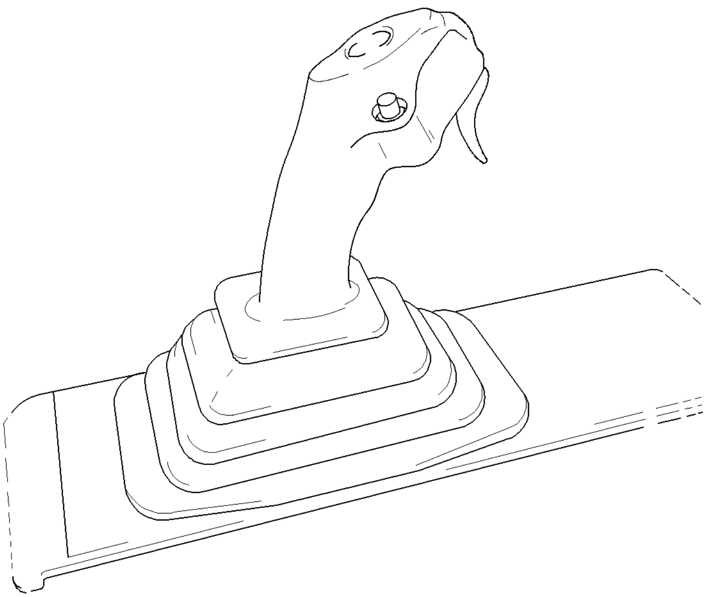
A319/A320/A321

FLIGHT CREW OPERATING MANUAL



FLIGHT OPERATIONS

3

AIRBUS®

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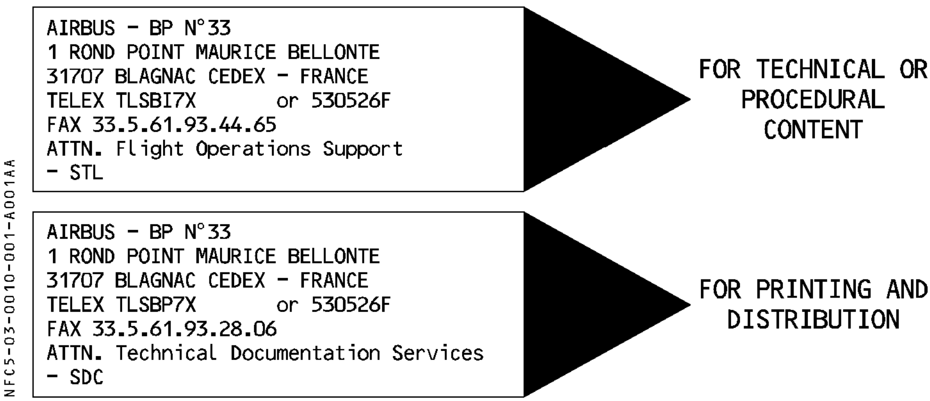
FOREWORD

This manual complements the approved Flight Manual. Airbus has attempted to ensure that the data contained in this manual agrees with the data in the Flight Manual. If there is any disagreement, the Flight Manual is the final authority.

COMMENTS - QUESTIONS - SUGGESTIONS

All manual holders and users are encouraged to submit any Flight Crew Operating Manual questions and suggestions to :



CONTENT

The Flight Crew Operating Manual is the support documentation for flight crew operations. The Flight Crew Operating Manual provides operating crews with the technical, procedural and performance characteristics of the A320 family aircraft to ensure a safe and efficient operation during normal and/or abnormal/emergency situations on ground and in flight. However, the Flight Crew Operating Manual is not intended to provide basic jet aircraft piloting techniques or information that are considered as basic airmanship for trained flight crews familiar with that type of aircraft and with its general handling characteristics.

The Flight Crew Operating Manual is intended :

- To be used directly as flight crew operating manual or to be the basis for elaboration of the relevant parts of the "crew manual" by the operations department of the operator in accordance with applicable requirements.
- To be used as a flight crew training manual (initial and refresher).
  However, the Flight Crew Operating Manual is not intended to be used for teaching basic piloting skills.

The content is divided into four volumes :
Vol 1 = Systems' description (description of the aircraft systems).
Vol 2 = Flight preparation (performance information, plus loading data).
Vol 3 = Flight operations (operating procedures, techniques, and performance information).
Vol 4 = FMGS pilot's guide (procedures for FMGS use).

USE

As a comprehensive set of references, the FCOM :
- can be used by an operator's flight operations department to supplement its own crew manual
- can be issued directly to crew members for training and subsequently for line operations.

WARNINGS, CAUTIONS AND NOTES

WARNING : an operating procedure, technique, etc, which may result in personel injury or loss of life if not carefully followed.
CAUTION : an operating procedure, technique, etc, which may result in damage to equipment if not carefully followed.
NOTE : an operating procedure, technique, etc, considered essential to emphasize.

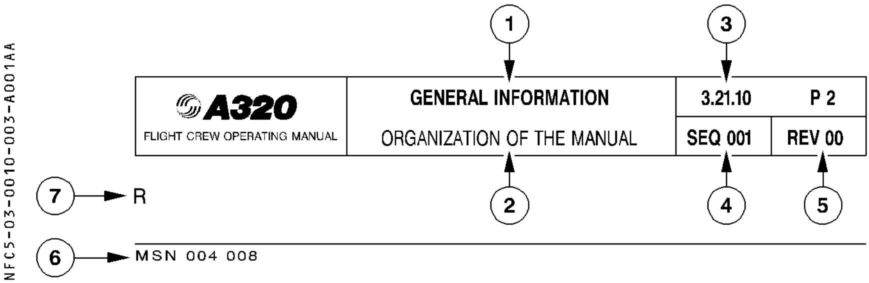
COMPLEMENTARY INFORMATION

The manual includes technical information required for training as well as complementary information.
- Where a paragraph or schematic is preceded by the heading FOR INFO the details given are considered to be "nice to know". Knowledge of these items is not required for the type rating qualification.
- ECAM warnings and cautions are summarized in a table at the end of each chapter of volume 1. Numeric values are given for information only.

OPTIONAL EQUIPMENT

The legend "◁*" indicates that a paragraph or a shematic is applicable only if the related equipment is installed.

PAGINATION



(1) Chapter title

(2) Subchapter title

(3) FCOM volume number, Chapter number, Section number, Page number

(4) Sequence number is used for Airbus Industrie management of different aircraft configurations and allows to enter into list of effective pages

(5) Revision number of the manual at which the page has been revised

(6) Aircraft MSN
- 004 008 means that the page is applicable to aircraft MSN 004 and MSN 008
- 010-014 means that the page is applicable to aircraft MSN 010 to MSN 014
- ALL means that the page is applicable to all aircraft covered by the manual.

Correspondance between MSN and registration may be found in the cross reference table

(7) An “R” in front of a line indicates that the line has been revised.

REVISIONS

NORMAL REVISIONS

There are issued periodically to cover non-urgent corrections and changes, and to add new data.
They are accompanied by filing instructions and an updated List of Effective Pages that includes customized pages.
A normal revision record sheet is at the front of each volume.
In addition, each volume has a “List of MOD/MP affecting the manual”, that gives a simple explanation of the technical content of each MOD/MP incorporated and its validity per aircraft.

TEMPORARY REVISIONS

Printed on yellow paper these are, issued to cover urgent matters arising between normal revisions. They are accompanied by filing instructions and an updated customized list of effective TR.
A yellow temporary revision record sheet is at the front of each volume.

INCORPORATION OF SERVICE BULLETINS IN THE MANUAL

When a Service Bulletin (SB) has been accomplished on one or more aircraft of the operator fleet, and notified to Airbus Industrie, all affected manuals will reflect the new aircraft configuration at next following revision. If judged necessary by Airbus Industrie, or requested by the operator, a “Temporary Revision” is issued between formal revisions.

OPERATIONS ENGINEERING BULLETINS

These are issued as the need arises to give operators revised or new, but significant, technical and procedural information.
OEBs come with an OEB record sheet. This record sheet is re-issued with each normal revision to update the bulletin embodiment status.
They are accompanied by filling instructions and an updated customized list of effective OEB.

HOW TO INSERT A REVISION

FILING INSTRUCTIONS

Use the filing instructions as follows :
- REMOVE : The page must be removed. It may be replaced by a new page if associated with an "INSERT" instruction. If not, the page is cancelled.
- INSERT : The page must be inserted. If not associated with a "REMOVE" instruction, the page is new for the operator fleet and does not replace an existing one.

The column "NOTE" indicates the reason for change. It states "EFFECTIVITY CHANGE ONLY" if the page is only revised due to effectivity change and not due to technical content.

LIST OF EFFECTIVE PAGES (LEP)

The manual after revision must comply with the LEP, which lists all the pages that are in the manual. The new pages are indicated by "N" and the revised pages by "R".

BEST WAY TO GET UPDATED DOCUMENTATION

The best way to ensure timely receipt of getting correct updated documentation is to advise :
AIRBUS INDUSTRIE
BP 33
31707 BLAGNAC CEDEX
FRANCE
Telex : TLSBP7X.. or 530526F
FAX 33.61.93.28.06
ATTN : Customer Service Directorate – Technical Documentation Services (AI/SE – D) as soon as any change has been completed on any airplane.

To simplify automatic LEP processing some modifications have been grouped under a common code.

CODE	DESIGNATION
0002	Mod : (21678+26377) = (21678+26999) = (21678+26377+26999)
0003	Mod : (22013+26017+26401) = (22013+25410+26017+26401)
0004	Mod : (21946+24624) = (21946+26169) = (21946+26169+30299) = (21946+26169+30299+31285)
0005	Mod : (24917+25335+25410+26017+26401) = (24917+25410+26017+26401+27276)
0006	Mod : 22013+23208+24077+26017+26401
0007	Mod : 30748+56-5-B3 = V2533 = (24105+30748)
0008	Mod : 26377 = 26999 = (26377+26999)
0009	Mod : (26270+31897) = (26117+31896) = (26117+31897) = (26270+31896) = (27866+31896) = (27866+31897) = (26851+27866+31896) = (25529+27866+31896) = (25529+27866+31897) = (25529+27866+32475) = (25529+26185+27866+31897) = (25529+27866+31896+32402)
0010	Mod : (23108+27276) = (23109+27276) = (23871+27276)
0011	Mod : (21054+22013+25199) = (21054+22013+25200)
0012	Mod : (22461+23426) = (22461+23943) = (23408+23426) = (23408+23943)
0013	STD = IAE V2500 = Mod : 25404 = 26017
0014	Mod : (22249+24215) = (22249+24588) = (22249+25534) = (22249+24588+25534) = (22249+24215+24588+25534)
0015	Mod : (23222+23871) = (24105+26057) = (23222+24105+26057)
0016	Mod : (21038+24064+24105+25199) = (21039+24066+24105+25200)
0017	Mod : (23108+30748)+V2500 = (23109+30748)+V2500 = (23408+30748)+V2500
0020	Mod : 26017+CFM 56-5-B1 = B2 = B3 = B4 = B5 = B6 = B7
0021	Mod : 25053 = 26338+CFM 56-5-A1 = A3 = A4 = A5
0022	Mod : 25871 = 25887 = 25893 = 26338 = (25887+26338)
0023	Mod : 25205 = (25205+26000) = (26000+26999) = (26000+28382) = (26001+30241) = (24105+26002+26999) = (25205+26000+26002) = (25205+26000+26999) = (26000+26999+28382) = (22013+25205+26000+26002) = (22013+26000+26002+28382) = (22013+26001+28218+30241) = (24105+26000+26002+26999) = (24105+26000+26002+28382) = (24105+26001+28218+30241) = (22013+26000+26001+26002+26999) = (22013+26000+26002+26999+28218) = (24105+26000+26002+26999+28218) = (22013+26000+26002+26999+28218+28382) = (24105+26000+26002+26999+28218+28382)
0025	Mod : (26017+26377) = (26017+26999) = (26017+26377+26999)
0026	Mod : 20268 = (20268+25800)
0027	Mod : 25720 = 26609 = (25720+26609)
0028	Mod : (26002+26111) = (26002+26999) = (26002+28382) = (22013+28218+30241) = (24105+28218+30241) = (26001+28218+30241) = (26002+26999+28218) = (26002+26999+28382) = (26002+28218+28382) = (22013+26111+26999+28218) = (24105+26002+26999+28218) = (24105+26002+28218+28382) = (26000+26002+2699928218) = (26000+26002+28218+28382) = (26002+26111+26999+28218) = (26002+26111+28218+28382) = (26002+26999+28218+28382) = (24105+26002+26999+28218+28382) = (26111+28218) = (24105+26002+26111) = (26002+26111+28218) = (22013+26002+26111+28218)
0029	Mod : (20024+22013+24613+26017) = (20024+22013+24613+26017+25410)
0030	Mod : (20024+22013+26017) = (20024+22013+25410+26017)
0031	Mod : (20024+26017) = (20024+25410+26017)
0032	STD = Mod : 20057 = 20059 = 30020 = (20057+20059)

	CODE	DESIGNATION
	0034	Mod : 22013+24511+25410+26017+26401
	0035	Mod : 20057+20059+20067+20069+20071
	0036	Mod : 21988 = (21988+22013) = (21988+24105)
	0037	Mod : 20059+20067+20069+20071+21708
	0038	Mod : 25205 = 26093 = 26111 = 26243 = (25205+26093) = (25205+26243) = (25205+27831) = (26093+26111) = (26111+26243) = (26111+26799) = (26111+27831) = (25205+26093+26799) = (26111+26243+27831)
R R	0039	Mod : (25404+28479) = (25404+28916) = (25404+26017+28479) = (25404+26017+28916) = (25404+28702) = (25404+26017+28702)
	0040	Mod : 20057+20059+20067+20069+20071+21708
	0041	Mod : (21678+26377) = (21678+26999) = (21678+26377+26999)
	0042	Mod : 24064 = 24065 = 24066 = 24067 = (24066+24067)
	0043	Mod : 26608 = (25357+26608) = (26149+26608) = (25357+25596+26608) = (25357+26149+26608) = (25596+26149+26608) = (25357+25596+26149+26608+IAE V2522 = V2524 = V2527 = V2527E = V2530 = V2533) = (25357+25596+26149+26608+27088+IAE V2522 = V2527 = V2527E = V2530 = V2533)
	0044	Mod : 26149 = 26608 = (26149+26608)+IAE V2522 = V2524 = V2527 = V2527E = V2530 = V2533
	0045	Mod : (21964+22013) = (21964+26334) = (21964+26335) = (21964+24105)
	0046	Mod : 23661 = 24783 = (23661+24783)
	0047	Mod : (20024+22013+26017) = (20024+22013+25410+26017)
	0049	STD = Mod : 25410 = 26017 = (25410+26017)
	0050	Mod : (25871+26017) = (25887+26017) = (25893+26017) = (26017+26149) = (26017+25871) = (25410+25871+26017) = (25410+25887+26017) = (25410+25893+26017) = (25410+26017+26149) = (25410+26017+26338) = (26017+26149+26608) = (25410+26017+26608) = (25410+25871+25893+26017) = (25410+25887+26017+26338) = (25410+26017+26149+26608) = (25410+25893+26017+26149+26608)
	0051	STD = Mod : 25072 = 27609 = (22562+25072) = (24667+25072) = (25888+27609) = (22562+24667+25072) = (22562+24955+25072)
	0052	STD = Mod : 22562 = 25072 = (22562+25072)
	0053	Mod : (28160+28479) = (28160+28916)
	0054	Mod : 24349 = 24785 = 24852 = (23779+24349) = (23779+24785) = (23779+24852) = (23779+24349+24785) = (23779+24785+24852)
	0055	Mod : 27112+27770+CFM 56-5-A4 = A5 = B5 = B6 = IAE V2522 = V2524
	0056	Mod : (21038+22013+24064) = (21039+22013+24066)
	0057	Mod : 25649 = (24178+25649)
	0058	Mod : 23219 = 25294 = 30400 = (23672+25294) = (23672+25294+25336)
	0059	Mod : (22013+26057) = (22013+23222+26057)
	0060	Mod : 22562+IAE V2522 = V2524 = V2527 = V2527E = V2527M = V2530 = V2533
	0061	Mod : (23108+27276) = (23109+27276) = (23408+27276) = (23871+27276+CFM 56-5-A1 = A3) = (23109+23408+27276) = (23108+23109+23408+27276)
	0062	Mod : 20075 = 20219 = 21776 = 24266 = 24267 = 31006 = (20075+20219)
	0063	Mod : 22536 = 23227 = 23529 = (22536+23529)
	0064	Mod : 25615+27276+30748+CFM 56-5-B4 = IAE V2527 = V2527E
	0065	Mod : (23108+20139+27276) = (23109+20139+27276) = (23408+20139+27276)+V2500A1
	0066	Mod : 26017 = (25410+26017) = (22013+24044+26017) = (22013+24404+25410+26017)

CODE	DESIGNATION
0067	Mod : (22249+25529) = (22249+26117) = (22249+26270)
0068	Mod : (22249+25529+26017) = (22249+26117+26017) = (22249+26270+26017)
0069	Mod : (27276+30748)+IAE V2500 = CFM 56-5-A1 = A3
0070	Mod : (22249+25529+26401+26017) = (22249+26117+26401+26017) = (22249+26270+2641+26017)
0071	Mod : 25888 = (22562+25072+25888)+IAE V2522 = V2524 = V2527 = V2527E = V2530 = V2533
0072	Mod : 22562 = 24498 = 24642 = 25568 = 25888
0073	Mod : 27942 = (23264+23900+27942)+CFM 56-5-B4 = IAE V2527E
0074	Mod : 23264 = (22269+23264+CFM 56-5-A3) = (22461+23264+IAE V2500)
0075	CFM 56-5-B4 = IAE V2527 = V2527M = (23108 = 23109 = 23871+CFM 56-5-B4 = IAE V2527 = V2527E)
0076	Mod : (20139+23108) = (20139+23109) = (20139+23408)+V2500
0077	Mod : (22562+28897) = (22562+24955+28897)
0078	Mod : 28160 = (22562+28160) = (25072+28160) = (22562+25072+28160)
0079	Mod : (22013+24064+24385+25199) = (22013+24066+24386+25200)
0081	Mod : (21678+22013) = (21678+24105) = (21678+28160)
0082	Mod : (20031+26723) = (20047+20063+27410) = (20063+27639) = (20047+20063+27639) = (20047+20063+26723)
0083	Mod : 20139+22129+22461+23408+23426+23943
0085	Mod : 23219 = 23672 = 24579 = 24581
0086	Mod : 25888 = (22562+25888) = (25072+25888) = (25888+30784) = (22562+24955+25888) = (22562+25072+25888) = (22562+24955+25072+25888)
0087	Mod : 27777 = (26608+27777) = (25357+26608+27777) = (26149+26608+27777) = (25357+25596+26149+27777) = (25357+25596+26608+27777) = (25357+26149+26608+27777) = (25596+26149+26608+27777) = (25357+25596+26149+26608+27777) = (25357+25596+26149+26608+27088+27777)+IAE V2522 = V2524 = V2527 = V2527E = V2527M = V2530 = V2533 = (25357+25596+26149+27088+27777)+IAE V2533
0088	STD = Mod : 25410 = 26017 = 26149 = (25410+26017)
0089	STD = Mod : 22190 = (20056+22190)
0090	Mod : 28053+CFM 56-5-A4 = A5 = B5 = B6 = IAE V2522 = V2524
0091	Mod : (22013+24404) = (22013+24405) = (22013+25530) = (24404+25951) = (24405+25951) = (25530+25951)+CFM
0092	STD = Mod : (24105+31896) = (24105+31897)
0093	STD = Mod : 25072 = (22562+25072) = (25888+27609)
0094	Mod : 28479 = 28916 = (26017+28916) = (28160+28479+28917) = (28160+28916+28917) = (25410+26017+28916)+CFM
0095	Mod : (24349+26526) = (23779+24349+26526) = (23779+24785+26526) = (23779+24852+26526) = (23779+24349+24785+26526) = (23779+24785+24852+26526)
0096	Mod : (26111+28244) = (26999+28244) = (28244+28382) = (25205+28244) = (28244+30241) = (26111+26999+28244) = (26111+28244+28382) = (26999+28244+28382) = (25205+26999+28244+28495) = (26999+28244+28382+28495)
0097	Mod : (25053+26017) = (25053+26338) = (26017+26338) = (25053+26017+26338)
0098	Mod : (25404+25410) = (25404+26017) = (25404+25410+26017+28160+28917)
0099	IAE V2522 = V2524 = V2527 = V2527E = V2527M = V2530 = V2533
0100	Mod : (22562+28160+28479) = (22562+28160+28916) = (25888+28160+28479) = (25888+28160+28916)

