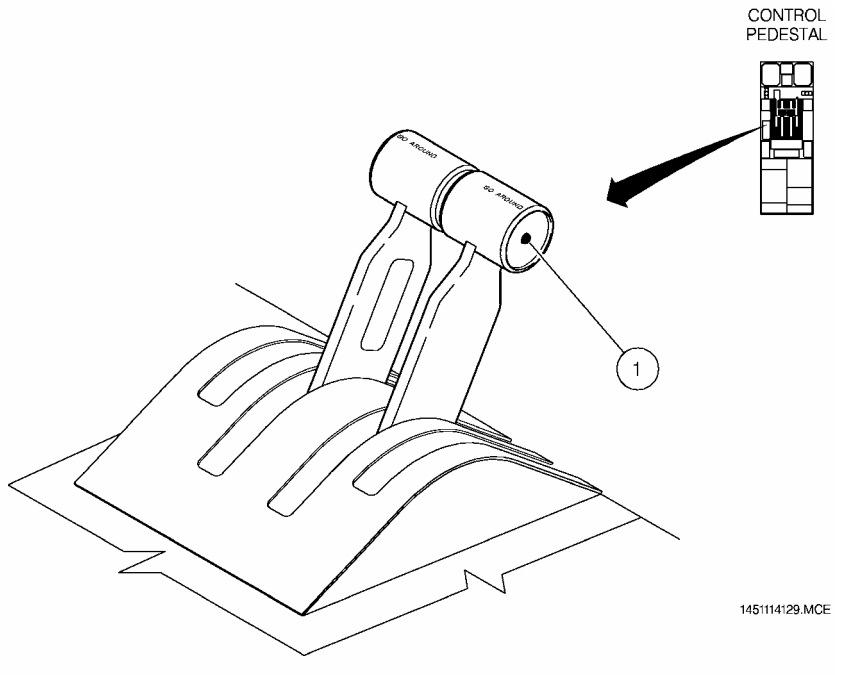
THRUST LEVERS

1 - GO AROUND BUTTON

- Selects the Go Around mode (Takeoff submode, Go Around Speed Target submode and Windshear mode).
- The button also forces the Flight Director into either the Go Around mode or the Windshear mode, depending on the windshear signal.



THRUST LEVERS

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DISPLAY CONTROLLER (DC-550)

1 - NAVIGATION SOURCES SELECTOR BUTTON

- Provides the selection of the VHF NAV (VOR, ILS and MLS) as navigation source for the EHSI. If the VHF NAV is already selected, pressing the NAV Button selects the opposite VHF NAV as navigation source for the on-side EHSI. Pressing the NAV Button once again will restore the normal operation: VHF NAV 1 information presented on the PFD 1 and VHF NAV 2 information presented on the PFD 2.

2 - FMS SOURCE SELECTOR BUTTON (OPTIONAL)

- Provides the selection of the FMS as navigation source for the EHSI.
- On airplanes equipped with dual FMS, pressing the FMS Button for the second time selects the opposite FMS as navigation source for the on-side EHSI (and for the on-side MFD MAP). Pressing the FMS Button once again will restore the normal operation: FMS 1 information presented on the PFD 1 (and MFD 1) and FMS 2 information presented on the PFD 2 (and MFD 2).

3 - BEARING SELECTOR KNOB

OFF: The associated PFD bearing pointers are disabled.

NAV 1 (2): Selects the respective VHF NAV as source for the associated bearing pointer.

ADF: Selects the respective ADF as source for the associated bearing pointer.

FMS: Selects the FMS as source for the associated bearing pointer.

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4 - DECISION HEIGHT SETTING AND IC-600 TEST KNOB

- Provides the Radio Altimeter (RA) decision height setting.
- When pressed on ground provides the IC-600 and RA test activation. Refer to Section 2-4 – Crew Awareness for further information on test function and Section 2-17 – Flight Instruments for further information on decision height setting and RA test in flight.

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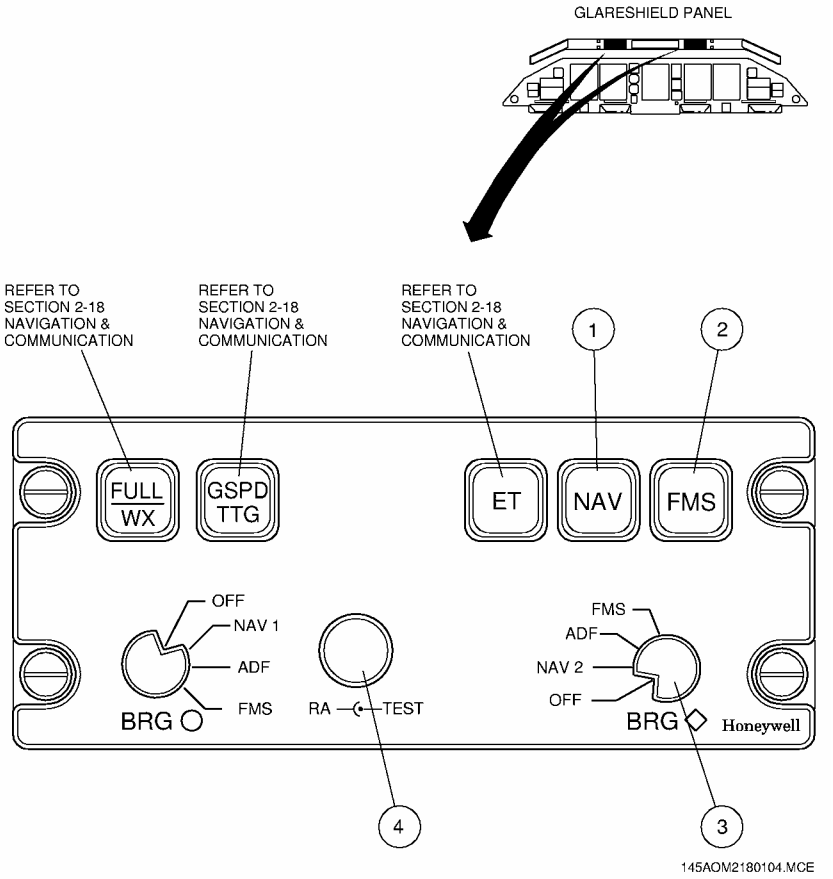

DISPLAY CONTROLLER PANEL (DG-550)

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PFD INDICATORS

1 - ARMED LATERAL MODE (WHITE)

- Indicates which lateral mode is armed.
- The mode annunciation is removed if the Flight Director fails.

2 - CAPTURED LATERAL MODE (GREEN)

- Indicates which lateral mode is captured.
- The mode annunciation is removed and an amber FD FAIL is displayed in case of Flight Director failure.

3 - AUTOPILOT MESSAGE FIELD

- Indicates autopilot status.
- Messages are mutua
- lly exclusive and therefore only one message can be displayed at a time.
- The following messages may be displayed:

MESSAGE	COLOR	MEANING
AP	Green	Autopilot engaged.
AP TEST		Autopilot test mode is active immediately after power up.
TCS	White	TCS submode is engaged (autopilot is engaged).
TKNB	Amber	Turn control knob is out of detent position (autopilot is disengaged).
AP		When the autopilot is normally disengaged, the green AP annunciation turns amber and flashes for 5 seconds, then extinguishes.
AP	Red	If the autopilot is engaged and a failure occurs, the green AP annunciation turns red and flashes for 5 seconds, then becomes steady. The AP annunciation appears in conjunction with the AUTOPILOT FAIL message on the EICAS and is removed when the autopilot is disengaged through the Quick Disconnect Button.

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4 - FLIGHT DIRECTOR COUPLE ARROW

- Indicates which Flight Director the autopilot is coupled to.
- The mode annunciation is removed if the Flight Director fails.

5 - YAW DAMPER ENGAGED ANNUNCIATION

- Color:
  - Green: indicates the yaw damper is engaged.
  - Amber: when the yaw damper is normally disengaged the annunciation flashes for 5 seconds and then extinguishes itself.
    If the yaw damper is engaged and a failure occurs, the annunciation flashes for 5 seconds then becomes steady until it is disengaged through the Quick Disconnect Button.