	CODE	DESIGNATION
	0101	Mod : (24917+26017) = (24917+25410+26017)
	0102	CFM 56-5-A1 = A3 = A4 = A5 = CFM 56-5-A4 = A5+US
	0103	IAE V2500 = V2522 = V2524 = V2527 = V2527E = V2527M
	0104	Mod : (21678+26017) = (20117+21678+26017)
	0105	Mod : 24871 = (24871+25410) = (24871+26017) = (24871+25410+26017)+IAE
	0106	Mod : 25410 = 26017 = (25410+26017)+CFM
	0107	STD = Mod : (22562+25072)+IAE V2522 = V2524 = V2527M
	0108	IAE V2500 = V2527 = V2527E = IAE V2500 = V2527 = V2527E+L
	0109	IAE V2522 = V2524 = CFM 56-5-A4 = A5 = B5 = B6
	0110	Mod : (23208+24077+25410) = (23208+24077+26017) = (23208+24077+25410+26017)
	0111	Mod : (21678+21858) = (20117+21678+21858)
	0112	Mod : (22013+26017) = (22013+25410+26017)
	0113	Mod : 26149 = 26608 = (26149+26608) = IAE V2522 = V2524 = V2527 = V2527E = V2527M = V2530 = V2533
R	0114	Mod : (20024+24613+25410) = (20024+24105+24613+25410)
R	0115	IAE V2500 = V2522 = V2524 = V2527 = V2527E = V2527M = (V2500 = V2522 = V2524 = V2527 = V2527E = V2527M+US) = (26346+IAE V2500 = V2524 = V2527 = V2527M)
	0116	Mod : 25871 = 25887 = 25893 = 26149 = 26338 = 26608 = (26149+26608)
	0117	STD = IAE = Mod : 26017 = (26017+IAE)
	0118	STD = Mod : 25410 = 26017 = (25410+26017)
	0120	CFM 56-5-A1 = A3 = B4 = IAE V2500 = V2527 = V2527E
	0121	Mod : 25419 = 27992 = (27992+28377) = (25419+26963+27992)
	0122	Mod : (22249+24215+24588+25529) = (22249+24215+24588+26117) = (22249+24215+24588+26270) = (22249+24215+24588+26117+26270)
	0123	STD = Mod : 31897 = 31896 = (22013+20586+28652)
	0124	Mod : (20024+25410) = (20024+24105+25410)
	0126	Mod : (21678+25410) = (20117+25410) = (21678+20117+25410)
	0127	Mod : 28479 = 28916 = (26017+28479) = (26017+28916) = (25410+26017+28479) = (25410+26017+28916)
	0128	Mod : 22013 = (22013+27846) = (22013+28960) = (22013+28479) = (22013+28916) = (22013+28479+28960) = (22013+27846+28916)
	0130	Mod : 26111 = 30631 = 30635 = 26485 = (26999+28218) = (28382+28218) = (30241+28218) = (30631+28218) = (30635+28218) = (24105+26111) = (22013+26111) = (22013+26999+28218) = (22013+28382+28218) = (22013+30241+28218) = (22013+30631+28218) = (22013+30635+28218) = (24105+26999+28218) = (24105+28382+28218) = (24105+30241+28218) = (24105+30631+28218) = (24105+30635+28218)
	0131	Mod : 25205 = 30631 = 30635 = 26485 = (26999+26001) = (28382+26001) = (30241+26001) = (30631+26001) = (30635+26001) = (24105+25205) = (22013+25205) = (24105+25205+26002) = (22013+25205+26002) = (24105+26999+26001+26002) = (24105+28382+26001+26002) = (24105+30241+26001+26002) = (24105+30631+26001+26002) = (24105+30635+26000+26002) = (22013+26999+26001+26002) = (22013+28382+26001+26002) = (22013+30631+26001+26002) = (22013+30635+26001+26002)
	0134	Mod : (20047+26723) = (20047+27410) = (20047+30277)
	0135	Mod : (25404+28479) = (25404+28916) = (25404+28160+28479+28917) = (25404+28160+28916+28917)
	0136	Mod : (22269+CFM 56-5-A3) = (22269+22461+IAE V2500) = (22269+26058+CFM 56-5-A3) = (22269+22461+26058+IAE V2500)

	CODE	DESIGNATION
	0137	Mod : 20063 = (20031+20047) = (20047+20063)
	0138	Mod : (20047+20151) = (20047+23092) = (20063+20151) = (20047+20063+20151) = (20047+20063+23092) = (20047+20063+31112)
	0139	Mod : 25328+CFM 56-5-A4 = A5 = B5 = B6 = IAE V2522 = V2524
	0140	Mod : 26457+CFM 56-5-A4 = A5 = B5 = B6 = IAE V2522 = V2524
	0141	Mod : (23264+23900) = (22269+23264+23900)
	0142	Mod : 27112+CFM 56-5-A4 = A5 = B5 = B6 = IAE V2522 = V2524
	0143	Mod : 21054 = (21054+25199) = (21054+25200)
	0144	Mod : 24404 = 24405 = 27640
	0145	Mod : 24404 = 24405 = 25530 = 27640
	0146	Mod : (25404+26017) = (25404+25410+26017) = (25404+25410+26017+28160+28917)
	0147	Mod : (22269+23900+IAE V2527) = (22269+23900+26058+IAE V2527)=(23900+26058+IAE V2527)
	0149	IAE V2522 = V2524 = V2527 = V2527E = V2530 = V2533
R	0150	Mod : (22013+28479) = (22013+28916)+IAE = CFM
R	0151	Mod : (22013+26401+25404+28479) = (22013+25404+26401+28916)
	0153	Mod : (21678+21706+21766+27498+28479) = (21678+21706+21766+27498+28702) = (21678+21706+21766+27498+28916)
	0154	Mod : (21678+21706+21768+27498+28479) = (21678+21706+21768+27498+28702) = (21678+21706+21768+27498+28916)
	0155	Mod : (21678+21766+21767+27498+28479) = (21678+21766+21767+27498+28702) = (21678+21766+21767+27498+28916)
	0156	Mod : (21678+21706+21766+21768+27498+28479) = (21678+21706+21766+21768+27498+28702) = (21678+21706+21766+21768+27498+28916)
	0157	Mod : (21678+21706+21766+21767+21768+27498+28479) = (21678+21706+21766+21767+21768+27498+28702) = (21678+21706+21766+21767+21768+27498+28916)
	0158	Mod : (22013+26401+28479) = (22013+26401+28916) = (22013+26017+26401+28479) = (22013+26017+26401+28916)
	0159	Mod : (24511+28479) = (24511+28916) = (24511+26017+28479) = (24511+26017+28916) = (24511+25410+26017+28479) = (24511+25410+26017+28916)
	0160	Mod : (22013+24511+28479) = (22013+24511+28916) = (22013+24511+26017+28479) = (22013+24511+26017+28916) = (22013+24511+25410+26017+28479) = (22013+24511+25410+26017+28916)
	0161	Mod : (24105+24511+28479) = (24105+24511+28702) = (24105+24511+28916) = (24105+24511+25410+26017+28479) = (24105+24511+25410+26017+28702) = (24105+24511+25410+26017+28916)
	0162	Mod : (22013+24511+26401+28479) = (22013+24511+26401+28916) = (22013+24511+25410+26017+26401+28479) = (22013+24511+25410+26017+26401+28916)
	0163	Mod : (24105+28479) = (24105+28702) = (24105+28916) = (24105+26017+28479) = (24105+26017+28702) = (24015+26017+28916) = (24105+25410+26017+28479) = (24105+25410+26017+28702) = (24015+25410+26017+28916)
	0166	Mod : 28479 = 28702 = 28916 = (25951+28702) = (26017+28479) = (26017+28702) = (26017+28916) = (22013+24044+28479) = (22013+24044+28916) = (25410+26017+28479) = (25410+26017+28702) = (25410+26017+28916) = (25951+26017+28702) = (22013+24044+26017+28479) = (22013+24044+26017+28916) = (25410+25951+26017+28702) = (22013+24044+25410+26017+28479) = (22013+24044+25410+26017+28916)
R	0167	Mod : (22013+28479) = (22013+28916) = (25951+28479) = (25951+28916)

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0168	Mod : (22013+25205) = (22013+26111) = (22013+26999) = (22013+28382) = (22013+30631) = (22013+30635) = (22013+26485)
0169	Mod : 25888 = (22562+25888) = (22562+25072+25888)
0170	Mod : (21038+24617+25199) = (21038+24617+25314) = (21038+24617+27780) = (21038+24064+24617+25199) = (21038+24065+24617+25314) = (21038+24065+24617+25314+27780+28416)
0172	Mod : (24064+26526) = (24065+26526) = (24066+26526) = (24067+26526) = (24065+24067+26526) = (24066+24067+26526)
0174	Mod : 28479 = 28702 = 28916 = (25410+28479) = (25410+28702) = (25410+28916)
0175	Mod : (21678+27498+28479) = (21678+27498+28702) = (21678+27498+28916)
0176	Mod : (21768+27498+28479) = (21768+27498+28702) = (21768+27498+28916)
0177	Mod : (21678+21706+27498+28479) = (21678+21706+27498+28702) = (21678+21706+27498+28916)
0178	Mod : (21678+21766+27498+28479) = (21678+21766+27498+28702) = (21678+21766+27498+28916)
0181	Mod : 28136 = 32217+CFM 56-5-A4 = A5 = B5 = B6 = IAE V2522 = V2524
R R 0183	Mod : 24105 = (24105+27846) = (24105+27846+28916) = (24105+27846+28479) = (24105+27846+28702)
0184	Mod : 21678+21706+21766+21767+21768
0185	Mod : 21678+21706+21766+21767+21768+21858
0186	STD = Mod : 26018 = (22707+26018)
0187	CFM = Mod : 24044 = 28307 = (24105+CFM 56-5-B4) = (25530+CFM 56-5-B6) = (24404+28307) = (24405+28307) = (25530+28307) = (22013+24044+28307+CFM)
0188	STD = Mod : 20062+22188
0189	Mod : 24035 = 24160 = 24211 = (24035+24211)
0190	Mod : (22013+26017) = (22013+25410+26017)
0191	Mod : (26017+26334) = (26017+26335) = (25410+26017+26334) = (25410+26017+26335)
0193	Mod : 26851 = (25529+26185) = (25529+26208) = (25529+26345) = (25529+26851)
0195	Mod : 25240 = 25274 = 28283 = 28711 = (25240+28238+28719) = (25274+28238+28719) = (28238+28283+28719) = (28238+28711+28719)
0196	Mod : (21039+24066) = (21039+24067) = (21039+23893+24067) = (21039+24066+24067) = (21039+24066+25200) = (21039+24067+25200) = (21039+23893+24066+25200) = (21039+24066+24067+25200)
0197	STD = Mod : 28037 = (22013+24044)
0198	Mod : 26017 = (23208+24077+26017) = (22013+23208+24077+26017) = (23208+24077+24105+26017)
0199	Mod : 25205 = 26111 = 26999 = 28382 = 30241 = 30631 = 30635 = 26485 = (26999+28382+28495) = (24075+24077+26999+28495)
0200	Mod : 23208 = 24077 = (23208+24077) = (22013+23208+24077) = (23208+24077+24105)
0201	Mod : 21678+21706+21766+21768+21858
0202	Mod : 25205 = 26111 = 26999 = 28382 = 30241 = (26111+26999) = (26999+28244+30170) = (26999+28244+28382+28495+30170)
0204	Mod : (23264+23900+CFM 56-5-A3) = (22461+23264+23900+IAE V2500) = (22269+23264+23900+CFM 56-5-A3) = (22269+22461+23264+23900+IAE V2500)
0205	Mod : 26876 = 26877 = 27698 = 27740 = 27753 = 28739 = 30163 = 28738 = 31001 = 31699

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R	0207	Mod : (25404+28160+28479) = (25404+28160+28916)
R	0209	Mod : 22562+25072+28160
	0210	Mod : (23219+30206) = (23672+30206) = (24579+30206) = (24581+30206) = (23219+23672+30206) = (23219+23672+24579+30206)
	0211	Mod : 26716 = 26799 = 26968 = 27780 = 27831 = 27832 = (26093+26799) = (26243+27831)
	0212	Mod : (20966+CFM 56-5-A3) = (20966+22461+IAE V2500)
	0213	Mod : 23219 = 23672 = 24579 = 24581 = (23219+23672) = (23219+23672+24579)
	0214	Mod : (23900+CFM 56-5-A3) = (22461+23900+IAE V2500)
	0215	Mod : 25205 = 26111 = 26999 = 28382 = 30241 = (25205+26999+28495) = (26999+28382+28495)
	0217	Mod : (21532+CFM 56-5-A3) = (21532+22461+IAE V2500)
	0218	Mod : (22269+23900+CFM 56-5-A3) = (22269+22461+23900+IAE V2500)
	0221	Mod : (22013+25415+28479) = (22013+25415+28916)
	0222	STD = Mod : 20067+20069+20071+28474+28478
	0223	Mod : 22562 = (22562+CFM 56-5-A1 = A3 = A4 = A5 = B1 = B3 = B4 = B5 = B6 = B7 = IAE V2500) = (22562+25888+27609+CFM 56-5 B4)
	0224	Mod : (22562+30051) = (24498+30051) = (24642+30051) = (25568+30051) = (25888+30051)
	0225	Mod : (22013+28479) = (22013+28916) = (22013+26017+28479) = (22013+26017+28916) = (22013+25410+26017+28479) = (22013+25410+26017+28916)
	0226	Mod : 25951+IAE V2500 = V2522 = V2527 = V2527E
	0227	Mod : (23264+23900) = (22269+23264+23900)
	0229	Mod : (26017+27276) = (24917+26017+27276) = (24917+25335+25410+26017) = (24917+25410+26017+27276)
	0230	STD = Mod : (22553+22889+25081+CFM 56-5-A1 = A3) = (22553+22889+25138+CFM 56-5-A1 = A3) = (22553+22889+25411+CFM 56-5-A1 = A3) = (22553+22889+26577+CFM)
	0231	Mod : (24917+25335+25410) = (24917+25410+27276)
	0232	STD = Mod : 25410 = 26017 = (25410+26017)
	0233	STD = Mod : (24917+25335) = (24917+27276)
	0234	Mod : (22013+28479+28960) = (22013+28721+28916) = (22013+28916+28960) = (22013+24588+28479+28721) = (22013+24588+28479+28960) = (22013+24588+28479+32011) = (20406+22013+23450+28479+28960) = (20406+22013+23450+28916+28960)
	0235	Mod : (21678+21858+26017) = (20117+21678+21858+26017)
	0236	Mod : 28479 = 28916 = (26017+28479) = (26017+28916)
	0237	Mod : (26017+28160+28479) = (26017+28160+28916) = (25410+26017+28160+28479) = (25410+26017+28160+28916)
R	0238	STD = Mod : (28160+28413) = (28160+28917) = (28160+28413+28917)
R	0239	Mod : (21678+21706) = (21678+21706+27498)
	0240	Mod : (21678+21706+21766) = (21678+21706+21766+27498)
	0241	Mod : (21678+21706+21768) = (21678+21706+21768+27498)
	0242	Mod : (21678+21766+21767) = (21678+21766+21767+27498)
	0243	Mod : (21678+21706+21766+21767+21768) = (21678+21706+21766+21767+21768+27498)
	0244	Mod : (21678+26017) = (21678+26017+28160+28917)
	0245	Mod : (21678+21858+24105+26017) = (20117+21678+21858+24105+26017)

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	0247	Mod : (20059+20084) = (30020+30066) = (20057+20059+20084)
	0248	Mod : 24035 = 24160 = 24189 = (24035+24612) = (24160+24612) = (24189+24612)
	0249	STD = Mod : 26346 = (26346+CFM 56-5-A1 = A3 = IAE V2500 = V2527) = (26346+FAA)
	0250	Mod : (22013+27846+28479+28960) = (22013+27846+28916+28960) = (22013+27846+28479+28721) = (22013+27846+28916+28721) = (22013+27846+28479+32011) = (22013+27846+28916+32011)
	0251	Mod : 24064 = 24065 = 24066 = 24067 = (24064+26346+US) = (24065+26346+US) = (24066+26346+US) = (24067+26346+US)
	0254	Mod : (22562+24667) = (22562+24955) = (22562+24667+24955)
	0255	Mod : (23742+24064+US) = (23742+24065+US) = (23742+24066+US) = (23742+24067+US)
	0258	STD = Mod : (22013+25199) = (22013+25200)
	0260	STD = Mod : 25072 = (22562+25072) = (25888+27609)+IAE V2522 = V2524 = V2527 = V2527E = V2527M = V2530 = V2533
	0261	Mod : (21533+23222) = (21533+26057) = (21533+23222+26057)
	0262	Mod : (24105+26057) = (23222+24105+26057)
	0263	(CFM 56-5-A1 = A3 = B4) = (CFM 56-5-A1 = A3 = B4+L)
	0264	Mod : 27698 = 27740 = 27753 = 28739 = 30163 = 28738 = 31001 = 26877 = 26876 = 31699 = (22536+27698) = (23227+28739) = (23529+27698) = (23529+27740) = (23529+27753) = (22536+30163) = (23227+27740)
	0271	Mod : (27498+28479) = (27498+28702) = (27498+28916)
	0273	Mod : 25357 = 25596 = (25357+25596)+IAE V2522 = V2524 = V2527 = V2527E = V2530 = V2533
	0274	Mod : 26149 = (25357+26149) = (25596+26149) = (25357+25596+26149)+IAE V2522 = V2524 = V2527 = V2527E = V2530 = V2533
	0275	STD = Mod : (28160+28917) = (25072+28160+28917) = (22562+25072+28160+28917)
	0276	STD = Mod : 28479 = 28916 =27846 = (27846+28479) = (27846+28916)
R	0277	Mod : 28238 = (27846+28238) = (27846+28238+28479) = (27846+28238+28916) = (27846+28238+28702)
	0279	Mod : (21678+22013+26017) = (21678+22013+25410+26017)
R	0280	Mod : (24105+25404+25410+26017+28479) = (24105+25404+25410+26017+28702) = (24105+25404+25410+26017+28916) = (25404+25410+26017+28916+30020)
	0292	Mod : 25410 = 26017 = (25410+26017) = (25410+26017+28160+28917)
	0293	Mod : 26017 = (25410+26017) = (25410+26017+28160+28917)
R	0294	STD = Mod : 23450 = 24588 = (20406+23450) = (23450+24588) = (20406+23450+24588) = (20406+23450+24588+28916)
	0296	Mod : (22013+24588) = (22013+23450+24588) = (20406+22013+23450+24588)
	0306	Mod : (23208+24077+24105+25410) = (23208+24077+24105+25410+26017)
	0307	Mod : (22013+23208+24077+25410) = (22013+23208+24077+26017) = (22013+23208+24077+25410+26017)
	0309	Mod : (22013+26017) = (22013+25410+26017)
	0310	Mod : (24105+26017) = (24105+25410+26017)
	0311	Mod : (25410+25871) = (25410+25887) = (25410+25893) = (25410+26338)
	0312	Mod : (25871+26017) = (25887+26017) = (25893+26017) = (26017+26338) = (25410+25871+26017) = (25410+25887+26017) = (25410+25893+26017) = (25410+26017+26338) = (25410+25871+25893+26017) = (25410+25887+26017+26338)

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0313	Mod : (26017+26149) = (25410+26017+26149)
0314	Mod : 25410 = 26017 = (25410+26017)
0315	Mod : 22562 = (22562+28160+28917)
0316	Mod : (24511+26017) = (24511+25410+26017)
0317	Mod : 25241 = 25242 = (25241+25242)
0318	CFM 56-5-A1 = A3 = A5 = B2 = B3 = B4 = B5 = B6 = B7 = Mod : 25072 = (25072+CFM 56-5-A1 = A3) = (22562+25072) = (25888+27609) = (22562+25072+CFM 56-5-A1 = A3 = B3 = B4)
0319	STD = Mod : 25072 = 27609 = (22562+25072) = (25888+27609)
0320	Mod : 21533 = (21533+25072) = (21533+22562+25072) = (21533+25888+27609)
0321	Mod : (26149+27777) = (26149+26608+27777)
0322	IAE V2500 = V2522 = V2524 = V2527 = V2527E = V2527M
0326	Mod : (24511+25410) = (24105+24511+25410)
0327	Mod : (20024+24613+26017) = (20024+24613+25410+26017)
0333	STD = Mod : (20024+22013) = (20024+22013+US)
0335	Mod : (21038+27780) =(21038+24064+25199) = (21038+24064+27780) = (21038+24065+25314) = (21038+24065+27780) = (21038+24065+28416) = (21038+25314+27780) = (21038+25314+28416) = (21038+27780+28416) = (21038+24065+25314+27780) = (21038+24065+27780+28416) = (21038+24064+24065+25199+25314) = (21038+24065+25314+27780+28416)
0340	Mod : (20406+22013+28479+28960) = (20406+22013+28721+28916) = (20406+22013+28916+28960)
0341	Mod : 25205 = 26111 = 26999 = 28382 = 30241 = 30631 = 30635 = 26485 = (24105+25205) = (24105+26111) = (24105+26999) = (24105+28382) = (24105+30631) = (24105+30635) = (24105+26485) = (24105+28238+31897) = (24105+28238+31896)
0342	Mod : (22013+28479+32011) =(22013+27846+28479+28721) = (22013+27846+28479+28960) = (22013+27846+28721+28916) = (22013+27846+28916+28960)
0344	Mod : (24105+26017+26377) = (24105+26017+26999) = (24105+26017+26377+26999)
0345	Mod : (22013+26017+26377) = (22013+26017+26999) = (22013+26017+26377+26999)
0346	Mod : (21678+26377) = (21678+26377+26999)
0347	Mod : (21678+26017) = (21678+25410+26017)
0348	Mod : (20268+22461) = (20268+23408) = (20268+22461+23408)
0349	Mod : 23108 = 23109 = 23408 = (23109+23408) = (23108+23109+23408)
0350	Mod : (21678+25410) = (21678+26017) = (21678+25410+26017)
0351	Mod : (22013+26017) = (25951+26017) = (22013+25410+26017) = (25410+25951+26017)
0352	Mod : (22013+25410) = (22013+26017) = (24105+25410) = (26017+28160) = (26017+30020) = (22013+25410+26017) = (24105+25410+26017) = (25410+26017+28160)
0354	Mod : (23108+23222+25615+26398) = (23222+24105+25615+26398)
0355	Mod : (24105+26017) = (24105+25410+26017)
0356	Mod : (22013+26017) = (22013+25410+26017)
0357	Mod : (20059+20067+20069+20071) = (20059+20067+20069+20816+27063)
R R 0358	Mod : 22013 = 23108 = 23109 = 23408 = 23871 = 24105 = (23108+23109) = (23108+23109+23408)
0359	Mod : 23699 = 24281 = (23698+23699) = (23698+24281) = (23699+24281)