6 - CAPTURED VERTICAL MODE (GREEN)

- Indicates which vertical mode is captured.
- The mode annunciation is removed if the Flight Director fails.

7 - MODE TRANSITION ANNUNCIATOR

- Each transition is annunciated by a box around the mode that is being transitioned. The box will highlight the new mode for 5 seconds and then disappear.

8 - ARMED VERTICAL MODE (WHITE)

- Indicates which vertical mode is armed.
- The mode annunciation is removed if Flight Director fails.

9 - ALTITUDE PRESELECT DISPLAY

- Ranges from –900 to 45000 ft with a resolution of 100 ft.
- The digits and bug are cyan and the box is white. They become amber 1000 ft prior to reaching the preselected altitude. Once the airplane is within 250 ft of the preselected altitude, the box returned to white. If the airplane exceeds the preselected altitude by more than 250 ft, the box turns amber.
- Large digits display hundreds, thousands and tens of thousands. Smaller digits, which are always zeros, display tens and ones.

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- The bug moves according to the digital altitude preselect value.
- If the preselected altitude value is not within the displayed range of the altitude scale, the bug will stay at the respective end of scale, half-visible and unfilled.

10 - COMMAND BAR AND AIRPLANE SYMBOL

- Color: magenta.
- Indicates pitch and roll Flight Director commands.
- Command bar is removed if the Flight Director fails or if the opposite side Flight Director selected source or tuned frequency is different.

NOTE: The command bar and airplane symbol may be presented in either V-bar or cross-bar formats, depending on operator selection.

11 - SELECTED HEADING BUG

- Color: magenta.
- Displayed full time on the PFD, unless when the PFD is in arc format.
- When setting the selected heading value, the bug will move around the heading scale.

12 - VERTICAL SPEED TARGET DISPLAY

- Color: cyan.
- Ranges from 0 to 9900 ft/min with a resolution of 100 ft/min.
- Displayed only when Vertical Speed Hold mode is selected in either Flight Director.

13 - SELECTED HEADING DIGITAL READOUT

- Color:
  - Digits: cyan.
  - Label: white.
- Indicates the heading selected through the Flight Guidance Controller panel.

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14 - GS/LOC/ILS COMPARISON MONITOR DISPLAYS

- Label: GS, LOC or ILS.
- Color: amber.
- Glide Slope comparison monitor (GS label) is displayed while in GS CAP and below 2500 ft if there is a difference of 0.7 dot deviation between the PFDs indication. If the radio altitude output is invalid, the monitor will then be activated by GS CAP only.
- Localizer comparison monitor (LOC label) is displayed while in approach mode, below 2500 ft if there is a difference of 0.5 dot deviation between the PFDs indication. If the radio altitude output is invalid, the monitor will then be activated by GS CAP only.
- ILS comparison monitor display is annunciated when both GS and LOC comparison monitors are displayed simultaneously.

15 - AOA INDICATION

- Color: amber.
- Indicates loss of PLI indication due to an invalid Stall Protection Computer signal.

16 - OVERSPEED/UNDERSPEED WARNING DISPLAY

- Color: amber.
- Label: MAX SPD for overspeed condition.
  MIN SPD for underspeed condition.
- Activated by the Flight Director.
- Remains displayed as long as the condition exists.

17 - INDICATED AIRSPEED/MACH TARGET DISPLAY

- Color: digits are cyan and box is white.
- Ranges from 80 KIAS to V_{MO} with a resolution of 1 KIAS or from 0.2 Mach to M_{MO} with a resolution of 0.01 Mach.
- Displayed full time.
- Bug moves according to the indicated airspeed/Mach target value set.
- If the indicated airspeed/Mach value is not within the displayed range of the airspeed scale, the bug will stay at the respective end of the scale, half-visible and unfilled.

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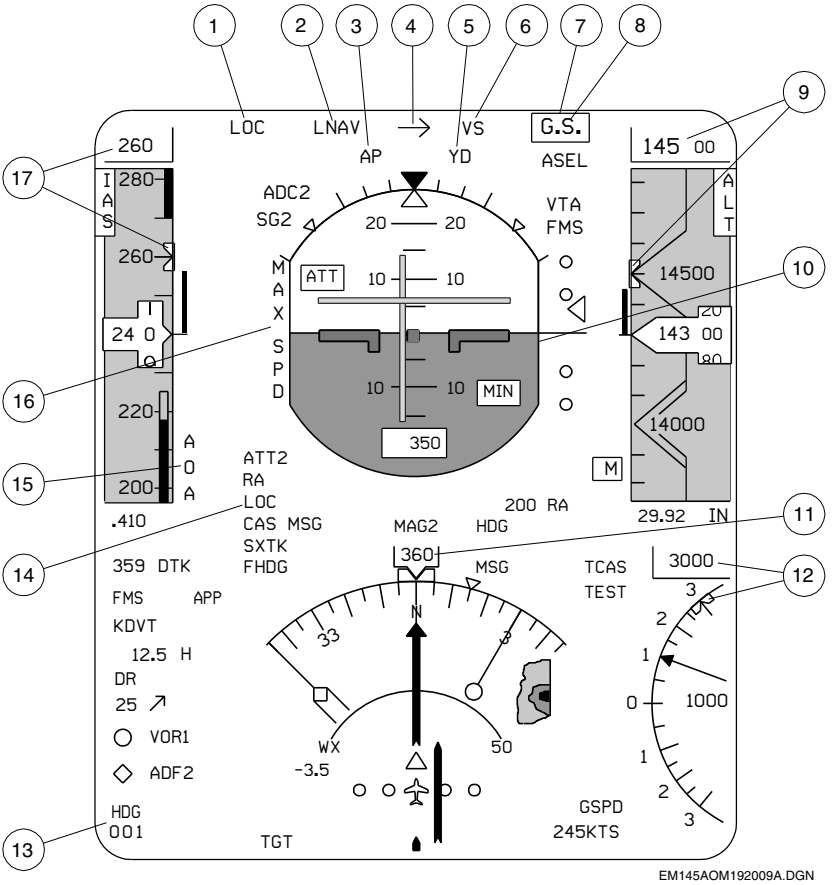

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PFD INDICATORS (CROSS-BAR FORMAT)

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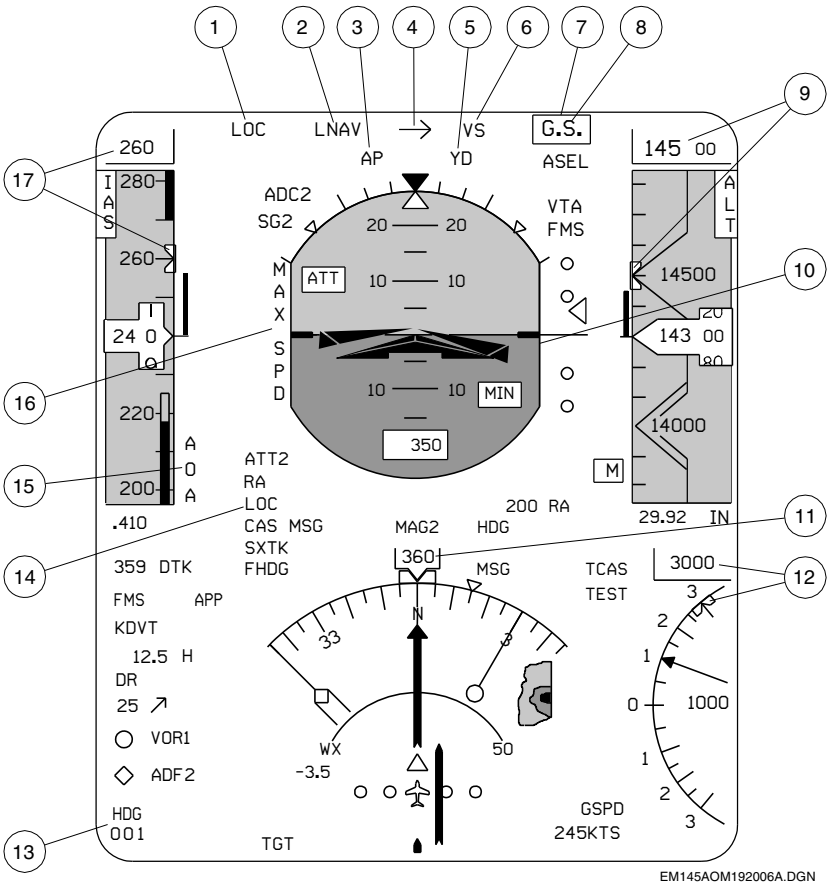