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	0360	Mod : (22013+23698) = (22013+23698+23699)
	0361	STD = Mod : 25410 = 26017 = (25410+26017)
	0362	Mod : (25415+28479) = (25415+28916) = (25415+28916) = MSN 0927
	0365	Mod : (20268+24404) = (20268+24404+25800) = (20268+25800+27727) = (20268+24404+25800+27727)
	0366	Mod : 20268 = (20268+25800) = (20268+24404+25502) = (20268+24404+25502+25800)
	0367	Mod : (20063+26723) = (20047+20063+20151+26723) = (20047+20063+20151+30277) = (20047+20063+20151+27763)
	0369	Mod : 23672 = 25108 = 25336 = 27917 = (23672+25336) = (25108+25336) = (23219+23672) = (23219+23672+25336)
	0370	Mod : 20268 = (20268+25800) = (20268+24405+25501) = (20268+24405+25501+25800)
	0379	Mod : (20268+24405) = (20268+24405+25800) = (20268+25800+27727) = (20268+24405+25800+27727)
	0380	Mod : (20268+25530) = (20268+25530+25800) = (20268+25800+27727) = (20268+25530+25800+27727)
	0381	Mod : (22013 = 25951+CFM) = (22013+28307+CFM 56-5-B2) = (25951+28307+CFM 56-5-B4)
R R R R	0382	Mod : 25529 = 26117 = 26270 = 27866 = (26851+27866) = (25529+26185+27866) = (25529+26208+27866) = (25529+26345+27866) = (26270+31896+32332) = (26270+31897+32333)+(27866+31897+32333) = (25529+27866+31896+32332)
	0383	Mod : 26526 = (24064+26526) = (24066+26526) = (24067+26526)
	0390	Mod : 20057+20067+20069+20071+21708
	0391	Mod : (25240+28238) = (25274+28238) = (28238+28711)
	0392	Mod : (26017+27276) = (25410+26017+27276)
R	0393	Mod : (21678+22013) = (21678+24105) = (21678+28160) =(21678+30020)
R	0394	Mod : (21678+22013) = (21678+24105) = (21678+28160)
R	0395	Mod : 31897 = 32929 = (31897+32333+32929)
R	0396	Mod : (23742+24064) = (23742+24065) = (23742+24066) = (23742+24067) = (23742+24064+26346+US) = (23742+24065+26346+US) = (23742+24066+26346+US) = (23742+24067+26346+US)
	0397	Mod : (20268+28238) = (20268+25800+28238)
	0398	STD = Mod : 26000 = 26002 = 28218 = (24105+26002) = (26002+28218) = (24105+26002+28218)
	0401	STD = Mod : 25072 = (22562+25072) = (28160+28917) = (25072+28160+28917) = (22562+25072+28160+28917)
	0403	Mod : 27650 = (24588+27650) = (24215+24588+27650)
	0407	Mod : (27650+28244+28382) = (26999+27650+28244+28382+28495)
	0413	Mod : 30310 = (24899+26600)
	0416	Mod : 20406 = (20406+24588) = (20406+24588+28916)
	0415	Mod : (20024+24105+24613+26017) = (20024+24105+24613+25410+26017)
	0417	Mod : 24105+25404+25410+26017
	0419	Mod : (28479+30363) = (28702+30363) = (28916+30363) = (25410+28479+30363) = (25410+28702+30363) = (25410+28916+30363)
	0420	Mod : (28238+30096) = (24105+26999+28238+30096)

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0421	Mod : (25205+30096) = (26111+30096) = (26999+30096) = (28382+30096) = (30096+30241) = (24105+25205+30096) = (24105+26111+30096) = (24105+26999+30096) = (24105+28382+30096) = (24105+25205+30096+28238+31896) = (24105+25205+30096+28238+31897) = (24105+26111+30096+28238+31896) = (24105+26111+30096+28238+31897) = (24105+30241+30096+28238+31896) = (24105+30241+30096+28238+31897) = (24105+26999+30096+28238+31896) = (24105+26999+30096+28238+31897) = (24105+28382+30096+28238+31896) = (24105+28382+30096+28238+31897)
0422	Mod : (22013+25205+30096) = (22013+26111+30096) = (22013+26999+30096) = (22013+28382+30096) = (22013+30096+30631) = (22013+30096+30635) = (22013+30096+26485)
0423	Mod : (25615+27276) = (23108+25615+27276)
0424	Mod : 27112+28238+28951
0425	Mod : 23264+23900+28547
0426	Mod : (21678+25404+26017+26377) = (21678+25404+26017+26999)
0427	Mod : 22013 = 23672 = 24105 = 24581 = 24785 = 25108
0429	MSN : 0002 = 0003 = 0004 = 0005 = 0006 = 0007 = 0008 = 0010 = 0011 = 0012 = 0013 = 0014 = 0016 = 0017 = 0018 = 0019 = 0020 = 0021
0430	MSN : 0163 = 0164 = 0168 = 0169 = 0179 = 0193 = 0221 = 0222 = 0230 = 0294 = 0299 = 0301 = 0338 = 0348 = 0349 = 0362 = 0363 = 0424 = 0429 = 0437 = 0444 = 0449 = 0476
0431	Mod : (24852+26858) = (25336+26858) = (26858+27917) = (26858+28218)
0432	Mod : (21678+22013+26377) = (21678+22013+26999) = (21678+22013+26379+26999)
0433	Mod : (21678+22013+25404+26017+26377) = (21678+22013+25404+26017+26999)
0434	Mod : 28258 = 30470 = 26438 = 27624 = 23888 = 25829 = 32015
0435	Mod : (21946+26169+30308) = (21946+26169+30299+30308)
0439	Mod : 31607 = 31701 = 31702+CFM 56-5-B3 = IAE V2533
0440	STD = (24105+31364) = (24105+31365) = (24105+31897) = (24105+31896)
0450	Mod : (28160+28479) = (28160+28916) = (28160+28479+22562+25072) = (28160+28916+22562+25072)
0451	Mod : 22562 = 25888 = (22562+28160+28917) = (25888+28160+28917)
0452	Mod : (28160+28479) = (28160+28916) = (22562+25072+28160+28479) = (28160+28916+22562+25072)
0453	Mod : (22562+28160+28479) = (22562+28160+28916)
0454	Mod : 25888 = (25888+28160+28917)
0455	Mod : (25888+28160+28479) = (25888+28160+28916)
0456	Mod : 28238 = (24105+2699+28238) = (24105+30631+28238) = (24105+30635+28238) = (24105+26485+28238)
0457	Mod : (26017+27276) = (25410+26017+27276)
0458	Mod : (20586+24105) = (20586+24105+28238)
0459	Mod : (22013+26057+26398) = (22013+23222+26398)
0460	Mod : (22269+23900) = (26058+23900)
0461	STD = Mod : (28238+31897) = (28238+31896)
0462	STD = Mod : 26963 = 28377 = 28667 = (25419+26963) = (25419+28667) = (27992+28377+28667) = (25419+26963+27992+28667) = (25419+26963+27992+28377)
0463	Mod : (22013+26017+27276) = (22013+26017+31395) = (22013+26017+27276+31395)
0464	Mod : (24105+26017+27276) = (24105+26017+27276+31395)

	CODE	DESIGNATION
R	0465	Mod : (26017+26334+27276) = (26017+26334+31395) = (26017+26335+27276) = (26017+26335+31395) = (26017+26334+27276+31395) = (26017+26335+27276+31395)
	0466	Mod : (26017+27276) = (26017+31395) = (26017+27276+31395)
R	0467	Mod : (21678+22013+30660) = (21678+24105+30660) = (21678+28160+30660) = (21678+30020+30660)
	0468	Mod : 22013 = (22013+25410) = (22013+25409+25410)
	0469	Mod : (25404+26017) = (25404+25410+26017) = (25404+25410+26017+28160+28917)
R	0470	0470 Mod : (25404+28479) = (25404+25410+26017+28916) = (25404+28160+28916+28917)+CFM = IAE
R	0471	Mod : (22013+25404+28916) = (22013+25404+28479)+CFM = IAE
R	0472	Mod : (25404+28479) = (25404+28916) = (25404+28160+28916+28917)+CFM = IAE
	0473	Mod : (26017) = (25410+26017) = (26017+25410+28160+28917)
	0474	Mod : (21678+26017) = (21678+25410+26017) = (21678+26017+25410+28160+28917)
	0475	Mod : (21678+22013+25410) = (21678+22013+25410+26017) = (21678+24105+25410+26017) = (21678+25410+26017+28160)
	0476	Mod : (21678+26999) = (21678+27646) = (21678+30631) = (21678+30635) = (21678+26485)
	0477	Mod : 26999 = 27646 = 30631 = 30635 = 26485
	0478	Mod : 31321 = (31321+31607) = (31321+31701) = (31321+31702)
	0479	Mod : 25820+30748+CFM 56-5-A1 = 56-5-A3 = IAE V2500
	0480	Mod : (23108+25820+30748) = (23109+25820+30748) = (23408+25820+30748)+IAE V2500
	0481	Mod : 23871+25820+30748+CFM 56-5-A1 = A3
	0482	Mod : 25820+30748+CFM 56-5-B4 = IAE V2527 = V2527E
	0483	Mod : (23108+25820) = (23109+25820) = (23408+25820)+V2500
	0484	Mod : 23871+25820+27276+30748+CFM 56-5-B4
	0485	Mod : 24178+31810+CFM 56-5-B1 = B2 = IAE V2530
	0486	Mod : 24899+31810+CFM 56-5-B1 = B2 = IAE V2530
	0487	Mod : 25649+31810+CFM 56-5-B1 = B2 = IAE V2530
	0488	Mod : 30334+31810+CFM 56-5-B1 = B2 = IAE V2530
	0489	Mod : 31810 = (26600+30310)+CFM 56-5-B1 = B2 = IAE V2530
	0490	Mod : (21678+26999) = (21678+21858+26377) = (21678+21858+26999) = (21678+26377+26999)
	0491	STD = (23219+23672+28785) = (ACA+23219+23672+28785)
	0492	Mod : (20268+28342) =(20268+25647+28342)
	0493	Mod : 30479 = (23900+30479)
	0494	Mod : 31896 = 31897 = (31896+26999+28495) = (31897+26999+28495)
	0495	Mod : 25205 = 26111 = 26999 = 28382 = 30241 = 31896 = 31897 = (25205+26999+28495+31896) = (25205+26999+28495+31897) = (26999+28382+28495+31896) = (26999+28382+28495+31897)
	0496	IAE V2500 = V2524 = V2527 = V2527M = V2527E = V2530 = V2533
	0497	Mod : (20059+20067+20069+20071) = (20059+20067+20069+20816+27063) = (20059+20067+20069+20071+32146)
	0498	Mod : (20067+20069+20071+32146) = (20057+20059+20067+20069+20071)

	CODE	DESIGNATION
	0499	Mod : (25404+26017+24035) = (25404+26017+24160) = (24189+25404+26017)
	0500	Mod : (25241+28138) = (25242+28138) = (25241+25242+28138)
	0501	Mod : (25241+26963) = (25242+26963) = (25241+25242+26963)
	0502	Mod : (25241+26963+28138) = (25242+26963+28138) = (25241+25242+26963+28138)
R	0503	Mod : (25205+28916) = (26111+28916) = (26485+28916) = (26999+28479) = (26999+28702) = (26999+28916) = (28382+28916) = (28916+30241) = (28916+30631) = (28916+30635) = (26999+28479+28495) = (26999+28382+28479+28495) = (26999+28382+28495+28702) = (26999+28382+28495+28916) = (24075+25205+26999+28495+28916) = (24075+26999+28495+28505+28916)
	0504	STD = Mod : (22013+24044) = (25951+32239)
R	0505	Mod : 28479 = 28702 = 28916 = (22013+24044+28479) = (22013+24044+28916) = (25951+28479+32239) = (25951+28916+32239)
	0506	Mod : 26017 = (25410+26017) = (22013+24044+26017) = (25951+26017+32239) = (22013+24404+25410+26017) = (25410+25951+26017+32239)
R	0507	Mod : (20170+20343) = (20172+20343) = (20343+21858) = (20343+26044) = (20170+31276) = (20172+31276) = (21858+31276) = (26044+31276)
R	0508	Mod : (20268+24946+26965) = (20268+24946+27773) = (20268+26760+26965) = (20268+26760+27773) = (20268+26965+32150) = (20268+26965+32238) = (20268+26965+32239) = (20268+26965+32311) = (20268+27773+32150) = (20268+27773+32238) = (20268+27773+32239) = (20268+27773+32311)
R	0509	Mod : 20268 = (20268+25951) = (20268+24946+25951+26965) = (20268+24946+25951+27773) = (20268+25951+26760+26965) = (20268+25951+26760+27773) = (20268+25951+26965+32150) = (20268+25951+26965+32238) = (20268+25951+26965+32239) = (20268+25951+26965+32311) = (20268+25951+27773+32150) = (20268+25951+27773+32238) = (20268+25951+27773+32239) = (20268+25951+27773+32311)
R	0510	Mod : 20268+V2527E = (20268+25951) = (20268+24946+25951+26965) = (20268+24946+25951+27773) = (20268+25951+26760+26965) = (20268+25951+26760+27773) = (20268+25951+26965+32150) = (20268+25951+26965+32238) = (20268+25951+26965+32239) = (20268+25951+26965+32311) = (20268+25951+27773+32150) = (20268+25951+27773+32238) = (20268+25951+27773+32239) = (20268+25951+27773+32311)
R	0511	Mod : 24105 = (24105+31364+31906) = (24105+31365+31905)
R	0512	Mod : (21678+22013+25404+26017+26377+32090) = (21678+22013+25404+26017+26999+32090
R	0513	STD = Mod : 31896+32332
R	0514	Mod : 27455 = (27455+31896+32332)
R	0515	Mod : 25800 = (25800+31896+32332)
R	0516	STD = Mod : (31897+32332)
R	0517	STD = Mod : 31896+32332+CFM 56-5-A1 = A3 = A4 = A5 = B4 = B5 = B6
R	0518	Mod : (22013+27620) = (23672+27620) = (24105+27620) = (24581+27620) = (24785+27620) = (25108+27620)
R	0519	Mod : 31896 = 32475 = (31896+32332+32475)
R	0520	Mod : (25800+31896) = (25800+32475) = (25800+31896+32332+32475)
R	0521	Mod : 31896 = 32475 = (31896+32332+32475)
R	0522	STD = Mod : (31896+32332) = (31897+32333)
R	0523	Mod : 31896 = 31897 = 32475 = (31896+32332+32475)
R	0524	Mod : (20057+20067+20069+20071) = (20057+20067+20062+20816+27063)
R	0525	Mod : (20067+20069+20071+21708) = (20067+20069+20816+21708+27063)
R	0526	Mod : 20057+20067+20069+20071+21708

CODE	DESIGNATION
0527	Mod : (20059+20067+20069+20071+21708) = (20052+20067+20069+20816+21708+27063)
0528	Mod : 20057+20059+20067+20069+20071+21708
0529	Mod : (20057+20067) = (20057+20069) = (20057+20067+20069)
0530	Mod : (20059+20067) = (20059+20069) = (20059+20067+20069)
0531	STD = Mod : (31371+30660+P0164) = (31371+31728) = (31371+28360) = (31371+30660+31728) = (31371+30660+28360)
0532	Mod : 20059+20067+20069+20071+21195
0533	Mod : (20057+20059+20067+20069+20071) = (20057+20059+20067+20069+20071+32146) = (20057+20059+20067+20069+20816+27063)
0534	STD = Mod : 23885 = (26999+28495) = (26999+27917)
0535	Mod : 25205 = 26111 = 26485 = 26999 = 28382 = 30241 = 30631 = (23885+26111) = (25205+26999+28495) = (26999+28382+28495) = (26999+31896+32332) = (26999+31897+32333) = (26999+28382+28495+31897+32333)
0536	Mod : (26999+31896) = (26999+31897) = (28382+31897) = (26999+28382+28495+31896) = (26999+28382+28495+31897)
0537	Mod : (26999+32475) = (26999+32929) = (26999+28382+28495+32929) = (26999+28382+28495+32475) = (26999+31896+32332+32475) = (26999+31897+32333+32929) = (26999+28382+28495+31896+32402)
0538	Mod : 25205 = 26111 = 26485 = 26999 = 28382 = 30241 = 30631 = (23885+26111) = (25205+26999+28495) = (26999+28382+28495)
0539	Mod : 31397 = 31896 = 32475 = 32929 = (31896+32402) = (31897+32401) = (26999+28495+31896) = (26999+28495+32475) = (26999+28495+32929) = (31896+32332+32475)
0540	Mod : (26999+31896) = (26999+31897) = (26999+32475) = (26999+32929) = (28382+31897) = (26999+28382+28495+31896) = (26999+28382+28495+32475) = (26999+28382+28495+32929) = (26999+31896+32332+32475) = (26999+31897+32333+32929) = (26999+28382+28495+31896+32402)
0541	Mod : 31133 = (22269+23900+31133) = (23900+26058+31133)
0542	Mod : (26002+26111) = (28218+26999) = (28218+28382) = (28218+30241) = (26999+28218+28382+28495)
0543	Mod : 25205 = 26111 = 26485 = 26999 = 28382 = 30241 = 30631 = 30635 = (22013+25204+26999) = (22013+25204+28382) = (24105+25294+26999) = (24105+25294+28382) = (26999+28218+28382) = (26999+28382+28495) = (22013+25204+26999+28382+28495) = (24105+25294+26999+28382+28495)
0544	STD = Mod : (31896+32332) = (31897+32333)
0545	Mod : 31896 = 31897 = 32401 = 32402 = 32475 = (31896+32332+32475)
0546	Mod : 26398 = (26398+31896+32332) = (26398+31897+32333)
0547	Mod : (26398+31896) = (26398+31897) = (26398+32475) = (26398+32401) = (26398+32402) = (26398+31896+32332+32475)
0548	Mod : 28244 = (23885+28244) = (26999+27917+28244) = (26999+28244+28495) = (23885+26111+26999+28244)
0549	Mod : (25205+28244) = (26999+28244) = (28244+28382) = (28244+30631) = (23885+26111+28244) = (26111+26999+28244) = (26111+28244+28382) = (26999+28244+30241) = (26999+28244+28382+28495)
0550	Mod : (26999+27650+28244) = (27650+28244+28382) = (26999+27650+28244+28382+28495)
0551	Mod : (21678+24105+25410+26017) = (21678+25410+26017+30020)
0552	Mod : (21678+24105+26017) = (21678+26017+30020)
0553	Mod : (24645+28479) = (24645+28702) = (24645+28916)

CODE	DESIGNATION
0554	Mod : (21678+26999) = (21678+21858+26377) = (21678+21858+26999) = (21678+26377+26999)
0555	Mod : (24105+26485) = (24105+26999) = (24105+27646) = (24105+30631)
0556	Mod : (22013+26485) = (22013+26999) = (22013+27646) = (22013+30631)
0557	Mod : 32456+CFM 56-5-B1 = B2 = B3 = IAE V2530 = V2533
0558	Mod : 21615+22269+23264+23900
0559	Mod : (21615+22269) = (21615+26058)
0560	STD = Mod : (26645+31040) = (27846+31040) = (28703+31040) = (30439+31040)
0561	Mod : 30020 = (24105+25410+26017+28479+30020)
0562	Mod : 30020 = (24105+26017+30020)
0563	Mod : 30020 = (23208+24077+24105+30020)
0564	Mod : (24105+25404+28479) = (24105+25404+28702) = (24105+25404+28916) = (25404+28916+30020)
0565	STD = Mod : (26526+28956) = (26526+27046+28956)
0566	Mod : 30020 = (26363+26792+28488+30020)
0567	STD = Mod : (25204+26999+27917) = (26999+28495) = (26999+28218+28495) = (24105+25294+26999+28495)
0568	Mod : 28479 = 28702 = 28916 = (25951+28479+32239) = (25951+28916+32239)
0569	Mod : (24105+28479) = (24105+28702) = (24105+28916) = (22013+24044+28479) = (22013+24044+28916)
0570	Mod : 26858 = (23219+23672+26858+28785)
0571	Mod : (22013+CFM) = (22013+IAE) = (22013+AUA)
0572	Mod : (22013+24385+CFM) = (22013+24385+IAE) = (22013+24385+AUA)
0573	Mod : (20268) = (20268+25800)
0574	Mod : (30020) = (25800+30020)
0575	STD = Mod : 23885 = (26999+28495) = (26999+27917)
0576	Mod : 26111 = 25205 = 26999 = 28382 = 30241 = 26485 = 30631 = (23885+26111) = (26999+28495+28382) = (25205+26999+28495)
0577	Mod : 28244 = (23885+28244) = (26999+27917+28244) = (26999+28244+28495) = (23885+26111+26999+28244)
0578	Mod : (28244+28382) = (26999+28244) = (25205+28244) = (28244+30631) = (26111+26999+28244) = (26111+28244+28382) = (26999+28244+30241) = (23885+26111+28244) = (26999+28244+28495+28382)
0579	Mod : (26999+27650 28244) = (27650+28244+28382) = (26999+27650+28244+28382+28495)
0580	Mod : (31133+CFM 56-5-A3) = (31133+IAE V2527) = (23408+31133+IAE V2500)
0581	Mod : (22562+25615+28897) = (22562+24955+25615+28897)
0582	Mod : 32619 = (32619+22013+24044) = (32619+25951+32239)
0583	Mod : (32619+22013) = (32619+25951)
0584	Mod : 28479 = 28916 = (26017+28479) = (26017+28916)
0585	Mod : 28238 = (28238+28479) = (28238+28702) = (28238+28916)
0586	Mod : (24105+28916) = (24105+28479) = (24105+28702)
0587	Mod : (24105+30660) = (24105+28479+30660)
0588	Mod : (22013+30660) = (22013+28479+30660)
0589	Mod : (22249+25529) = (22249+26117) = (22249+26270)

	CODE	DESIGNATION
R	0590	Mod : (22249+25529+26401) = (22249+26117+26401) = (22249+26270+26401)
R	0592	Mod : (20268+24917) = (20268+24917+31607)
R	0593	Mod : (25241+32088) = (25241+32090) = (25242+32088) = (25242+32090) = (25241+25242+32088) = (25241+25242+32090)
R	0594	Mod : (25241+28138+32088) = (25241+28138+32090) = (25242+28138+32088) = (25242+28138+32090) = (25241+25242+28138+32088) = (25241+25242+28138+32090)
R	0595	Mod : (25241+26963+32088) = (25241+26963+32090) = (25242+26963+32088) = (25242+26963+32090) = (25241+25242+26963+32088) = (25241+25242+26963+32090)
R	0596	Mod : (21678+21706+28479) = (21678+21706+28916)
R	0597	Mod : (21678+21706+21766+28479) = (21678+21706+21766+28916)
R	0598	Mod : (21678+21706+21768+28479) = (21678+21706+21768+28916)
R	0599	Mod : (25241+26963+28138+32088) = (25241+26963+28138+32090) = (25242+26963+28138+32088) = (25242+26963+28138+32090) = (25241+25242+26963+28138+32088) = (25241+25242+26963+28138+32090)
R	0600	Mod : 28238 = (27846+28238) = (28238+28479) = (27846+28238+28479) = (27846+28238+26916) = (27846+28238+28702)
R	0601	Mod : 25888 = (25888+22562+25072)
R	0602	Mod : 31896 = 31897 = 32475 = 32929 = (31896+32402) = (31897+32401) = (26999+28495+31896) = (26999+28495+32475) = (26999+28495+32929) = (31896+32332+32475)
R	0603	STD = Mod : 31896 = 31897 = (20586+22013+30422)
R	0604	Mod : 31896 = 31897 = (26999+31896) = (26999+31897) = (28382+31897) = (26999+28495+31896) = (26999+28382+28495+31896) = (26999+28382+28495+31897)
R	0605	Mod : 32929 = 32475 = (26999+32475) = (26999+32929) = (31896+32402) = (31897+32402) = (26999+28495+32929) = (26999+31896+32402) = (26999+31897+32401) = (26999+28495+32475) = (31896+32332+32475) = (31897+32333+32929) = (26999+28382+28495+32475) = (26999+28495+31896+32402) = (26999+28382+28495+32929) = (26999+31896+32332+32475) = (26999+31897+32333+32929) = (26999+28382+28495+31896+32402) = (26999+28382+28495+31897+32401) = (26999+28382+28495+31897+32333+32929) = (26999+28382+28495+31896+32332+32475)
R	0606	Mod : (24785+27620) = (23672+24105+27620) = (24105+24785+27620)
R	0607	Mod : (25205+28916) = (26111+28916) = (26485+28916) = (26999+28479) = (26999+28702) = (26999+28916) = (28382+28916) = (28916+30241) = (28916+30631) = (28916+30635) = (25205+26999+28495+28916) = (26999+28382+28479+28495) = (26999+28382+28495+28702) = (26999+28382+28495+28916)
R	0608	Mod : 30020 = (30020+24105) = (30020+24105+US)
R	0609	Mod : (20268+24917+V2533) = (20268+24917+31607+V2530)
R	0610	Mod : (20268+24946+26965) = (20268+24946+27773) = (20268+25951+26965) = (20268+25951+27773) = (20268+26760+26965) = (20268+26760+27773) = (20268+26965+32150) = (20268+26965+32238) = (20268+26965+32239) = (20268+26965+32311) = (20268+27773+32150) = (20268+27773+32238) = (20268+27773+32239) = (20268+27773+32311)
R	0611	Mod : 27522 = (27522+31371+31728) = (27522+30660+P0164+31371+31728)
R	0612	MSN : 0163 = 0164 = 0168 = 0169 = 0179 = 0193 = 0221 = 0222 = 0230 = 0294 = 0299 = 0301 = 0338 = 0348 = 0349 = 0362 = 0363 = 0424 = 0429 = 0444 = 0449 = 0476
R	0613	STD = Mod : (26999+27917) = (26999+28495) = (26999+28479+28495)
R	0614	Mod : 25205 = 26111 = 26485 = 26999 = 28382 = 30241 = 30631 = 30635 = (23885+26111) = (26999+28382+28495) = (24075+25205+26999+28495)

CODE	DESIGNATION
0615	Mod : 28347 = 28960 = 32011 = 32456
0616	Mod : (28160+28479) = (28160+28916)+CFM = IAE
0617	Mod : (24105+25404+28479) = (24105+25404+28702) = (24105+25404+28916)+CFM = IAE
0618	Mod : 24105+25404+28479+30020+CFM = IAE = PW
0619	Mod : 23108 = 23109 = 23408 = 23871 = 24105 = (23108+23109)+IAE V2527M = CFM 56-5-B7
0620	Mod : (22269+CFM56-5-A3) = (22269+22461+IAEV2500) = (22269+26058+CFM56-5-A3) = (22269+22461+26058+IAEV2500A1) = (23264+26058+CFM56-5-A3)
0621	Mod : (25328+CFM56-5-A4) = (25328+CFM56-5-A5) = (25328+CFM56-5-B5) = (25328+CFM56-5-B6) = (25328+IAEV2522) = (25328+IAEV2524) = (25328+26457+CFM56-5-B6)
0622	Mod : (27112+CFM56-5-A4) = (27112+CFM56-5-A5) = (27112+CFM56-5-B5) = (27112+CFM56-5-B6) = (27112+IAEV2522) = (27112+IAEV2524) = (27112+28136+32217+CFM56-5-B6)
0623	Mod : (22013+27846+28479+28721) = (22013+27846+28479+28960) = (22013+27846+28479+32011) = (22013+27846+28721+28916) = (22013+27846+28916+28960) = (22013+27846+28916+32011) = (22013+28479+30439+32011) = (22013+28479+30439+32456)
0624	Mod : (22013+27846+28479+28721) = (22013+27846+28479+28960) = (22013+27846+28721+28916) = (22013+27846+28916+28960) = (22013+27846+28479+32011) = (22013+28479+30439+32011) = (22013+28479+30439+32456)

N°	ISSUE DATE	
00	JAN 1987	
01	FEB 1987	
02	SEP 1987	
03	JAN 1988	
04	MAR 1988	
05	MAY 1988	
06	JUL 1988	
07	AUG 1988	
08	OCT 1988	
09	JAN 1989	
10	JAN 1989	
11	APR 1989	
12	JAN 1989	
13	JAN 1990	
14	SEP 1990	
15	FEB 1991	
16	JUL 1991	
17	MAR 1992	
18	DEC 1992	
19	APR 1993	
20	JUL 1993	
21	NOV 1993	
22	JUL 1994	
23	JUL 1995	
24	MAR 1997	
25	JAN 1998	
26	JUL 1998	
27	JAN 1999	

R

N°	ISSUE DATE	
28	APR 1999	
29	SEP 1999	
30	MAR 2000	
31	JUL 2000	
32	DEC 2000	
33	JUL 2001	
34	DEC 2001	
35	JUN 2002	
36	MAR 2003	

N° TITLE	STATUS	LOCATION
To be filled by the operator, if needed.		

THIS TABLE GIVES, FOR EACH AIRCRAFT INCLUDED IN THE MANUAL, THE CROSS REFERENCE BETWEEN :

- THE MANUFACTURING SERIAL NUMBER (MSN) WHICH APPEARS IN THE LIST OF EFFECTIVE PAGES

- THE REGISTRATION NUMBER OF THE AIRCRAFT AS KNOWN BY AIRBUS INDUSTRIE.

MSN	REGISTRATION
1068	F-GTFM
1145	OO-SSF

```
V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                        ----------------------REASONS OF CHANGE-------------------
-------------------------------------------------------------------------------------

3 01 20  003        105 REV036  CODE 0358

                       - TECHNICAL AMENDMENT
                          1)Page updated to indicate the maximum
                            wind speed for cargo door operation,
                            in order to be consistent with the
                            AMM : Cargo doors must not be opened,
                            if the wind exceeds 40 knots, and must
                            be closed before the wind exceeds 65
                            knots.

3 01 21  001        001 REV034

                       - TECHNICAL AMENDMENT
                          1)Page created to reflect the cabin
                            pressure graphic, when the max
                            operational altitude is 39800 feet.

3 01 22  001        002 REV036  STD=M:24105=US=(24105/US)

                       - TECHNICAL AMENDMENT
                          1)The FLIGHT MANAGEMENT FUNCTION item
                            was moved to the next page, for
                            repagination purposes.

3 01 22  002        105 REV036  CODE 0535

                       - INCORPORATION OF MOD 25205
                       - INCORPORATION OF MOD 26111
                       - INCORPORATION OF MOD 26485
                       - INCORPORATION OF MOD 26999
                       - INCORPORATION OF MOD 28495
                       - INCORPORATION OF MOD 30241
                       - INCORPORATION OF MOD 30631
                       - TECHNICAL AMENDMENT
                          1)The FLIGHT MANAGEMENT FUNCTION item,
                            which was moved from the previous
                            page, has been reviewed to be in line
                            with the AFM.
                          2)The FMGS is also certified for
                            navigation within PRNAV airspace. This
                            is now reflected on this page.

3 01 22  002A       100 REV036  CODE 0538

                       - INCORPORATION OF MOD 25205
                       - INCORPORATION OF MOD 26111
                       - INCORPORATION OF MOD 26485
                       - INCORPORATION OF MOD 26999
                       - INCORPORATION OF MOD 28382
                       - INCORPORATION OF MOD 28495
                       - INCORPORATION OF MOD 30241
                       - INCORPORATION OF MOD 30631
                       - TECHNICAL AMENDMENT
                          1)The USE OF NAV AND FINAL APP MODES FOR
                            NON PRECISION APPROACH item has been
                            reviewed to be in line with the AFM,
                            and this page has been created for
                            repagination purposes.

3 01 22  003        108 REV036  M:24105/CFM/IAE

                       - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE
                       - TECHNICAL AMENDMENT
                          1)No technical change. The sequence
```

```
V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                          ----------------------REASONS OF CHANGE-------------------
-------------------------------------------------------------------------------------
                             number was changed to ensure the
                             correct validation for all
                             customers.

3 01 22  004         115 REV036  24105/CFM ALL

                        - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE
                        - TECHNICAL AMENDMENT
                           1)Additional information to precise the
                             required VAPP in autoland.
                           2)Automatic landing in CAT1 or better
                             conditions is moved to p 4a.

3 01 22  004A        100 REV036  24105=22013

                        - INCORPORATION OF MOD 22013
                        - INCORPORATION OF MOD 24105
                        - TECHNICAL AMENDMENT
                           1)No technical change. The sequence
                             number has changed to ensure the
                             correct validity for all customers.

3 01 32  001         040 REV035  STD OR (25951+32239)CFM ENG

                        - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 01 34  001         100 REV036  CODE 0427

                        - TECHNICAL AMENDMENT
                           1)EGPWS limitations updated to be in
                             accordance with the existing Flight
                             Manual.

3 01 70  001         050 REV033  STD OR US/CFM 56-5-B

                        - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 00  003         001 REV036

                        - TECHNICAL AMENDMENT
                           1)Page revised to reflect the correct
                             pagination for the fire protection
                             chapter.

3 02 00  007         001 REV036

                        - TECHNICAL AMENDMENT
                           1)The Table of Contents has been updated
                             to reflect FCOM revisions and take
                             into account various pagination
                             changes.

3 02 00  009         025 REV030  CFM ALL

                        - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 10  002         100 REV036  M:26017

                        - INCORPORATION OF MOD 26017
                        - TECHNICAL AMENDMENT
                           1)Introduction of the FWC E2 :
                             With this standard, the "ENG REV
                             UNLOCKED" message is only inhibited
                             in flight phase 8. It may appear at
                             takeoff.
```

V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
----------------------REASONS OF CHANGE------------------

---

3 02 10 003 001 REV036

- TECHNICAL AMENDMENT
  1)PA call information revised for standardization purposes, and to be in accordance with training.

3 02 10 005 200 REV036 CODE 0396

- TECHNICAL AMENDMENT
  1)Recommendations for rotation technique have been harmonized with the 3.02.10 P4 : At VR, rotate the aircraft to 12.5 deg. and, after lift off, follow Speed Reference System (SRS) orders.

3 02 21 004 001 REV036

- TECHNICAL AMENDMENT
  1)Deletion of "FWD CRG HEAT" from the inoperative system list, as forward cargo heating is not installed.

3 02 21 006 110 REV036 MOD:22561

- TECHNICAL AMENDMENT
  1)Deletion of "FWD CRG HEAT", from the inoperative system list, as forward cargo heating is not installed.
  2)LAV DET is removed from the "LAV+ GALLEY FAN FAULT" INOP SYS list because the ambient lavatory detectors (Mod 22561) are not lost in case of "LAV+GALLEY FAN FAULT" failure.

3 02 22 002 001 REV036

- TECHNICAL AMENDMENT
  1)Addition of information to indicate that following a RUD TRV LIM SYS fault at slats' extension, full rudder travel authority may be recovered, depending on the cause of the failure.

3 02 22 004 240 REV036 CODE 0589

- TECHNICAL AMENDMENT
  1)Addition of information to indicate that following a FAC 1 + 2 FAULT at slats' extension, full rudder travel authority is recovered.

3 02 23 001 001 REV036

- TECHNICAL AMENDMENT
  1)Page revised to reflect the fact that, in case of continuous emission, the onside ACP must not be used for emission.
  A part of the note has been removed since the recommendation appeared not to be appropriate.

```
V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                         ----------------------REASONS OF CHANGE------------------
------------------------------------------------------------------------------------

3 02 24  003        008 REV029  CFM ALL

                       - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 24  005        108 REV032  CODE 0008/CFM ALL

                       - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 24  006        205 REV036  M:21678+26377

                       - TECHNICAL AMENDMENT
                          1)Page revised to delete the "ANTI ICE
                            CAPT AOA" line, since this alarm is
                            not triggered by an "AC ESS BUS
                            FAULT".

3 02 24  006        215 REV036  CODE:0554

                       - TECHNICAL AMENDMENT
                          1)Page revised to delete the "ANTI ICE
                            CAPT AOA" line, since this alarm is
                            not triggered by an "AC ESS BUS
                            FAULT".

3 02 24  009        205 REV036  CODE:0555

                       - INCORPORATION OF MOD 27646
                       - TECHNICAL AMENDMENT
                          1)If installed, the CDLS (Cockpit Door
                            Locking System) is inoperative, in
                            case of a DC BUS 2 FAULT.
                            The list of inoperative systems has
                            been updated accordingly.
                          2)The sequence number was changed to
                            ensure the correct page validation for
                            all customers.

3 02 24  013        205 REV036  21678+24105

                       - TECHNICAL AMENDMENT
                          1)No technical change. The sequence
                            number was changed to ensure the
                            correct page validation for all
                            customers.

3 02 24  014        400 REV036  CODE 0426

                       - TECHNICAL AMENDMENT
                          1)SDCU2 has been removed from the list
                            of INOP SYS displayed on the ECAM.
                          2)The inoperative system list has been
                            updated to reflect the fact that, if
                            installed, the Cockpit Door Locking
                            System (CDLS) is inoperative, in case
                            of a DC BUS 1+2 FAULT.

3 02 24  018        215 REV036  24105+25404 CFM=IAE

                       - TECHNICAL AMENDMENT
                          1)The sequence number was changed to
                            correct validation problems on the
                            page.
```

```
V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                          ----------------------REASONS OF CHANGE-------------------
-----------------------------------------------------------------------------------

3 02 24  019       100 REV036  M:22013=24105=28160

                      - INCORPORATION OF MOD 22013
                      - INCORPORATION OF MOD 28160
                      - TECHNICAL AMENDMENT
                         1)Modification of the "ELEC ESS BUSES
                           ON BAT" note for improved technical
                           understanding.
                         2)The sequence number has been changed
                           to ensure the correct page validation
                           for all customers.

3 02 24  026       110 REV030  M:24105=28160=30020

                      - INCORPORATION OF MOD 30020

3 02 24  027       100 REV030  M:22013=24105=28160=30020

                      - INCORPORATION OF MOD 30020

3 02 26  005       100 REV036  20057=20059=30067

                      - INCORPORATION OF MOD 20057
                      - INCORPORATION OF MOD 20059
                      - INCORPORATION OF MOD 30067
                      - TECHNICAL AMENDMENT
                         1)When both BLOWER and EXTRACT
                           pushbuttons are in the OVRD position,
                           a single pack may not be able to keep
                           the cabin pressure. So, to avoid
                           depressurization, it is asked to
                           switch the BLOWER and the EXTRACT
                           pushbuttons to the AUTO position
                           before setting the single pack
                           operation of the smoke procedure. If
                           smoke still persists after the single
                      - ADDITIONAL INFORMATION
                           pack operation, once both packs are
                           switched back ON, BLOWER and EXTRACT
                           pushbuttons should be set to OVRD
                           again.

3 02 26  007       300 REV036  CODE 0475

                      - TECHNICAL AMENDMENT
                         1)Page modified to reflect the exact
                           aircraft definition : Aircraft not
                           powered by IAE engines.

3 02 26  008       300 REV032  24105+25410+26017

                      - INCORPORATION OF MOD 24105

3 02 26  010       001 REV036

                      - TECHNICAL AMENDMENT
                         1)The procedure has been harmonized with
                           the Long Range family. In order to
                           open the cockpit window (if
                           necessary), the differential pressure
                           should be zero (no residual pressure).
                           Consequently, it is requested, at
                           FL100 or MEA, to switch both packs
                           OFF, set the pressure MODE SEL to MAN,
                           and set the MAN V/S CTL to FULL UP.
```

```
V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                        ----------------------REASONS OF CHANGE-------------------
------------------------------------------------------------------------------------
                            2)Fwd (aft) cargo smoke warning (if
                         - ADDITIONAL INFORMATION
                              previously contained on this page) has
                              been moved to next page for
                              standardization purposes.

3 02 26  011          400 REV036  CODE:0357

                         - TECHNICAL AMENDMENT
                            1)The "FWD (AFT) CARGO SMOKE" warning
                              has been moved from the previous page
                              for standardization purposes.
                            2)The "LAV + CRG DET FAULT" warning has
                              been moved to 3.02.26, page 12, for
                              standardization purposes.
                            3)Introduction of the C/Bs' panel
                              location in the FWD (AFT) CARGO SMOKE
                              procedure.

3 02 26  012          210 REV036  CODE 0530

                         - INCORPORATION OF MOD 20059
                         - INCORPORATION OF MOD 20067
                         - INCORPORATION OF MOD 20069
                         - TECHNICAL AMENDMENT
                            1)The "LAV + CRG DET FAULT" warning has
                              been moved from page 11 to this page,
                              for standardization purposes.

3 02 27  002          405 REV032  CODE 0415

                         - INCORPORATION OF MOD 25410

3 02 27  008          410 REV036  24105+24511+25410+26017

                         - TECHNICAL AMENDMENT
                            1)Correction of the landing coefficient,
                              when two SECs are affected, to be in
                              accordance with the "LDG CONF-APPR
                              SPD-LDG DIST CORRECTIONS FOR FAILURES"
                              table (FCOM 3.02.80).

3 02 28  006          100 REV026  CODE 0359/CFM ALL

                         - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 28  008          001 REV036

                         - TECHNICAL AMENDMENT
                            1)The Fuel leak section has been updated
                              to :
                              a) Indicate an additional method of
                                 detecting a fuel leak.
                              b) Specify that, in case of leak from
                                 an engine, the crossfeed valve may
                                 be used, as required.

3 02 28  009          110 REV036  20024

                         - TECHNICAL AMENDMENT
                            1)The presentation of the procedure has
                              been changed to clarify that, except
                              in the case of leak from an engine,
                              the crossfeed valve must remain
                              closed.
```

```
V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                         ----------------------REASONS OF CHANGE------------------
---------------------------------------------------------------------------------

3 02 28  010        100 REV036  20024

                      - TECHNICAL AMENDMENT
                         1)Procedure modified to prevent opening
                           the crossfeed valve, in case of fuel
                           leak.

3 02 29  001        105 REV036  M:22013=24105

                      - INCORPORATION OF MOD 22013
                      - INCORPORATION OF MOD 24105
                      - TECHNICAL AMENDMENT
                         1)No technical change. The sequence
                           number was changed to ensure the
                           correct page validation for all
                           customers.

3 02 29  011        310 REV034  CODE 0464

                      - INCORPORATION OF MOD 31395

3 02 29  016        105 REV036  M:22013=24105

                      - INCORPORATION OF MOD 22013
                      - INCORPORATION OF MOD 24105
                      - TECHNICAL AMENDMENT
                         1)No technical change. The sequence
                           number was changed to ensure the
                           correct page validation for all
                           customers.

3 02 32  003        110 REV036  24645

                      - TECHNICAL AMENDMENT
                         1)Reference to "BRAKES SYS 1(2) FAULT"
                           has been corrected to read : "BRAKES
                           BSCU CH 1(2) FAULT" to reflect the
                           actual ECAM wording.

3 02 32  010        110 REV036  M:24105=(22013+24044)

                      - INCORPORATION OF MOD 24105
                      - TECHNICAL AMENDMENT
                         1)No technical change, the sequence
                           number was changed to ensure
                           correct page validation for all
                           customers.

3 02 34  005        001 REV036

                      - TECHNICAL AMENDMENT
                         1)Addition of information to further
                           enhance the ADR 1 + 2 + 3 FAULT paper
                           procedure : Since the Rudder Travel
                           Limiter is lost, "RUD WITH CARE ABV
                           160 KT" will be displayed on the ECAM.
                         2)Minor editorial change for improved
                           technical understanding.

3 02 34  009        300 REV036  CODE 0198

                      - TECHNICAL AMENDMENT
                         1)No technical change. The sequence
                           number was changed to ensure the
                           correct page validation for all
```

V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
----------------------REASONS OF CHANGE-------------------

customers.