PFD INDICATORS (V-BAR FORMAT)

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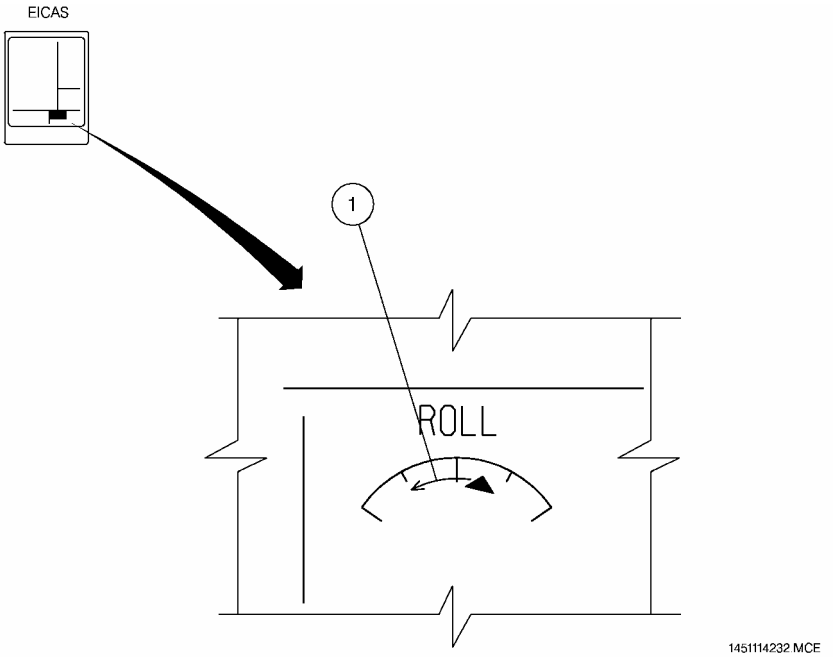
EICAS INDICATORS

1 - ROLL MISTRIM ANNUNCIATION

- Color: amber.
- Indicates that a roll mistrim exists, which may cause an abrupt roll command at the time the autopilot is disengaged.
- Direction of arrow indicates the side the roll trim must be commanded to eliminate the condition.
- It is displayed in conjunction with the AP AIL MISTRIM message on the EICAS.



ROLL MISTRIM ANNUNCIATION

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CATEGORY II APPROACH (OPTIONAL)

The IC-600 may be optionally equipped with a Category II checklist logic warning which is automatically activated whenever the Decision Height is selected between 80 and 200 ft through the RA knob on the Display Control Panel.

CATEGORY II CONDITIONS

The required conditions to obtain a Cat II valid conditions are:

- Radio Altimeter indication valid on both PFDs.
- Radio altitude above 80 ft (80 ft is included for EICAS version 20.7).
- Flaps 22°.
- NAV 1 on pilot's side and NAV 2 on copilot's side, both tuned to the same frequency.
- An active approach mode selected above 1000 ft AGL.
- Both Flight Directors operational (command bars visible).
- Attitude and heading valid on both PFDs.
- Glide slope and localizer deviation valid on both PFDs.
- No reversions (SG, AHRS, IRS or ADC) modes selected on both PFDs.
- Valid airspeed and barometric altitude on both PFDs.
- No comparison monitors are tripped (attitude, heading, airspeed, barometric altitude, localizer, glide slope and radio altitude) on both PFDs.
- No back course selected.
- Autopilot engaged (not required for EMB-135 and EMB-145 XR models).
- Cat II Decision Height setting on both Display Control Panels (greater than 80 ft and less than 200 ft - 80 ft is included for EICAS version 20.7).