3 02 34 010 100 REV036 CODE:0382

- TECHNICAL AMENDMENT
  1)Information moved to improve technical understanding.

3 02 34 012 001 REV036

- TECHNICAL AMENDMENT
  1)Page modified to clarify that the LOC mode is available via the FCU LOC pushbutton, in case of a double Radio Altimeter fault.

3 02 34 015 100 REV036 M:26526

- TECHNICAL AMENDMENT
  1)The heading has been shaded to indicate that this is not an ECAM procedure (for some batches of printed pages, the shading was inadvertently omitted).

3 02 36 003 001 REV036

- TECHNICAL AMENDMENT
  1)Deletion of the note advising that the forward cargo isolation valve should be closed to minimize the rate at which the cabin altitude increase is removed, since forward cargo ventilation is not installed.

3 02 36 005 200 REV036 MOD:22562+24105

- TECHNICAL AMENDMENT
  1)FCOM page amended to specify that the crossbleed valve must be opened, when wing anti-ice is used, and if one bleed is inoperative.

3 02 70 001 120 REV030 M:28307=27725/CFM 56-5-B

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 002 130 REV030 CODE:0046/56-5-B

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 003 035 REV024 CFM 56-5-B

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 004 150 REV028 CODE 0020

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 005 020 REV024 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 006 010 REV026 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
----------------------REASONS OF CHANGE-------------------

---

3 02 70 006 010 REV026 CFM ALL

3 02 70 007 020 REV032 CFM

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 008 010 REV032 CFM

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 009 020 REV030 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 010 110 REV029 CODE 0145/CFM 56-5-B

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 011 035 REV032 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 016 230 REV034 CODE 0312/CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 018 020 REV024 CODE 0361 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 019 030 REV024 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 022 130 REV024 CODE 0106

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 023 120 REV033 CODE 0314/CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 024 120 REV024 M:24035=24160=24189 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 025 020 REV026 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 70 026 020 REV024 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 80 003 001 REV036

- TECHNICAL AMENDMENT
  1)The "DITCHING" procedure has been revised to recommend that bleed sources be switched OFF, before setting the DITCHING pushbutton ON, in order to be in accordance with the "ON GROUND DE-ICING" procedure.
  2)Rewording of the ditching pushbutton

```
V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                           ----------------------REASONS OF CHANGE-------------------
------------------------------------------------------------------------------------
                             description to be in line with the
                             FCOM 1.21.20 p 7.

3 02 80  005         100 REV036  26526

                           - TECHNICAL AMENDMENT
                             1)Procedure enhanced to specify that, if
                               the engines are not running, the
                               landing gear is extended by gravity.

3 02 80  016         025 REV027  CFM ALL

                           - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 02 80  018         302 REV036  23208+24077+24105

                           - TECHNICAL AMENDMENT
                             1)Addition of the "delta VREF" and
                               landing coefficient when there is a
                               "REVERSE UNLOCKED" warning, and when
                               the landing is performed in CONF 3.

3 02 90  005         001 REV036

                           - TECHNICAL AMENDMENT
                             1)Page revised to reflect the fact that
                               the described procedure is applicable
                               to aircraft fitted with the slide, not
                               the slide-raft.
                             2)Addition of a note to clarify that
                               doors, equipped with slides, should be
                               given priority for use in case of
                               evacuation.

3 03 04  005         001 REV036

                           - TECHNICAL AMENDMENT
                             1)Due to several cases of activation of
                               autobrake at taxi, the crew should
                               check that the SPEED BRAKE lever is
                               retracted and disarmed.
                             2)Addition of information to warn pilots
                               that, before turning ON the APU bleed,
                               they should check with the ground crew
                               and should also check the ECAM BLEED
                               page to ensure that HP ground air
                               unit is not connected.

3 03 04  007         110 REV030  M:22013=24105=24701/CFM ALL

                           - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 03 05  003         105 REV036  22199=24105

                           - INCORPORATION OF MOD 22199
                           - INCORPORATION OF MOD 24105
                           - TECHNICAL AMENDMENT
                             1)Page created to remove the "Wing
                               leading edge ventilation intake"
                               item, as it is not applicable.

3 03 06  002         100 REV036  CODE 0435

                           - INCORPORATION OF MOD 21946
                           - TECHNICAL AMENDMENT
                             1)No technical change. The sequence
```

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V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                            ----------------------REASONS OF CHANGE-------------------
--------------------------------------------------------------------------------------
                               number was changed to ensure the
                               correct page validation for all
                               customers.

3 03 06  006        100 REV036  MOD 22031=25440

                            - INCORPORATION OF MOD 22031
                            - INCORPORATION OF MOD 25440
                            - TECHNICAL AMENDMENT
                               1)A note has been added to highlight
                                 the fact that the Flight Number should
                                 be exactly entered on the MCDU INIT
                                 page, with the same syntax as the one
                                 shown in the ICAO flight plan. Indeed,
                                 an inexactly entered flight number can
                                 cause the communication and
                                 identification with the ATC to fail.

3 03 07  002        001 REV036

                            - TECHNICAL AMENDMENT
                               1)The check of the red circle on the
                                 window handle has been removed, since
                                 this feature is not necessarily
                                 installed on all A320 family aircraft.

3 03 08  002        020 REV032  CFM ALL

                            - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 03 09  001        020 REV029  CFM ALL

                            - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 03 09  002        025 REV030  CFM ALL

                            - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 03 10  006        105 REV036  24105

                            - TECHNICAL AMENDMENT
                               1)The schematic and wording have been
                                 clarified to reflect that the 2 meters
                                 of reference, are before the runway
                                 edge.

3 03 11  001        040 REV024  CODE:0187

                            - DELETION OF MOD 25530
                            - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 03 11  001        040 REV036  CODE:0504/CFM

                            - TECHNICAL AMENDMENT
                               1)The benefits of bleed selections for
                                 takeoff are clarified and standardized
                                 to be in accordance with the A330 SOP.

3 03 12  002        120 REV025  CODE 0189 CFM ALL

                            - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 03 12  003        001 REV036

                            - TECHNICAL AMENDMENT
                               1)Modification of the pilot rotation
```

V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
----------------------REASONS OF CHANGE------------------

technique to achieve a continuous rotation rate. The aim is to avoid pitch PIO (Pilot Induced Oscillations) and obtain a similar aircraft rotation for all the Airbus fly-by-wire aircraft family. Recommendations regarding lateral inputs on ground and during the rotation have also been amended.

3 03 13 001 001 REV036

- TECHNICAL AMENDMENT
  1)FCOM page amended to clarify that icing conditions may be expected, when temperatures are at (or below) 10 deg. C, in order to be in accordance with the Flight Manual.

3 03 15 002 001 REV036

- TECHNICAL AMENDMENT
  1)Page modified to include an additional recommendation, in case the cockpit oxygen mask has been used. The mask should be stowed, as per the FCOM 1.35.20, in order to avoid potential risk of oxygen depletion.

3 03 16 002 001 REV036

- TECHNICAL AMENDMENT
  1)Page modified to reflect that the correct QRH page reference is 2.31, not 2.41.

3 03 17 003 100 REV036 CODE:0189

- TECHNICAL AMENDMENT
  1)The recommendation concerning the use of the EGPWS TERR on ND display has been modified : Depending on operational conditions, the EGPWS TERR display or the weather radar display may be selected on both sides. However, if both weather radar and EGPWS TERR displays are needed, it is recommended to select the weather radar display on the PF side and the
- ADDITIONAL INFORMATION
  EGPWS TERR display on the PNF side.

3 03 18 001 200 REV027 M:26018+26398

- INCORPORATION OF MOD 26398

3 03 18 002 210 REV036 CODE:0578

- TECHNICAL AMENDMENT
  1)The legends of the NAV accuracy table have been clarified for improved technical understanding.

3 03 18 003 100 REV036 CODE:0511

- TECHNICAL AMENDMENT

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V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                           ----------------------REASONS OF CHANGE-------------------
-------------------------------------------------------------------------------------
                              1)Page revised to introduce ALAR program
                                recommendations.

3 03 18  006        001 REV036

                           - TECHNICAL AMENDMENT
                              1)Information has been moved to the FCOM
                                3.03.18, page 7, for pagination
                                purposes.

3 03 18  007        001 REV036

                           - TECHNICAL AMENDMENT
                              1)Information has been moved from the
                                previous page, and some information
                                has been moved to the next page, for
                                pagination purposes.
                              2)Page modified to add the
                                recommendations given in OIT/FOT
                                999.0108/02/BB. After landing gear
                                extension, additional guidelines are
                                given to prevent undue flight crew
                                action, in case of brakes' residual
                           - ADDITIONAL INFORMATION
                                pressure. Particularly, the antiskid
                                and nosewheel steering must be kept
                                ON.

3 03 18  008        001 REV036

                           - TECHNICAL AMENDMENT
                              1)Information has been moved from the
                                previous page, for pagination
                                purposes.

3 03 18  009        001 REV036

                           - TECHNICAL AMENDMENT
                              1)Information has been moved from the
                                previous page, for pagination
                                purposes.

3 03 19  001        105 REV036  CODE 0535

                           - INCORPORATION OF MOD 26485
                           - INCORPORATION OF MOD 30631
                           - TECHNICAL AMENDMENT
                              1)"NON RNAV" approaches has been
                                included in the title. RNAV approaches
                                are described further in this chapter.
                              2)Additional references to Airbus
                                operational documentation, regarding
                                NAV database validation, is included.
                              3)Now, it is requested to check the
                                lateral and vertical F-PLN against the
                                IAP approach, before starting the
                                approach.
                           - ADDITIONAL INFORMATION
                              4)New indications are given on how to
                                deal with a GPS PRIMARY loss, or a
                                FM/GPS POS DISAGREE caution.

3 03 19  002        001 REV036

                           - TECHNICAL AMENDMENT
                              1)Addition of information on approach
```

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V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                           ----------------------REASONS OF CHANGE-------------------
-------------------------------------------------------------------------------------
                             guidance for RNAV approaches.

3 03 19  003        120 REV036  CODE 0543

                        - INCORPORATION OF MOD 24105
                        - INCORPORATION OF MOD 25294
                        - TECHNICAL AMENDMENT
                           1)Addition of information on approach
                             guidance for RNAV approaches.

3 03 19  004        105 REV036  CODE 0546

                        - INCORPORATION OF MOD 26398
                        - TECHNICAL AMENDMENT
                           1)Page created to include information
                             that was moved from a previous page,
                             for repagination purposes.
                           2)Introduction of the ALAR program
                             recommendations.

3 03 19  005        001 REV036

                        - TECHNICAL AMENDMENT
                           1)Information was moved from a previous
                             page, for repagination purposes.

3 03 19  006        200 REV036  CODE 0549

                        - INCORPORATION OF MOD 26999
                        - INCORPORATION OF MOD 28244
                        - INCORPORATION OF MOD 28382
                        - INCORPORATION OF MOD 28495
                        - TECHNICAL AMENDMENT
                           1)Information was moved from a previous
                             page for repagination purposes.
                           2)The legends of the NAV accuracy table
                             have been clarified for improved
                             technical understanding.
                           3)A note is added to advise that, if
                             during an overlay approach to a
                             conventional radio procedure, the
                             raw data indicates that the managed
                             guidance is unsatisfactory, the crew
                        - ADDITIONAL INFORMATION
                             must revert to selected guidance.

3 03 19  007        100 REV036  CODE 0538

                        - INCORPORATION OF MOD 25205
                        - INCORPORATION OF MOD 26111
                        - INCORPORATION OF MOD 26485
                        - INCORPORATION OF MOD 26999
                        - INCORPORATION OF MOD 28382
                        - INCORPORATION OF MOD 28495
                        - INCORPORATION OF MOD 30241
                        - INCORPORATION OF MOD 30631

3 03 19  007        100 REV032  CODE 0042

                        - DELETION OF MOD 24064
                        - DELETION OF MOD 24065
                        - DELETION OF MOD 24066
                        - DELETION OF MOD 24067
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V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                           ----------------------REASONS OF CHANGE-------------------
-----------------------------------------------------------------------------------------

3 03 19  007        100 REV036  CODE 0538

                       - TECHNICAL AMENDMENT
                          1)Information was moved from a previous
                            page for repagination purposes.
                          2)Specific procedure lines for RNAV
                            approaches have been added to ensure
                            the required navigation accuracy for
                            the approach. It is also reminded that
                            the RNAV approaches without GPS are
                            subject to specific operational
                            approval.

3 03 19  008        001 REV036

                       - TECHNICAL AMENDMENT
                          1)Information was moved from a previous
                            page for repagination purposes.
                          2)Page modified to add the
                            recommendations given in
                            OIT/FOT 999.0108/02/BB. After landing
                            gear extension, additional guidelines
                            are given to prevent undue flight crew
                            action in case of brakes residual
                            pressure. Particularly, the antiskid
                            and nose wheel steering must be kept
                       - ADDITIONAL INFORMATION
                            ON.

3 03 19  009        001 REV036  STD=M:24105

                       - INCORPORATION OF MOD 24105
                       - TECHNICAL AMENDMENT
                          1)Information was moved from a previous
                            page for repagination purposes.
                          2)New indications for the POSITION and
                            FLIGHT PATH monitoring and adjusting,
                            regarding the RNAV approaches and
                            approaches overlay to a conventional
                            radio navaid procedure.

3 03 19  010        001 REV036

                       - TECHNICAL AMENDMENT
                          1)Information was moved from a previous
                            page for repagination purposes.

3 03 19  011        100 REV036  M:24064=24065=24066=24067

                       - INCORPORATION OF MOD 24064
                       - INCORPORATION OF MOD 24065
                       - INCORPORATION OF MOD 24066
                       - INCORPORATION OF MOD 24067
                       - TECHNICAL AMENDMENT
                          1)Information was moved from page 7 for
                            repagination purposes.

3 03 19  012        100 REV036  M:23742

                       - INCORPORATION OF MOD 23742
                       - TECHNICAL AMENDMENT
                          1)Information was moved from page 8 for
                            repagination purposes.
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V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                        ----------------------REASONS OF CHANGE-------------------
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3 03 19  013        001 REV036

                     - TECHNICAL AMENDMENT
                        1)Information was moved from page 9 for
                          repagination purposes.

3 03 20  001        100 REV035  26398

                     - INCORPORATION OF MOD 26398

3 03 22  004        105 REV036  M:24105

                     - TECHNICAL AMENDMENT
                        1)Page modified to include attitude
                          monitoring during flare.
                          Attitude monitoring is done by the
                          PNF and its aim is to avoid
                          tailstrike, or wingtip or engine
                          scrape during the flare maneuver.

3 03 23  001        110 REV036  25863

                     - TECHNICAL AMENDMENT
                        1)Information has been moved to the next
                          page for pagination and
                          standardization purposes.

3 03 23  002        001 REV036

                     - TECHNICAL AMENDMENT
                        1)- Information has been moved from
                            page 1.
                          - Addition of a conditional procedure,
                            to manually disengage GO-Around SRS
                            Mode by pulling the FCU ALT knob,
                            should the target speed not
                            automatically increase when climbing
                            through GO Acceleration Altitude.

3 03 23  004        100 REV036  M:25863

                     - INCORPORATION OF MOD 25863
                     - TECHNICAL AMENDMENT
                        1)Blank page moved from previous page to
                          this page for pagination and
                          standardization purposes.

3 03 25  001        020 REV035  CODE 0186/CFM ALL

                     - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 03 25  003        170 REV035  22013=23119/CFM ALL

                     - VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 04 00  001        203 REV036  CODE 0501

                     - TECHNICAL AMENDMENT
                        1)The title of the SUPPLEMENTARY
                          TECHNIQUES' FLIGHT CONTROLS chapter
                          has been modified to indicate that it
                          also contains flying techniques.
                        2)AIRCRAFT TRIMMING is moved to page 12.
```

V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
----------------------REASONS OF CHANGE-------------------

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3 04 10 002 115 REV028 M:24105/CFM ALL=IAE ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 04 23 001 001 REV036

- TECHNICAL AMENDMENT
  1)Simplification of the note concerning noisy frequencies.

3 04 23 001A 001 REV036

- TECHNICAL AMENDMENT
  1)Page created to harmonize pagination changes.

3 04 24 004 103 REV036 24771

- INCORPORATION OF MOD 24771
- TECHNICAL AMENDMENT

  1)Addition of a CIDS reset procedure in case of uncommanded EVAC horn actuation.
  2)Some information has been moved to the next page, to accommodate additional information on page 4, and ensure the correct page validation for all customers.

3 04 24 005 101 REV036 24613=22013+24613

- INCORPORATION OF MOD 24613
- TECHNICAL AMENDMENT
  1)Some information has been moved from page 4 to this page, and some information has been moved to page 6, to accommodate additional information page 4 and ensure the correct page validation for all customers.

3 04 24 006 001 REV036

- TECHNICAL AMENDMENT
  1)Page created to accommodate additional information on page 4 and ensure the correct page validation for all customers.

3 04 27 002 001 REV036

- TECHNICAL AMENDMENT
  1)Sidestick position indication on PFD may be monitored by the crew, not only when in crosswind condition. References to crosswind conditions have consequently been removed from our recommendations regarding the use of the sidestick position indication.
  2)A crossreference to the SOP 3.03.12 has been added, since this chapter contains some additional information
- ADDITIONAL INFORMATION
  on takeoff technique.

```
V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                         ----------------------REASONS OF CHANGE------------------
-------------------------------------------------------------------------------------

3 04 27  003        001 REV036

                      - TECHNICAL AMENDMENT
                         1)Recommendations regarding lateral
                           inputs on ground and during the
                           rotation have been amended : Lateral
                           inputs on ground and during the
                           rotation should be minimized to avoid
                           spoiler extension. Spoiler deflection
                           starts to become significant with more
                           than one third sidestick deflection.

3 04 27  004        001 REV036

                      - TECHNICAL AMENDMENT
                         1)Recommendations for crosswind landing
                           technique, have been harmonized with
                           the SOP 3.03.22.

3 04 27  005        001 REV036

                      - TECHNICAL AMENDMENT
                         1)Introduction of recommendations, in
                           case of bounce at landing.
                         2)Some text has been moved to page 6.

3 04 27  006        001 REV036

                      - TECHNICAL AMENDMENT
                         1)The "BACKUP CONTROL" chapter has
                           been renamed "MECHANICAL BACKUP"
                           for improved understanding of the
                           meaning of this term.
                         2)Some text has been moved from page
                           5, and the illustration to page 7,
                           to accomodate additional info on
                           page 5.

3 04 27  007        001 REV036

                      - TECHNICAL AMENDMENT
                         1)Some text has been moved from page 6,
                           and some to page 8, to accomodate
                           additional info on page 5.

3 04 27  008        001 REV036

                      - TECHNICAL AMENDMENT
                         1)Some text has been moved from page 7,
                           and some to page 9, to accomodate
                           additional info on page 5.

3 04 27  009        001 REV036

                      - TECHNICAL AMENDMENT
                         1)Some text has been moved from page 8,
                           and some to page 10, to accomodate
                           additional info on page 5.

3 04 27  010        001 REV036

                      - TECHNICAL AMENDMENT
                         1)Some text has been moved from page 9,
                           and some to page 11, to accomodate
                           additional info on page 5.
```

V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
----------------------REASONS OF CHANGE-------------------

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3 04 27 011 001 REV036

- TECHNICAL AMENDMENT
  1)Some text has been moved from page 10, and some to page 12, to accomodate additional info on page 5.

3 04 27 012 001 REV036

- TECHNICAL AMENDMENT
  1)New page created : Some text has been moved from page 11, to accomodate info on page 5.

3 04 70 003 020 REV026 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 04 70 005 100 REV029 CODE 0145/CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 04 70 006 020 REV033 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 04 70 007 020 REV028 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 04 70 008 007 REV030 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 04 90 001 020 REV024 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 04 90 002 020 REV035 CFM ALL

- VERSION AND/OR ENGINE INCORPORATION, DELETION OR CHANGE

3 04 91 004 001 REV036

- TECHNICAL AMENDMENT
  1)No technical change. Information has been moved to the next page for pagination purposes.

3 04 91 005 001 REV036

- TECHNICAL AMENDMENT
  1)No technical change. Information has been moved from the previous page for pagination purposes.

3 04 91 007 001 REV036

- TECHNICAL AMENDMENT
  1)Introduction of the "outflow valve check ditching" Temporary Revision : A recommendation has been added to check that no external air is supplied to the aircraft via the low or high pressure ground connectors, before

V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
----------------------REASONS OF CHANGE-------------------

starting the de-icing procedure.
2)Minor editorial changes have been made to reflect the fact that the aircraft can be de-iced with the APU and the
- ADDITIONAL INFORMATION
engines running.
3)The note concerning the DITCHING pushbutton has been updated to reflect the fact that the avionic ventilation inlet valve is also closed.

3 04 91 008 001 REV036

- TECHNICAL AMENDMENT
1)Introduction of TR 734-1 : A recommendation has been added within the de-icing procedure, to check that the outflow valve is indicated open, after completion of this procedure.
2)The sequence number was changed to ensure the correct page validation for all customers.

3 04 92 001 001 REV036

- TECHNICAL AMENDMENT
Page revised :
1)To indicate that pilots must check the version of F.O.V.E. installed on their PCs, not the version of each module, as previously stated.
2)For improved technical understanding and standardization.

3 04 92 002 001 REV036

- TECHNICAL AMENDMENT
Page revised to indicate that :
1)Pilots must check the version of F.O.V.E. installed on their PCs, not the version of each module, as previously stated.
2)The "Aircraft Loading" module has been replaced by the "Weight and Balance" module.

3 04 92 004 001 REV036

- TECHNICAL AMENDMENT
Page revised to :
1)Replace the "Aircraft Loading" module by the "Weight and Balance" module.
2)Introduce the description of the LPC's Weight and Balance (W & B) module.
3)Delete the reference to the ECAM CG, as there is no ECAM CG on the A320 aircraft family.

3 04 92 005 001 REV036

- TECHNICAL AMENDMENT
1)Page created to introduce the description of the LPC's Weight and Balance (W & B) module.

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V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA-----
                         ----------------------REASONS OF CHANGE-------------------
-----------------------------------------------------------------------------------

3 04 92  006        001 REV036

                       - TECHNICAL AMENDMENT
                          1)Page created to introduce the
                            description of the LPC's Weight
                            and Balance (W & B) module.

3 05 35  001        100 REV036  M:22013=24105

                       - TECHNICAL AMENDMENT
                          1)In note 2, replace VLS by VREF for
                            CONF FULL. VLS is for CONF 3.
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M	V	CH	SEC	PAGE	SEQ	REV	VALIDATION CRITERIA	EFFECTIVITY
	3	00	00	001-2	001	REV024	CONTENT	ALL
	3	00	10	001	001	REV035	ORGANIZATION OF THE MANUAL	ALL
	3	00	10	002	001	REV035	ORGANIZATION OF THE MANUAL	
	3	00	10	003	001	REV024	ORGANIZATION OF THE MANUAL	ALL
	3	00	10	004	001	REV024	ORGANIZATION OF THE MANUAL	
	3	00	10	005	001	REV024	ORGANIZATION OF THE MANUAL	ALL
R	3	00	20	001	001	REV036	LIST OF CODES	ALL
R	3	00	20	002	001	REV036	LIST OF CODES	
R	3	00	20	003	001	REV036	LIST OF CODES	ALL
R	3	00	20	004	001	REV036	LIST OF CODES	
R	3	00	20	005	001	REV036	LIST OF CODES	ALL
R	3	00	20	006	001	REV036	LIST OF CODES	
R	3	00	20	007	001	REV036	LIST OF CODES	ALL
R	3	00	20	008	001	REV036	LIST OF CODES	
R	3	00	20	009	001	REV036	LIST OF CODES	ALL
R	3	00	20	010	001	REV036	LIST OF CODES	
R	3	00	20	011	001	REV036	LIST OF CODES	ALL
R	3	00	20	012	001	REV036	LIST OF CODES	
R	3	00	20	013	001	REV036	LIST OF CODES	ALL
R	3	00	20	014	001	REV036	LIST OF CODES	
N	3	00	20	015	001	REV036	LIST OF CODES	ALL
N	3	00	20	016	001	REV036	LIST OF CODES	
N	3	00	20	017	001	REV036	LIST OF CODES	ALL
R	3	00	30	001	001	REV027	LIST OF NORMAL REVISION	ALL
R	3	00	30	002	001	REV036	LIST OF NORMAL REVISION	
	3	00	35	001	001	REV025	RECORD OF TEMPORARY REVISION	ALL
R	3	00	36	001	001	REV036	LIST OF EFFECTIVE TEMPO.REVI	ALL
R	3	00	70	001	001	REV036	CROSS REFERENCE TABLE	ALL
R	3	00	75	001	001	REV036	HIGHLIGHTS	ALL
R	3	00	80	001	001	REV036	LIST OF EFFECTIVE PAGES	ALL
R	3	00	85	001	001	REV036	LIST OF MODIFICATIONS	ALL
	3	01	00	001	001	REV032	CONTENTS	ALL
	3	01	00	002	001	REV028	CONTENTS	
	3	01	10	001	105	REV024	M:24105 OR (24105 US)	ALL
	3	01	20	001	116	REV032	CODE 0140	ALL
	3	01	20	002	209	REV029	M:24105+27276	

M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
N	3	01	20	003	105	REV036	CODE 0358	ALL
N	3	01	20	004	001	REV026		
	3	01	20	005	105	REV027	MOD:24105	ALL
	3	01	20	006	070	REV034	CFM 56-5-B6	
	3	01	20	007	100	REV031	M:24105	ALL
	3	01	20	008	105	REV026	MOD:24105	
	3	01	20	009	020	REV025	V2530=V2533=B1/B2/B3 = 24105	ALL
	3	01	20	010	105	REV025	M:22013 = 24105	
	3	01	21	001	001	REV034		ALL
	3	01	21	002	001	REV024		
N	3	01	22	001	002	REV036	STD=M:24105=US=(24105/US)	ALL
N	3	01	22	002	105	REV036	CODE 0535	
N	3	01	22	002A	100	REV036	CODE 0538	ALL
N	3	01	22	003	108	REV036	M:24105/CFM/IAE	ALL
N	3	01	22	004	115	REV036	24105/CFM ALL	
N	3	01	22	004A	100	REV036	24105=22013	ALL
	3	01	24	001	001	REV024		ALL
	3	01	24	002	001	REV024		
	3	01	27	001	001	REV024		ALL
	3	01	27	002	001	REV024		
	3	01	28	001	001	REV026		ALL
	3	01	28	002	100	REV024	MOD:20024	
	3	01	29	001	001	REV024		ALL
	3	01	29	002	001	REV024		
	3	01	32	001	040	REV035	STD OR (25951+32239)CFM ENG	ALL
R	3	01	34	001	100	REV036	CODE 0427	ALL
	3	01	35	001	105	REV024	CODE 0137	ALL
	3	01	49	001	110	REV034	22562=(22562+25888+27609)	ALL
	3	01	49	002	230	REV033	CODE:0254	
	3	01	49	003	105	REV024	CODE 0223	ALL
	3	01	70	001	050	REV033	STD OR US/CFM 56-5-B	ALL
	3	01	70	002	064	REV032	CFM 56-5-B6/B7	
	3	02	00	001	001	REV032		ALL
	3	02	00	002	001	REV027		
R	3	02	00	003	001	REV036		ALL
R	3	02	00	004	001	REV028		
	3	02	00	005	001	REV026		ALL
	3	02	00	006	100	REV035	22875	

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R	3	02	00	007	001	REV036		ALL
R	3	02	00	008	001	REV024	CODE 0531	
	3	02	00	009	025	REV030	CFM ALL	ALL
	3	02	00	010	100	REV035	25529	
	3	02	01	001	001	REV024		ALL
	3	02	01	002	001	REV030		
	3	02	01	003	001	REV033		ALL
	3	02	01	004	001	REV032		
N	3	02	10	001	001	REV024		ALL
N	3	02	10	002	100	REV036	M:26017	
R	3	02	10	003	001	REV036		ALL
R	3	02	10	004	001	REV030	CODE 0249	
R	3	02	10	005	200	REV036	CODE 0396	ALL
R	3	02	10	006	100	REV030	M:23742	
	3	02	10	006A	001	REV032		ALL
	3	02	10	007	001	REV033	CODE 0461	ALL
	3	02	10	008	001	REV033	CODE 0276	
	3	02	21	001	001	REV028		ALL
	3	02	21	002	320	REV035	26363+26792+28488	
R	3	02	21	003	001	REV024	CODE 0032	ALL
R	3	02	21	004	001	REV036		
R	3	02	21	005	100	REV024	20059=30067	ALL
R	3	02	21	006	110	REV036	MOD:22561	
	3	02	21	007	100	REV024	MOD:24794	ALL
	3	02	21	008	001	REV025		
	3	02	21	009	001	REV024		ALL
	3	02	21	010	001	REV024		
	3	02	21	011	001	REV024		ALL
	3	02	21	012	001	REV024		
	3	02	21	013	110	REV029	M:21899	ALL
	3	02	21	014	001	REV025	CODE 0089	
R	3	02	22	001	100	REV035	26645=27846=28703=30439	ALL
R	3	02	22	002	001	REV036		
N	3	02	22	003	001	REV024		ALL
N	3	02	22	004	240	REV036	CODE 0589	
	3	02	22	005	001	REV028		ALL
	3	02	22	006	100	REV024	CODE 0248	
	3	02	22	007	400	REV027	CODE:0122	ALL
R	3	02	23	001	001	REV036		ALL

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	3	02	24	001	002	REV034	STD=24105	ALL
	3	02	24	002	100	REV031	CODE:0072	
	3	02	24	003	008	REV029	CFM ALL	ALL
	3	02	24	004	305	REV031	21678+24105+26017	
N	3	02	24	005	108	REV032	CODE 0008/CFM ALL	1068
N	3	02	24	006	205	REV036	M:21678+26377	
N	3	02	24	005	108	REV032	CODE 0008/CFM ALL	1145
N	3	02	24	006	215	REV036	CODE:0554	
	3	02	24	007	100	REV027	M:21678	ALL
	3	02	24	008	400	REV032	CODE 0426	
N	3	02	24	009	205	REV036	CODE:0555	ALL
N	3	02	24	010	001	REV028		
	3	02	24	011	200	REV030	24105+26017	ALL
	3	02	24	012	370	REV026	21678+24105+26017	
N	3	02	24	013	205	REV036	21678+24105	ALL
N	3	02	24	014	400	REV036	CODE 0426	
	3	02	24	015	200	REV026	CODE 0393	ALL
	3	02	24	016	220	REV035	CODE 0393	
N	3	02	24	017	250	REV033	CODE:0350	ALL
N	3	02	24	018	215	REV036	24105+25404 CFM=IAE	
N	3	02	24	019	100	REV036	M:22013=24105=28160	ALL
N	3	02	24	020	210	REV033	MOD 21678+21706	
	3	02	24	021	100	REV035	21678	ALL
	3	02	24	022	230	REV027	CODE 0476	
	3	02	24	023	310	REV031	M:21285+21678+25404/CFM	ALL
	3	02	24	024	200	REV032	CODE 0239	
	3	02	24	025	303	REV029	CODE 0552	ALL
	3	02	24	026	110	REV030	M:24105=28160=30020	
	3	02	24	027	100	REV030	M:22013=24105=28160=30020	ALL
	3	02	24	028	001	REV032		
	3	02	26	001	001	REV032		ALL
	3	02	26	002	001	REV033		
	3	02	26	003	001	REV033		ALL
	3	02	26	004	100	REV035	27498=31891	
N	3	02	26	005	100	REV036	20057=20059=30067	ALL
N	3	02	26	006	001	REV035		
R	3	02	26	007	300	REV036	CODE 0475	ALL
R	3	02	26	008	300	REV032	24105+25410+26017	
N	3	02	26	009	001	REV032		ALL
N	3	02	26	010	001	REV036		

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N	3	02	26	011	400	REV036	CODE:0357	ALL
N	3	02	26	012	210	REV036	CODE 0530	
	3	02	27	001	200	REV024	24612+26017	ALL
	3	02	27	002	405	REV032	CODE 0415	
	3	02	27	003	110	REV028	CODE 0183	ALL
	3	02	27	004	400	REV032	20024+24105+25410+26017	
	3	02	27	005	100	REV024	MOD:24612	ALL
	3	02	27	006	001	REV033		
R	3	02	27	007	220	REV027	CODE 0392	ALL
R	3	02	27	008	410	REV036	24105+24511+25410+26017	
	3	02	27	009	100	REV026	MOD:26017	ALL
	3	02	27	010	215	REV032	CODE 0229	
	3	02	27	011	110	REV031	25410	ALL
	3	02	27	012	100	REV025	MOD:26017	
	3	02	27	013	300	REV028	24105+25410+26017	ALL
	3	02	27	014	200	REV024	MOD 24105+26017	
	3	02	27	015	310	REV024	24105+25410+26017	ALL
	3	02	27	016	240	REV033	M:21964+22087	
	3	02	27	017	110	REV025	26017=(25410+26017)	ALL
	3	02	27	018	001	REV024		
	3	02	27	019	001	REV024		ALL
	3	02	27	020	200	REV028	CODE 0045	
	3	02	27	021	001	REV024		ALL
	3	02	27	022	001	REV024		
	3	02	28	001	100	REV033	M:20024	ALL
	3	02	28	002	002	REV033		
	3	02	28	003	100	REV028	MOD 20024	ALL
	3	02	28	004	001	REV024		
	3	02	28	005	001	REV026		ALL
	3	02	28	006	100	REV026	CODE 0359/CFM ALL	
R	3	02	28	007	100	REV024	MOD 20024	ALL
R	3	02	28	008	001	REV036		
R	3	02	28	009	110	REV036	20024	ALL
R	3	02	28	010	100	REV036	20024	
N	3	02	29	001	105	REV036	M:22013=24105	ALL
N	3	02	29	002	001	REV024		
	3	02	29	003	110	REV032	MOD:26017	ALL
	3	02	29	004	001	REV024		
	3	02	29	005	110	REV033	26017	ALL
	3	02	29	006	001	REV025		

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	3	02	29	007	002	REV024		ALL
	3	02	29	008	230	REV024	CODE 0355	
	3	02	29	009	001	REV024		ALL
	3	02	29	010	001	REV024		
	3	02	29	011	310	REV034	CODE 0464	ALL
	3	02	29	012	001	REV024		
	3	02	29	013	200	REV034	24105+26017	ALL
	3	02	29	014	100	REV034	26017	
N	3	02	29	015	100	REV033	26017	ALL
N	3	02	29	016	105	REV036	M:22013=24105	
	3	02	30	001	100	REV030	25410=26017	ALL
	3	02	30	002	001	REV024		
	3	02	30	003	001	REV027		ALL
	3	02	30	004	001	REV024		
	3	02	30	005	100	REV025	MOD:22875	ALL
	3	02	30	006	001	REV027		
	3	02	30	007	001	REV024		ALL
	3	02	30	008	205	REV028	M:24105+26017	
	3	02	31	001	001	REV024		ALL
	3	02	31	002	001	REV032		
	3	02	31	003	001	REV024		ALL
	3	02	31	004	001	REV033		
	3	02	32	001	001	REV030	STD=31897=31896	ALL
	3	02	32	002	001	REV034		
R	3	02	32	003	110	REV036	24645	ALL
R	3	02	32	004	002	REV033	STD=(20139+22129)	
	3	02	32	005	001	REV024		ALL
	3	02	32	006	001	REV032		
	3	02	32	007	001	REV031		ALL
	3	02	32	008	001	REV035		
N	3	02	32	009	105	REV035	24105	ALL
N	3	02	32	010	110	REV036	M:24105=(22013+24044)	
	3	02	32	011	001	REV033	STD=27979	ALL
	3	02	34	001	001	REV024	CODE:0294	ALL
	3	02	34	002	223	REV030	CODE 0095	
	3	02	34	003	100	REV033	26526	ALL
	3	02	34	004	205	REV033	M:26017+26526	
R	3	02	34	005	001	REV036		ALL
R	3	02	34	006	105	REV033	26017=(25410+26017)	

M V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA----- -----EFFECTIVITY-----

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	3	02	34	007	200	REV035	CODE 0172	ALL
	3	02	34	008	105	REV031	CODE 0383	
N	3	02	34	009	300	REV036	CODE 0198	ALL
N	3	02	34	010	100	REV036	CODE:0382	
R	3	02	34	011	100	REV033	MOD:26017	ALL
R	3	02	34	012	001	REV036		
	3	02	34	013	105	REV035	CODE 0614	ALL
	3	02	34	014	105	REV035	22769	
R	3	02	34	015	100	REV036	M:26526	ALL
R	3	02	34	016	100	REV025	M:26526	
	3	02	34	017	105	REV033	CODE:0205	ALL
	3	02	34	018	100	REV035	26017	
	3	02	34	019	001	REV035		ALL
	3	02	34	020	001	REV035		
	3	02	34	021	001	REV035		ALL
	3	02	34	022	001	REV035		
	3	02	34	023	035	REV035	56-5-B5/B6/B7	ALL
	3	02	34	024	035	REV035	56-5-B5/B6/B7	
	3	02	34	025	035	REV035	56-5-B5/B6/B7	ALL
	3	02	36	001	001	REV024		ALL
	3	02	36	002	001	REV034		
R	3	02	36	003	001	REV036		ALL
R	3	02	36	004	200	REV028	M:22562+24105	
R	3	02	36	005	200	REV036	MOD:22562+24105	ALL
R	3	02	36	006	001	REV024		
	3	02	36	007	100	REV025	M:24105	ALL
	3	02	49	001	001	REV024		ALL
	3	02	52	001	001	REV024	CODE 0188	ALL
	3	02	70	001	120	REV030	M:28307=27725/CFM 56-5-B	ALL
	3	02	70	002	130	REV030	CODE:0046/56-5-B	
	3	02	70	003	035	REV024	CFM 56-5-B	ALL
	3	02	70	004	150	REV028	CODE 0020	
	3	02	70	005	020	REV024	CFM ALL	ALL
	3	02	70	006	010	REV026	CFM ALL	
	3	02	70	007	020	REV032	CFM	ALL
	3	02	70	008	010	REV032	CFM	
	3	02	70	009	020	REV030	CFM ALL	ALL
	3	02	70	010	110	REV029	CODE 0145/CFM 56-5-B	

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	3	02	70	011	035	REV032	CFM ALL	ALL
	3	02	70	012	200	REV030	M:25404+26017	
	3	02	70	013	100	REV033	MOD:25410	ALL
	3	02	70	014	105	REV035	MOD 24105	
	3	02	70	015	040	REV035	CFM ENG:ALL	ALL
	3	02	70	016	230	REV034	CODE 0312/CFM ALL	
	3	02	70	017	220	REV026	CODE 0050	ALL
	3	02	70	018	020	REV024	CODE 0361 CFM ALL	
	3	02	70	019	030	REV024	CFM ALL	ALL
	3	02	70	020	150	REV028	M:26017 CFM 56-5-B4/B5/B6/B7	