NOTE: For EMB-135 and EMB-145 XR models the CAT II approaches are allowed using either the Autopilot or Flight Director for guidance**.**

If all conditions are met, a green CAT 2 annunciation is displayed on the PFDs. If any of the required conditions for establishing CAT 2 goes invalid, the green CAT 2 will be replaced by flashing amber CAT 2 annunciation. It will flash for ten seconds and then go steady.

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NOTE: For airplanes Pre-Mod. SB 145-31-0022, equipped with EICAS version 16.5, the CAT 2 annunciator may remain green even with the Autopilot disengaged. Once the CAT 2 limitations have not changed, before performing CAT 2 approaches on the mentioned airplanes, the flight crew must check the green CAT 2 annunciation and also confirm if the Autopilot is engaged.

LOCALIZER EXCESSIVE DEVIATION WARNING

The Localizer Excessive Deviation Warnings are active when CAT II is valid. It is triggered between 500 ft and 80 ft of Radio Altimeter height, when the ILS lateral deviation is greater than 1/3 dot. The pilots will be alerted by:

- The lateral deviation bar on the EHSI are changed from green to amber.
- The lateral deviation scale changing from white to amber and flashing with a duty cycle of 0.5 second on followed by a 0.5 second off.

NOTE: The on-side excessive deviation warning is also displayed when the cross-side system has detected an excessive deviation.

GLIDESLOPE EXCESSIVE DEVIATION WARNING

The Glideslope Excessive Deviation Warnings are active when CAT II is valid. It is triggered between 500 ft and 80 ft of Radio Altimeter height, when the ILS vertical deviation is greater than one dot or when the glideslope deviation warning is invalid for more than five seconds. The pilots will be alerted by:

- The GS pointer on the EADI changing from green to amber.
- The GS scale on the EADI changing from white to amber and flashing with a duty cycle of 0.5 second on followed by 0.5 second off.

NOTE: The on-side excessive deviation warning is also displayed when the cross-side system has detected an excessive deviation.

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CONTROLS AND INDICATORS

PFD INDICATORS

1 - CAT 2 ANNUNCIATION

- Indicates the Cat II condition.
- Label: CAT 2.
- Color:
  - Normal condition: green.
  - Abnormal condition: amber.

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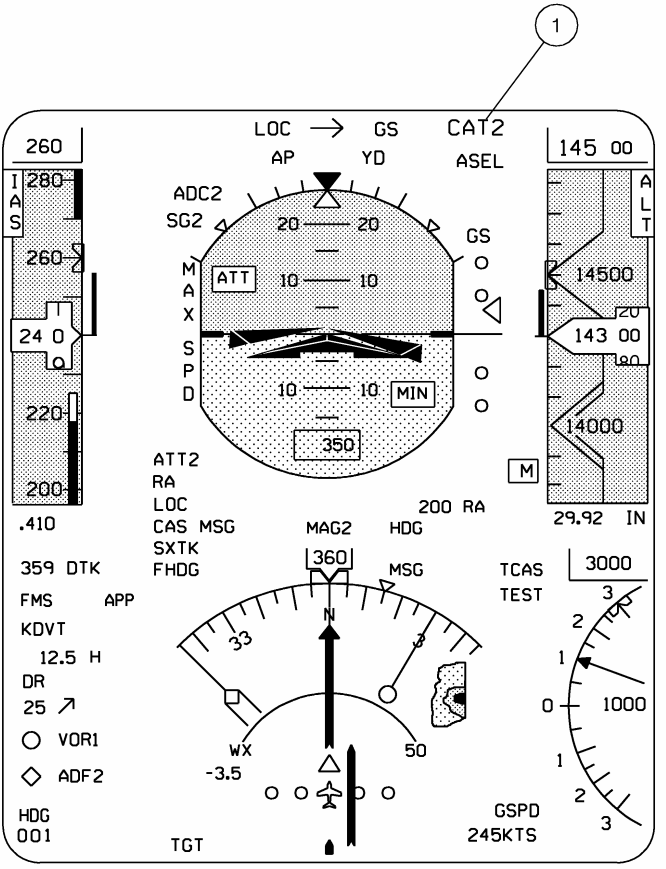

PFD INDICATORS

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