	3	02	70	021	020	REV034	CFM 56-5-A4/A5/B5/B6/B7	ALL
	3	02	70	022	130	REV024	CODE 0106	
	3	02	70	023	120	REV033	CODE 0314/CFM ALL	ALL
	3	02	70	024	120	REV024	M:24035=24160=24189 CFM ALL	
	3	02	70	025	020	REV026	CFM ALL	ALL
	3	02	70	026	020	REV024	CFM ALL	
	3	02	80	001	001	REV035		ALL
	3	02	80	002	100	REV031	M:26526	
R	3	02	80	003	001	REV036		ALL
R	3	02	80	004	001	REV024		
R	3	02	80	005	100	REV036	26526	ALL
R	3	02	80	006	001	REV035		
	3	02	80	007	001	REV034		ALL
	3	02	80	008	065	REV029	CODE:0109/T=L	
	3	02	80	009	001	REV025		ALL
	3	02	80	010	001	REV034		
	3	02	80	010A	001	REV031		ALL
	3	02	80	011	001	REV035		ALL
	3	02	80	011A	001	REV034		ALL
	3	02	80	012	001	REV034		ALL
	3	02	80	013	001	REV030		ALL
	3	02	80	014	001	REV033		
	3	02	80	015	100	REV032	MOD:22562	ALL
	3	02	80	016	025	REV027	CFM ALL	
N	3	02	80	017	110	REV035	24105	ALL
N	3	02	80	018	302	REV036	23208+24077+24105	
	3	02	80	019	100	REV035	22249	ALL
	3	02	80	020	100	REV035	25529=25819=26117=26270	

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	3	02	90	001	001	REV028		ALL
	3	02	90	002	105	REV030	24105=30203	
	3	02	90	003	001	REV033		ALL
	3	02	90	004	001	REV028		
R	3	02	90	005	001	REV036		ALL
	3	03	00	001-2	001	REV027		ALL
	3	03	01	001	001	REV035		ALL
	3	03	01	002	001	REV035		
	3	03	01	003	001	REV034		ALL
	3	03	01	004	001	REV034		
	3	03	01	005	001	REV024		ALL
	3	03	02	001	001	REV034		ALL
	3	03	02	002	001	REV025		
	3	03	03	001	001	REV024		ALL
	3	03	04	001	001	REV024		ALL
	3	03	04	002	001	REV025		
	3	03	04	003	100	REV028	22373=(22373+25072+28897)	ALL
	3	03	04	004	001	REV033		
R	3	03	04	005	001	REV036		ALL
R	3	03	04	006	100	REV025	MOD 22013 OR 24105 OR 24701	
	3	03	04	007	110	REV030	M:22013=24105=24701/CFM ALL	ALL
	3	03	04	008	001	REV024	CODE 0462	
	3	03	05	001	001	REV024		ALL
	3	03	05	002	001	REV024		
N	3	03	05	003	105	REV036	22199=24105	ALL
N	3	03	05	004	001	REV024		
	3	03	05	005	001	REV033		ALL
	3	03	05	006	001	REV032		
N	3	03	06	001	001	REV024		ALL
N	3	03	06	002	100	REV036	CODE 0435	
	3	03	06	003	100	REV033	24852=25336=27917=28218	ALL
	3	03	06	004	105	REV032	M:24373	
N	3	03	06	005	001	REV031		ALL
N	3	03	06	006	100	REV036	MOD 22031=25440	
	3	03	06	007	001	REV025		ALL
	3	03	06	008	001	REV033	STD=31896=31897	
	3	03	06	009	001	REV024	STD=31896=31897	ALL
	3	03	06	010	001	REV024		

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	3	03	06	012	100	REV034	21946	
	3	03	06	013	001	REV030	STD OR 24588 OR(24215+24588)	ALL
	3	03	06	014	001	REV030		
	3	03	06	015	001	REV028		ALL
	3	03	06	016	001	REV029		
R	3	03	07	001	001	REV033		ALL
R	3	03	07	002	001	REV036		
	3	03	07	003	001	REV033		ALL
	3	03	08	001	020	REV034	CFM56-5-A1/A3/A4/A5/B5/B6/B7	ALL
	3	03	08	002	020	REV032	CFM ALL	
	3	03	08	003	040	REV030	CFM56-5-B1/B2/B3/B4/B5/B6/B7	ALL
	3	03	09	001	020	REV029	CFM ALL	ALL
	3	03	09	002	025	REV030	CFM ALL	
	3	03	10	001	001	REV034		ALL
	3	03	10	002	001	REV034		
	3	03	10	003	200	REV024	MOD:21964+22087	ALL
	3	03	10	004	001	REV033	STD=31896=31897	
R	3	03	10	005	001	REV026	STD=31896=31897	ALL
R	3	03	10	006	105	REV036	24105	
R	3	03	11	001	040	REV036	CODE:0504/CFM	ALL
R	3	03	11	002	100	REV035	20081	
	3	03	12	001	001	REV030		ALL
	3	03	12	002	120	REV025	CODE 0189 CFM ALL	
R	3	03	12	003	001	REV036		ALL
R	3	03	12	004	100	REV032	CODE 0189	
	3	03	12	005	001	REV033	CODE 0092	ALL
	3	03	12	006	001	REV035		
R	3	03	13	001	001	REV036		ALL
	3	03	14	001	100	REV027	CODE 0189	ALL
	3	03	14	002	100	REV027	MOD:24035 OR 24160 OR 24211	
R	3	03	15	001	001	REV035	CODE 0603	ALL
R	3	03	15	002	001	REV036		
R	3	03	16	001	001	REV024	STD OR M:28238+28719	ALL
R	3	03	16	002	001	REV036		
	3	03	16	003	001	REV035	CODE 0230	ALL
	3	03	17	001	100	REV025	CODE 0036	ALL
	3	03	17	002	001	REV024	STD:CODE 0211	

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R	3	03	17	004	100	REV034	24404=24405=25416=25530	
N	3	03	18	001	200	REV027	M:26018+26398	ALL
N	3	03	18	002	210	REV036	CODE:0578	
R	3	03	18	003	100	REV036	CODE:0511	ALL
R	3	03	18	004	100	REV030	CODE 0001	
R	3	03	18	005	001	REV030		ALL
R	3	03	18	006	001	REV036		
R	3	03	18	007	001	REV036		ALL
R	3	03	18	008	001	REV036		
N	3	03	18	009	001	REV036		ALL
R	3	03	19	001	105	REV036	CODE 0535	ALL
R	3	03	19	002	001	REV036		
N	3	03	19	003	120	REV036	CODE 0543	ALL
N	3	03	19	004	105	REV036	CODE 0546	
N	3	03	19	005	001	REV036		ALL
N	3	03	19	006	200	REV036	CODE 0549	
N	3	03	19	007	100	REV036	CODE 0538	ALL
N	3	03	19	008	001	REV036		
N	3	03	19	009	001	REV036	STD=M:24105	ALL
N	3	03	19	010	001	REV036		
N	3	03	19	011	100	REV036	M:24064=24065=24066=24067	ALL
N	3	03	19	012	100	REV036	M:23742	
N	3	03	19	013	001	REV036		ALL
N	3	03	20	001	100	REV035	26398	ALL
N	3	03	20	002	001	REV024		
	3	03	21	001	001	REV024		ALL
	3	03	22	001	035	REV032	56-5-B5/B6/B7	ALL
	3	03	22	002	035	REV032	56-5-B5/B6/B7	
R	3	03	22	003	105	REV035	24105	ALL
R	3	03	22	004	105	REV036	M:24105	
	3	03	22	005	001	REV033		ALL
	3	03	22	006	001	REV027		
N	3	03	23	001	110	REV036	25863	ALL
N	3	03	23	002	001	REV036		
N	3	03	23	003	100	REV036	MOD:25863=(ACA/25863)	ALL
N	3	03	23	004	100	REV036	M:25863	
	3	03	24	001	100	REV035	20081	ALL
	3	03	24	002	001	REV034	STD=(25951+32239)	

M V CH SEC ---PAGE-- SEQ --REV-- ----VALIDATION CRITERIA----- -----EFFECTIVITY-----

M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
	3	03	25	001	020	REV035	CODE 0186/CFM ALL	ALL
	3	03	25	002	001	REV035		
	3	03	25	003	170	REV035	22013=23119/CFM ALL	ALL
	3	03	26	001	100	REV030	CODE 0213	ALL
	3	03	90	001	001	REV035		ALL
	3	03	90	002	001	REV034		
	3	03	90	003	001	REV027		ALL
	3	03	90	004	001	REV027		
	3	03	90	005	001	REV027		ALL
	3	03	90	006	001	REV030		
	3	03	90	007	001	REV033		ALL
R	3	04	00	001	203	REV036	CODE 0501	ALL
R	3	04	00	002	001	REV032		
	3	04	00	003	001	REV033		ALL
	3	04	10	001	001	REV024		ALL
	3	04	10	002	115	REV028	M:24105/CFM ALL=IAE ALL	
	3	04	10	003	001	REV024		ALL
	3	04	10	004	100	REV024	MOD:22013 OR 24105	
	3	04	21	001	001	REV032		ALL
	3	04	21	002	001	REV024		
N	3	04	23	001	001	REV036		ALL
N	3	04	23	001A	001	REV036		ALL
N	3	04	23	002	100	REV024	20137=(20137+28360+30239)	ALL
	3	04	23	003	100	REV024	CODE 0317	ALL
	3	04	24	001	001	REV035		ALL
	3	04	24	002	001	REV033		
N	3	04	24	003	001	REV033		ALL
N	3	04	24	004	103	REV036	24771	
N	3	04	24	005	101	REV036	24613=22013+24613	ALL
N	3	04	24	006	001	REV036		
R	3	04	27	001	001	REV028		ALL
R	3	04	27	002	001	REV036		
R	3	04	27	003	001	REV036		ALL
R	3	04	27	004	001	REV036		
R	3	04	27	005	001	REV036		ALL
R	3	04	27	006	001	REV036		

M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
R	3	04	27	007	001	REV036		ALL
R	3	04	27	008	001	REV036		
R	3	04	27	009	001	REV036		ALL
R	3	04	27	010	001	REV036		
N	3	04	27	011	001	REV036		ALL
N	3	04	27	012	001	REV036		
	3	04	28	001	100	REV024	MOD:20024	ALL
	3	04	30	001	100	REV034	22013=24105	ALL
	3	04	30	002	001	REV024		
	3	04	31	001	001	REV024		ALL
	3	04	31	002	001	REV024		
	3	04	32	001	001	REV031		ALL
	3	04	32	002	001	REV031	STD OR (25951 + 32239)	
	3	04	32	003	001	REV034		ALL
	3	04	34	001	001	REV030		ALL
	3	04	34	002	100	REV032	CODE:0317	
	3	04	34	003	001	REV031		ALL
	3	04	34	004	001	REV035		
	3	04	34	005	001	REV026		ALL
	3	04	34	006	001	REV032		
	3	04	34	007	001	REV031	CODE 0058	ALL
	3	04	34	008	001	REV034		
	3	04	34	009	100	REV034	23672=24581=24785=25108	ALL
	3	04	34	010	001	REV024		
	3	04	34	011	100	REV024	CODE 0063	ALL
	3	04	34	012	120	REV024	CODE 0063	
	3	04	34	013	105	REV029	CODE 0264	ALL
	3	04	34	014	105	REV029	CODE 0264	
	3	04	34	015	120	REV024	CODE 0063	ALL
	3	04	34	016	001	REV029		
	3	04	34	017	001	REV026		ALL
	3	04	34	018	001	REV026		
	3	04	34	019	001	REV028	CODE 0258	ALL
	3	04	34	020	001	REV028		
	3	04	34	021	100	REV031	M:26526	ALL
	3	04	70	001	001	REV024		ALL
	3	04	70	002	110	REV024	M:22013=24035=24160=24189	
	3	04	70	003	020	REV026	CFM ALL	ALL
	3	04	70	004	100	REV033	CODE 0145 CFM ALL	

M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
	3	04	70	005	100	REV029	CODE 0145/CFM ALL	ALL
	3	04	70	006	020	REV033	STD=M:30439+31040/CFM	
	3	04	70	007	020	REV028	CFM ALL	ALL
	3	04	70	008	007	REV030	CFM ALL	
	3	04	70	009	001	REV030		ALL
	3	04	70	010	001	REV030		
	3	04	80	001	001	REV030		ALL
	3	04	80	002	001	REV032		
	3	04	80	003	001	REV032		ALL
N	3	04	90	001	020	REV024	CFM ALL	ALL
N	3	04	90	002	020	REV035	CFM ALL	
	3	04	91	001	110	REV033	24105=(20268+24105)	ALL
	3	04	91	002	265	REV028	M:20268+24917 CFM 56-5-B5/B6	
R	3	04	91	003	100	REV025	M:24917	ALL
R	3	04	91	004	001	REV036		
R	3	04	91	005	001	REV036		ALL
R	3	04	91	006	001	REV026		
N	3	04	91	007	001	REV036		ALL
N	3	04	91	008	001	REV036		
	3	04	91	008A	001	REV033		ALL
	3	04	91	009	001	REV035		ALL
	3	04	91	010	001	REV028		
	3	04	91	011	001	REV028		ALL
	3	04	91	012	001	REV028		
	3	04	91	013	100	REV028	M:21729	ALL
	3	04	91	014	001	REV028		
	3	04	91	015	001	REV028		ALL
R	3	04	92	001	001	REV036		ALL
R	3	04	92	002	001	REV036		
R	3	04	92	003	001	REV033		ALL
R	3	04	92	004	001	REV036		
N	3	04	92	005	001	REV036		ALL
N	3	04	92	006	001	REV036		
	3	05	00	001	001	REV025		ALL
	3	05	00	002	001	REV024		
	3	05	05	001	001	REV024		ALL
	3	05	05	002	001	REV025		
	3	05	05	003	001	REV024		ALL
	3	05	05	004	001	REV024		

M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
3		05	05	005	001	REV032		ALL
3		05	05	006	001	REV024		
3		05	06	001	020	REV024	CODE:0517	ALL
3		05	06	002	080	REV025	CFM 56-5-B6	
3		05	06	003	080	REV025	CFM 56-5-B6	ALL
3		05	06	004	001	REV024		
3		05	06	005	078	REV027	CFM 56-5-B6	ALL
3		05	06	006	075	REV027	CFM 56-5-B6	
3		05	06	007	075	REV025	CFM 56-5-B5/B6	ALL
3		05	06	008	075	REV025	CFM 56-5-B5/B6	
3		05	06	009	075	REV025	CODE:0513/56-5-B5/B6	ALL
3		05	06	010	020	REV025	STD=M:28238/CFM ALL/T=L	
3		05	10	001	115	REV027	M:25800/CFM 56-5-B1 TO B7	ALL
3		05	10	002	280	REV031	CODE:0380/56-5-B5/B6	
3		05	10	003	280	REV031	CODE:0380/56-5-B5/B6	ALL
3		05	10	004	280	REV031	CODE:0380/56-5-B5/B6	
3		05	10	005	280	REV031	CODE:0380/56-5-B5/B6	ALL
3		05	10	006	280	REV031	CODE:0380/56-5-B5/B6	
3		05	10	007	280	REV031	CODE:0380/56-5-B5/B6	ALL
3		05	10	008	280	REV031	CODE:0380/56-5-B5/B6	
3		05	10	009	280	REV031	CODE:0380/56-5-B5/B6	ALL
3		05	15	001	130	REV030	CODE:0515/56-5-B5/B6	ALL
3		05	15	002	080	REV030	CODE:0513/56-5-B5/B6	
3		05	15	003	080	REV030	CODE:0513/56-5-B5/B6	ALL
3		05	15	004	080	REV030	CODE:0513/56-5-B5/B6	
3		05	15	005	280	REV035	CODE:0380/56-5-B5/B6	ALL
3		05	15	006	280	REV030	CODE:0380/56-5-B5/B6/T=L	
3		05	15	007	280	REV030	CODE:0380/56-5-B5/B6	ALL
3		05	15	008	110	REV025	MOD:24105	
3		05	15	009	280	REV030	CODE:0380/56-5-B5/B6	ALL
3		05	15	010	280	REV030	CODE:0380/56-5-B5/B6	
3		05	15	011	280	REV030	CODE:0380/56-5-B5/B6	ALL
3		05	15	012	280	REV030	CODE:0380/56-5-B5/B6	
3		05	15	013	280	REV030	CODE:0380/56-5-B5/B6	ALL
3		05	15	014	280	REV030	CODE:0380/56-5-B5/B6	
3		05	15	015	280	REV030	CODE:0380/56-5-B5/B6	ALL
3		05	15	016	280	REV030	CODE:0380/56-5-B5/B6	
3		05	15	017	280	REV030	CODE:0380/56-5-B5/B6	ALL
3		05	15	018	280	REV030	CODE:0380/56-5-B5/B6	

M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
	3	05	15	019	280	REV030	CODE:0380/56-5-B5/B6	ALL
	3	05	15	020	280	REV030	CODE:0380/56-5-B5/B6	
	3	05	20	001	250	REV030	M:24105+25800/56-5-B5/B6/B7	ALL
	3	05	20	002	280	REV030	CODE:0380 56-5-B5/B6	
	3	05	20	003	280	REV030	CODE:0380 56-5-B5/B6	ALL
	3	05	20	004	280	REV030	CODE:0380 56-5-B5/B6	
	3	05	20	005	280	REV030	CODE:0380 56-5-B5/B6	ALL
	3	05	20	006	280	REV030	CODE:0380 56-5-B5/B6	
	3	05	20	007	280	REV030	CODE:0380 56-5-B5/B6	ALL
	3	05	20	008	280	REV030	CODE:0380 56-5-B5/B6	
	3	05	20	009	280	REV030	CODE:0380 56-5-B5/B6	ALL
	3	05	20	010	280	REV030	CODE:0380 56-5-B5/B6	
	3	05	20	011	280	REV030	CODE:0380 56-5-B5/B6	ALL
	3	05	20	012	280	REV030	CODE:0380 56-5-B5/B6	
	3	05	20	013	280	REV030	CODE:0380 56-5-B5/B6	ALL
	3	05	20	014	280	REV030	CODE:0380 56-5-B5/B6	
	3	05	20	015	280	REV030	CODE:0380 56-5-B5/B6	ALL
	3	05	20	016	280	REV030	CODE:0380 56-5-B5/B6	
	3	05	20	017	280	REV030	CODE:0380 56-5-B5/B6	ALL
	3	05	25	001	140	REV027	M:25800/56-5-B1 TO B7	ALL
	3	05	25	002	280	REV031	CODE:0380/56-5-B5/B6	
	3	05	25	003	280	REV031	CODE:0380/56-5-B5/B6	ALL
	3	05	25	004	280	REV031	CODE:0380/56-5-B5/B6	
	3	05	25	005	280	REV031	CODE:0380/56-5-B5/B6	ALL
	3	05	30	001	120	REV027	M:25800/56-5-B	ALL
	3	05	30	002	280	REV030	CODE:0380 56-5-B5/B6	
	3	05	30	003	280	REV030	CODE 0380/CFM 56-5-B5/B6	ALL
R	3	05	35	001	100	REV036	M:22013=24105	ALL
R	3	05	35	002	135	REV025	M:20268/CFM 56-5-B6	
	3	05	35	003	135	REV025	MOD:20268 CFM 56-5-B6	ALL
	3	05	35	004	001	REV026		
	3	05	35	005	145	REV026	MOD 20268 CFM 56-5-B6	ALL
	3	05	35	006	001	REV026		
	3	05	35	007	145	REV026	MOD 20268 CFM 56-5-B6	ALL
	3	05	35	008	001	REV026		
	3	05	35	009	001	REV029		ALL
	3	05	35	010	001	REV029		
	3	05	35	011	001	REV029		ALL
	3	05	35	012	001	REV029		

M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
	3	05	40	001	250	REV030	M:24105+25800/56-5-B5/B6/B7	ALL
	3	05	40	002	280	REV030	CODE:0380 56-5-B5/B6	
	3	05	40	003	280	REV030	CODE:0380 56-5-B5/B6	ALL
	3	05	50	001	001	REV025		ALL
	3	05	50	002	001	REV026		
	3	05	50	003	110	REV025	MOD 24105	ALL
	3	05	50	004	110	REV025	MOD 24105	
	3	06	00	001	001	REV024		ALL
	3	06	10	001	125	REV027	M:25800/56-5-B	ALL
	3	06	10	002	001	REV024		
	3	06	20	001	225	REV035	CODE 0380 CFM 56-5-B5/B6	ALL
	3	06	30	001	125	REV027	M:25800/56-5-B1 TO B7	ALL
	3	06	30	002	280	REV030	CODE 0380 CFM 56-5-B5/B6	
	3	06	30	003	280	REV030	CODE 0380/CFM 56-5-B5/B6	ALL
	3	06	30	004	280	REV030	CODE 0380 CFM 56-5-B5/B6	
	3	06	30	005	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
	3	06	30	006	280	REV030	CODE 0380 CFM 56-5-B5/B6	
	3	06	30	007	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
	3	06	30	008	280	REV030	CODE 0380 CFM 56-5-B5/B6	
	3	06	30	009	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
	3	06	30	010	280	REV030	CODE 0380 CFM 56-5-B5/B6	
	3	06	30	011	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
	3	06	30	012	235	REV030	M:24105+25800/56-5-B5/B6/B7	
	3	06	30	013	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
	3	06	40	001	125	REV032	M:25800/56-5-B1 TO B7	ALL
	3	06	40	002	280	REV030	CODE 0380/CFM 56-5-B5/B6	
	3	06	40	003	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
	3	06	40	004	280	REV030	CODE 0380 CFM 56-5-B5/B6	
	3	06	40	005	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
	3	06	40	006	280	REV030	CODE 0380 CFM 56-5-B5/B6	
	3	06	40	007	001	REV024		ALL
	3	06	50	001	125	REV027	M:25800/56-5-B	ALL
	3	06	50	002	280	REV030	CODE 0380/CFM 56-5-B5/B6	
	3	06	50	003	280	REV030	CODE 0380/CFM 56-5-B5/B6	ALL
	3	06	50	004	280	REV030	CODE 0380/CFM 56-5-B5/B6	
	3	06	50	005	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
	3	06	50	006	280	REV030	CODE 0380 CFM 56-5-B5/B6	

M	V	CH	SEC	---PAGE--	SEQ	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
3		06	50	007	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
3		06	50	008	280	REV030	CODE 0380 CFM 56-5-B5/B6	
3		06	50	009	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
3		06	50	010	280	REV030	CODE 0380 CFM 56-5-B5/B6	
3		06	50	011	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
3		06	50	012	280	REV030	CODE 0380 CFM 56-5-B5/B6	
3		06	50	013	235	REV030	M:24105+25800/56-5-B5/B6/B7	ALL
3		06	50	014	280	REV030	CODE 0380 CFM 56-5-B5/B6	
3		06	50	015	280	REV030	CODE 0380 CFM 56-5-B5/B6	ALL
3		06	55	001	280	REV030	CODE 0380/CFM 56-5-B5/B6	ALL
3		06	60	001	280	REV030	CODE 0380/CFM 56-5-B5/B6	ALL
3		06	70	001	002	REV024		ALL
3		06	70	002	110	REV024	MOD:24105	
3		06	70	003	001	REV026		ALL
3		07	00	001-2	001	REV024		ALL
3		07	10	001-2	001	REV024		ALL
3		07	20	001	001	REV030	LIST OF EFFECTIVE OEBS	ALL
3		07	30	001	001	REV025		ALL
3		07	30	002	001	REV025		

M V T	REV	MOD SB	MP	TITLE / VALIDITY
N	036	....	P0164	COMMUNICATIONS - DATA LINK SYSTEM - DEFINE PIN PROGRAMMING ALL
.	035A	20024	......	FUEL- INSTALL A CENTRE TANK SYSTEM- ALL
.	035A	20059	......	AIR CONDITIONING - CARGO COMPARTMENT - VENTILATION - INSTALL SYSTEM IN AFT COMPARTMENT - ALL
.	035A	20063	......	OXYGEN - FLIGHT CREW SYSTEM - INSTALL A 77.1 CU/FT BOTTLE IN COMPOSITE MATERIAL - ALL
.	035A	20067	......	FIRE PROTECTION - FWD CARGO COMPARTMENT - INSTALL SMOKE DETECTION SYSTEM - ALL
.	035A	20069	......	FIRE PROTECTION - AFT CARGO COMPARTMENT - INSTALL SMOKE DETECTION SYSTEM - ALL
.	035A	20071	......	FIRE PROTECTION - CARGO COMPARTMENT FIRE EXTINGUISHING - INSTALL A SINGLE SHOT SYSTEM - ALL
.	035A	20081	......	LIGHTS - EXTERIOR LIGHTS - INSTALL SYNCHRONIZED STROBE LIGHTS ALL
.	035A	20137	......	COMMUNICATIONS - RADIO MANAGEMENT - INSTALL A 3RD RMP - ALL
.	035A	20268	......	WINGS-WING TIP FENCES-INTRODUCE WING TIPS INCLUDING FENCES- ALL
N	036	21206	......	NAVIGATION - ADIRU - PROVIDE COMMUNITY FOR CFM AND IAE ENGINES - ALL

M V T	REV	MOD	MP SB	TITLE	VALIDITY
.	035A	21285	....	ENGINE CONTROLS-MODIFY POWER SUPPLY FOR HP FUEL SOLENOID	ALL
.	035A	21678	....	ELECTRICAL POWER-AC/DC ESSENTIAL POWER DISTRIBUTION-PROVIDE PROVISIONS FOR ETOPS-	ALL
.	035A	21706	....	AIR CONDITIONING - VENTILATION CONT. ISOLATION VALVES - CHANGE POWER SUPPLY FOR ETOPS -	ALL
.	035A	21729	....	AIR CONDITIONING -AVIONICS VENTILATION- IMPROVE ACCURANCY OF SKIN TEMPERATURE READING	ALL
.	035A	21812	....	ICE AND RAIN PROTECTION - WING ANTI-ICING - INSTALL MODIFIED VALVES	ALL
.	035A	21899	....	AIR CONDITIONING-AVIONICS VENTILATION- INSTALL A NRV AT AIR INLET	ALL
.	035A	21946	....	OXYGENE - COCKPIT - INSTALL MODIFIED LP OXYGEN SUPPLY SOLENOID VALVE	ALL
.	035A	21964	....	FLIGHT CONTROLS - ELAC/EFCS SYSTEM - INTRODUCE SOFTWARE L62	ALL
.	035A	21988	....	FUEL - IMPROVE LOW LEVEL WARNING	ALL
.	035A	21992	....	INDICATING/RECORDING SYSTEMS - INTRODUCE CFDIU BATCH 2	ALL
N	036	22031	....	NAVIGATION - INSTALL BENDIX TYPE TRA 67A ATC TRANSPONDERS (BFE)	ALL

M V T	REV	MOD SB	MP	TITLE / VALIDITY
.	035A	22087	......	FLIGHT CONTROLS - FCDC - INSTALL SOFTWARE L45 ALL
N	036	22199	......	WINGS - REMOVE LEADING EDGE VENTILATION SYSTEM ALL
.	035A	22249	......	AUTO FLIGHT - ACTIVATE WINDSHEAR FUNCTION ALL
.	035A	22373	......	ELECTRICAL POWER - DC GENERATION - INTRODUCE IMPROVED BCL ALL
.	035A	22450	......	ICE AND RAIN PROTECTION - WING ICE PROTECTION - INTRODUCE AN IMPROVED LOW PRESSURE WARNING SWITCH ALL
.	035A	22536	......	NAVIGATION - INSTALL A BENDIX TCAS II COLLISION AVOIDANCE SYSTEM ALL
.	035A	22561	......	FIRE PROTECTION - LAVATORY SMOKE DETECTION - INTRODUCE AMBIENT SYSTEM ALL
.	035A	22562	......	AIRBORNE AUXILIARY POWER UNIT - INTRODUCE APIC APS-3200 ALL
.	035A	22707	......	INDICATING RECORDING SYSTEMS - EIS - DEFINE COF A STANDARD FOR A320/A321 DMC ALL
.	035A	22769	......	NAVIGATION - GPWS - INSTALL GPWC MARK V WITH INTERFACE WITH CFDS ALL
.	035A	22875	......	ICE AND RAIN PROTECTION - ICE DETECTION - INSTALL DUAL ADVISORY ICE DETECTION SYSTEM ALL

M V T	REV	MOD	MP SB	TITLE / VALIDITY
.	035A	23119	....	HYDRAULIC POWER-BLUE MAIN HYDRAULIC POWER-IMPROVE MAINTENANCE STATUS OF BLUE HYDRAULIC RESERVOIR ALL
.	035A	23208	....	LANDING GEAR - WHEELS AND BRAKES - INTRODUCE BSCU STD 6 ALL
.	035A	23661	....	ENGINE FUEL AND CONTROL - CFM 56 - EIU - INTRODUCE VERSION 13 ALL
.	035A	23672	....	NAVIGATION - ADIRS - INSTALL LITTON 4MCU ON A321 A/C ALL
.	035A	23698	....	AUXILIARY POWER UNIT - CONTROL AND MONITORING - INTRODUCE A NEW ECB ALL
.	035A	23699	....	AUXILIARY POWER UNIT - CONTROL AND MONITORING - MODIFY WIRE HARNESSES FOR NEW ECB 817-1 ALL
.	035A	23742	....	AUTO FLIGHT - FCU - INTRODUCE FCU STANDARD M10 ALL
.	035A	23779	....	MINOR IMPROVEMENTS INTRODUCED FROM A/C 508 (ST2) TO A/C 521 (ST2) ALL
.	035A	23901	....	LANDING GEAR - WHEELS AND BRAKES - INTRODUCE MODIFIED ALTERNATE BRAKE DISTRIBUTION DUAL VALVE ALL
.	035A	24035	....	INDICATING/RECORDING SYSTEMS - GENERAL- DEFINE CPIP3 ALL

M V T	REV	MOD MP SB	TITLE	VALIDITY
.	035A	24064	AUTO FLIGHT-FMS-INTRODUCE FMGC A320/321 B1 STD WITH OPTIONS AND 400 KILOWORDS FOR CFM 56 VERSIONS	ALL
.	035A	24077	LANDING GEAR - BSCU - TWIN WHEEL - INTRODUCE A320/A321 STD 6 VERSION 60C	ALL
.	035A	24105	FUSELAGE - REAR FUSELAGE - ADAPT SECTION 17/19 STRUCTURE TO A319 DEFINITION	ALL
.	035A	24215	AUTO FLIGHT - FAC - INSTALL TWO FACS P/N BAM 0509	ALL
.	035A	24373	FUEL - TANK LEVEL SENSING - INTRODUCE MODIFIED LOW FUEL PRESSURE WARNING CONTROL	ALL
.	035A	24440	LANDING GEAR-NOSE LANDING GEAR-SHOCK ABSORBER-INTRODUCE MODIFIED THROTTLING ROD GUIDE	ALL
.	035A	24449	LANDING GEAR - A320/A321 TWIN WHEELS - INTRODUCE BSCU STANDARD 7 (70B VERSION)	ALL
.	035A	24498	APU - STORAGE AND DISTRIBUTION - MODIFY APU COMMON LUBRICATION SYSTEM	ALL
.	035A	24511	FLIGHT CONTROLS -S.E.C. SYSTEM INTRODUCE A320/A321 S.E.C STANDARD P/N BAM0508	ALL
.	035A	24588	AUTO FLIGHT-FAC-INTRODUCE FAC P/N BAM 510	ALL

M V T	REV	MOD	MP SB	TITLE	VALIDITY
.	035A	24612	....	INDICATING/RECORDING SYSTEMS - FWC - INTRODUCE FWC D2 STD	ALL
.	035A	24613	....	FLIGHT CONTROLS - ELAC - INTRODUCE ELAC STD P/N L69	ALL
.	035A	24642	....	ELECTRICAL POWER - AC AUXILIARY GENERATION (APU GENERATOR) - INTRODUCE MODIFIED GENERATOR	ALL
.	035A	24645	....	LANDING GEAR-MLG-LGCIU-INTRODUCTION OF STANDARD UNIT P/N A4C	ALL
N	036	24771	....	COMMUNICATIONS-CIDS-INTRODUCE MODIFIED DIRECTOR POWER SUPPLY PRINCIPLE	ALL
.	035A	24783	....	ENGINE FUEL AND CONTROL-FUNCTIONAL INTERFACE-INTRODUCE EIU VERSION 14 ON CFM56 ENGINES	ALL
.	035A	24794	....	AIR CONDITIONING-COCKPIT AND CABIN TEMPERATURE CTRL-INTRODUCE MODIFIED TEMPERATURE SENSOR P/N-02.ON MIXER UNIT	ALL
.	035A	24805	....	PNEUMATIC-ENGINE BLEED AIR SUPPLY-INTRODUCE A BLEED AIR MONITORNG COMPUTER STD6	ALL
.	035A	24852	....	NAVIGATION-ADIRU-INTRODUCE ADIRU P/N -307	ALL
.	035A	24917	....	FLIGHT CONTROLS-INTRODUCE ELAC STD L69J	ALL

M V T	REV	MOD	MP SB	TITLE / VALIDITY
.	035A	24946	....	LANDING GEAR - MLG - MESSIER - INTRODUCE BRAKES P/N C202253 ALL
.	035A	24955	....	AIRBORNE AUXILIARY POWER-ENGINE- APIC APS 3200-INTRODUCE MODIFIED PRESS REGULATOR ON FCU ALL
.	035A	25199	....	FLIGHT MANAGEMENT AND GUIDANCE SYSTEM- INSTALL FMGC ON A320/321 (CFM 56-5A/5B) ALL
.	035A	25241	....	COMMUNICATIONS - RADIO MANAGEMENT - INSTALL A NEW STD RMP1 AND RMP2 WITH VHS SPACING 8, 33KHZ ALL
.	035A	25242	....	COMMUNICATIONS - RADIO MANAGEMENT - INSTALL A NEW STD RMP3 (3°) WITH VHF SPACING 8, 33KHZ ALL
.	035A	25287	....	POWERPLANT - GENERAL - INSTALL ON A319 ENGINE RATED VERSION OF CFM 56-5B6 23500 LBS ALL
.	035A	25294	....	NAVIGATION - ADIRS - INSTALL HONEYWELL ADIRS CAPABLE OF A319 A/C ALL
.	035A	25335	....	FLIGHT CONTROLS-ELAC-INTRODUCE A319 EIS L77 SOFTWARE STD- ALL
.	035A	25336	....	NAVIGATION-ADIRS-INTRODUCE AIRU LITTON P/N -308 ALL
.	035A	25360	....	FLIGHT CONTROLS-SLATS/FLAPS-ELECTRICAL CONTROL AND MONITORING INTRODUCE SFCC P/N 07 ON A319 A/C AND A321 AIRCRAFT ALL

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M
V REV   MOD   MP          TITLE
T              SB                                 VALIDITY

. 035A 25404 ......  EXHAUST-THRUST REVERSER CONTROL AND
          ...........  INDICATING-ACTIVATE ADDITIONAL THRUST
                       REVERSER LOCK CONTROL
                             ALL

. 035A 25410 ......  INDICATING RECORDING SYSTEM-FWC-
          ...........  INTRODUCE F.W.C. E1 STANDARD
                             ALL

. 035A 25419 ......  ICE AND RAIN PROTECTION-WINDSHIELD
          ...........  RAIN PROTECTION-DESACTIVATION OF RAIN
                       REPELLENT SYSTEM
                             ALL

N 036  25440 ......  NAVIGATION - GENERAL - CHANGE
          ...........  EQUIPMENTS TO COMPLY WITH
                       MARCH 95 SPECS.
                             ALL

. 035A 25529 ......  NAVIGATION - WEATHER RADAR SYSTEM -
          ...........  ACTIVATE PREDICTIVE WINDSHEAR FUNCTION
                             ALL

. 035A 25530 ......  ENGINE - COMBUSTION SECTION -
          ...........  INTRODUCE DOUBLE ANNULAR COMBUSTOR
                       ON CFM56-5B6 (CFM56-5B6/2)
                             ALL

. 035A 25800 ......  POWER PLANT-GENERAL-INTRODUCE
          ...........  CFM56-5B/P
                             ALL

. 035A 25863 ......  AUTO FLIGHT - FCU - DEFINE FLIGHT
          ...........  DIRECTOR ENGAGEMENT IN CROSSED BARS
                       AT GO AROUND
                             ALL

. 035A 25871 ......  ENGINE FUEL AND CONTROL-CONTROLLING-
          ...........  INTRODUCE ECU SOFTWARE 5DH FOR
                       CFM56-5B (DAC -DAC/P) ENGINES
                             ALL

N 036  26000 ......  NAVIGATION-ADIRS-INTRODUCE HONEYWELL
          ...........  ADIRU 4 MCU STD WITH HARDWARE P/N
                       AD09
                             ALL
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M V T	REV	MOD SB	MP	TITLE VALIDITY
.	035A	26001	......	NAVIGATION-ADIRS-INTRODUCE HONEYWELL 4 MCU P/N AC09 ALL
.	035A	26002	......	NAVIGATION-ADIRS-INTRODUCE LITTON ADIRU 4 MCU STD WITH P/N-309 (AIME FUNCTION) ALL
.	035A	26017	......	INDICATING/RECORDING SYSTEMS-FLIGHT WARNING COMPUTER (FWC)-INTRODUCE FWC ST2 E2 ALL
.	035A	26018	......	INDICATING/RECORDING SYSTEMS-DISPLAY MANAGEMENT COMPUTER (DMC)-INTRODCUE DMC V32 STD ALL
.	035A	26187	......	NAVIGATION - VOR - INSTALL VOR RECEIVERS ALLIED SIGNAL QUANTUM LINE P/N 066-50012-0202 ALL
.	035A	26363	......	AIR CONDITIONING-AIR COOLING SYSTEM-INTRODUCE MODIFIED RAM AIR OUTLET ALL
.	035A	26377	......	NAVIGATION - ILS - INSTALL ADDITIONAL WIRING PROVISIONS FOR MMR INSTALLATION ALL
N	036	26398 00-1043 06	......	ADDITIONAL CERTIFICATION ITEMS - LANDING WITH A 15 KNOT TAILWIND ALL
.	035B	26443	......	NAVIGATION - VOR/MARKER - INSTALL TWO VOR/MARKER RECEIVERS 900 COLLINS P/N 822-0297-020 00-SSF
.	035A	26457	......	GENERAL - DESIGN WEIGHTS - INCREASE MAXIMUM TAKE-OFF WEIGHT (MTOW) TO 68T ALL

M V T	REV	MOD SB	MP	TITLE / VALIDITY
.	035A	26526	......	NAVIGATION - GPWS - ACTIVATE ENHANCED FUNCTIONS OF THE EGPWS ALL
.	035A	26642	......	ENGINE -CONTROLLING-CFM56-5B/2 FADEC SYSTEM-INTRODUCE ECU STD 5DK ALL
.	035A	26645	......	AUTO-FLIGHT-FAC INTRODUCE FAC STD BAM 0513 ALL
.	035A	26726	......	INDICATING/RECORDING SYSTEM-SDAC- INTRODUCE SDAC (NEW TECHNOLOGY) ALL
.	035A	26785	......	PNEUMATIC-ENG BLEED AIR SYS-INTRODUCE A TEMP THERMOSTAT WITH MODIFIED LIMITATION SETTINGS (P/N 341E020000) ALL
.	035A	26792	......	AIR CONDITIONING-PACK TEMPERATURE CTRL- INTRODUCE MODIFIED PACK TEMPERATURE CONTROLLER ALL
.	035A	26963	......	ICE AND RAIN PROTECTION-WINSHIELD RAIN PROTECTION-ACTIVATION OF RAIN REPELLENT SYS.(FLUID COMPATIBLE WITH OZONE RULES) ALL
.	035A	26968	......	AUTO FLIGHT-FMGC-INTRODUCE FMGC CAM0102 FOR A319 AUTOLAND AND GPS/ACARS FOR CFM ENGINES ALL
.	035B	26999	......	NAVIGATION - MMR - INSTALL COLLINS MMR PROVIDING ILS AND GPS FUNCTION OO-SSF
.	035A	27276	......	FLIGHT CONTROLS-ELAC SYSTEM-INTRODUCE ELAC SOFTWARE "L80" ALL

M V T	REV	MOD SB	MP	TITLE / VALIDITY
.	035A	27498	......	ELECTRICAL POWER - GENERAL - AC-DC MAIN DISTRIBUTION - INSTALL AC-DC SHEDDABLE BUSBARS ALL
.	035B	27522	......	INFORMATION SYSTEM - AIR TRAFFIC AND INFORMATION SYSTEM (ATIMS) - INSTALL ATSU COMPUTER FOR ACARS OO-SSF
.	035A	27572	......	OXYGEN-PASSENGER OXYGEN-INTRODUCE MODIFIED CHEMICAL OXYGEN CONTAINER -15 MIN- PURITAN ALL
.	035A	27646	......	NAVIGATION - MMR - INSTALL SEXTANT MMR PROVIDING ILS (FM IMMUNE) ALL
.	035A	27698 34-1177 10	......	NAVIGATION - TCAS - INSTALL ALLIED SIGNAL TCAS COMPUTER P/N 066-50000-2220 (WITH CHANGE 7.0) ALL
.	035A	27723	......	PNEUMATIC-ENGINE BLEED AIR SUPPLY SYSTEM-INTRODUCE NEW TEMPERATURE CTL THERMOSTATS (SERIAL AND RETROFIT) ALL
.	035A	27725	......	ENGINE FUEL AND CONTROL-FADEC SYSTEM-INTRODUCE ECU SOFTWARE 5DM FOR CFM56-5B DAC ENGINE ALL
.	035A	27727	......	ENGINE -COMBUSTION SECTION-INTRODUCE CFM56-5B DAC II PIP ENGINES ALL
.	035A	27866 34-1178 06	......	NAVIGATION - WEATHER RADAR SYSTEM - INSTALL ALLIED SIGNAL WEATHER RADAR TRANSCEIVER P/N 066-50008-0405 ALL

M V T	REV	MOD SB	MP	TITLE / VALIDITY
.	035A	27952	......	PNEUMATIC-ENGINE BLEED AIR SYSTEM-INTRODUCE TLT P/N 341E030000 ALL
.	035A	28009 21-1116 04	......	AIR CONDITIONING-PRESSURE CONTROL AND MONITORING-INTRODUCE PRESSURE CONTROLLER P/N 9022-15702-10 ALL
.	035A	28164	......	LANDING GEAR - WHEELS AND BRAKES - INSTALL CARBON BRAKES TYPE SEPCARB III PLUS - MESSIER BUGATTI ALL
.	035A	28218	......	NAVIGATION-ADIRS-INTRODUCE LITTON ADIRU 4 MCU STD-312 ALL
.	035A	28244 34-1193 18	......	NAVIGATION-GPWS-INTRODUCE EGPWS P/N 206-206 AND INHIBIT AUTOMATIC DEACTIVATION ENHANCED FUNCTIONS ALL
.	035A	28284	......	NAVIGATION-ILS-INSTALL SEXTANT MMR PROVIDING ILS (FM IMMUNE) P/N TLS 755.01.0101B ALL
.	035B	28360	......	INFORMATION SYSTEMS-ATIMS-REMOVE ATSU INSTALLATION BACK TO ACARS PROVISIONS OO-SSF
.	035A	28377	......	ICE AND RAIN PROTECTION-WINSHIELD-RAIN PROTECTION-INTRODUCE MODIFIED GAGE ASSY -P/N 4020W35-2 ALL
.	035A	28382	......	NAVIGATION - MMR - ACTIVATE GPS PRIMARY FUNCTION (HYBRID) IN SEXTANT MMR (WITH HONEYWELL OR LITTON ADIRU) ALL

M V T	REV	MOD SB	MP	TITLE / VALIDITY
.	035A	28488	......	AIR CONDITIONING-PACK TEMP.CTRL INTRODUCE MODIFIED PACK TEMP. CTRL P/N 759D0000-02 — ALL
.	035B	28495	......	NAVIGATION - MMR - REMOVE COLLINS MMR PROVIDING ILS (FM IMMUNE) AND GPS PRIMARY FUNCTION (PREVIOUS SPEC.) — 00-SSF
.	035A	28667	......	ICE AND RAIN PROTECTION-WINDSHIELD RAIN PROTECTION-INTRODUCE MODIFIED GAGE ASSY WITH INPUT VALUE FUNCTION SUPPRESSED — ALL
.	035B	28669	......	NAVIGATION-VOR/MARKER-REINTRODUCE COLLINS 700 VOR/MARKER RECEIVERS (PREVIOUS A/C STANDARD SPECIFICATION) — 00-SSF
.	035B	30239 46-1009 06	......	INFORMATION SYSTEM - ATIMS - MODIFY ATSU AIRCRAFT INTERFACE SOFTWARE ACCORDING TO SERVICE PROVIDERS LIST — 00-SSF
N	036	31395 27-1135 02	......	FLIGHT CONTROLS - ELAC SYSTEM - INTRODUCE ELAC STD L81 — ALL

01.00 CONTENTS

GENERAL

This section includes the limitations required by the regulations and contained in the Flight Manual.
All references to airspeed, Mach and altitude relate to indicated airspeed, indicated Mach and pressure altitude, unless otherwise noted.

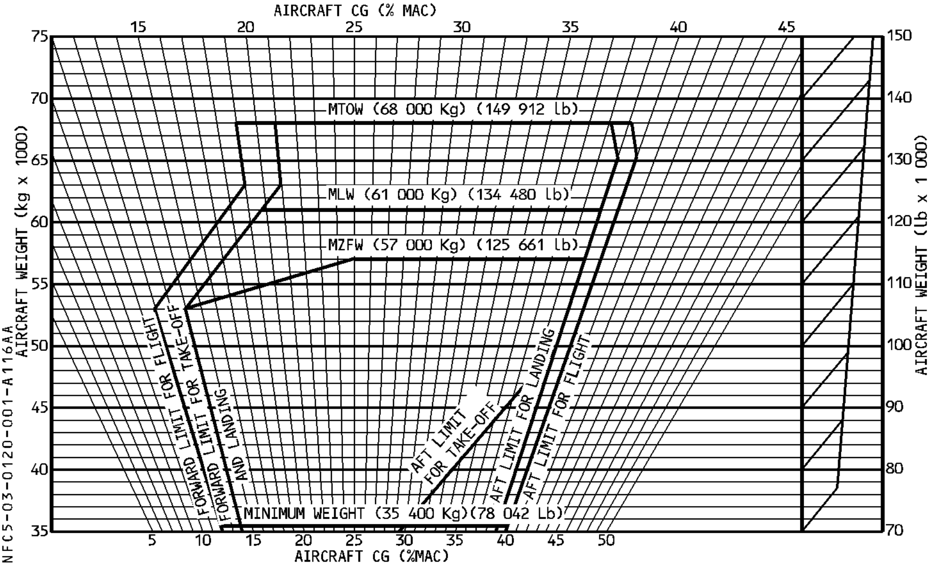
KIND OF OPERATIONS

This airplane is certified in the public transport category (passengers and freight) for day and night operations, in the following conditions when the appropriate equipment and instruments required by the airworthiness and operating regulations are approved, installed and in an operable condition :
- VFR and IFR
- Extended overwater flight
- Flight in icing conditions
- Maximum number of passenger seats : 145.

MINIMUM FLIGHT CREW

The minimum flight crew consists of 2 pilots.

CENTER OF GRAVITY LIMITS



- CG limits are given in percentage of the reference chord length aft of the leading edge.
- The reference chord length is 4.193 m (13.76 ft). It is 14.71 m (48.26 ft) aft of the aircraft nose.
- The CG must always be within these limits, regardless of fuel load.

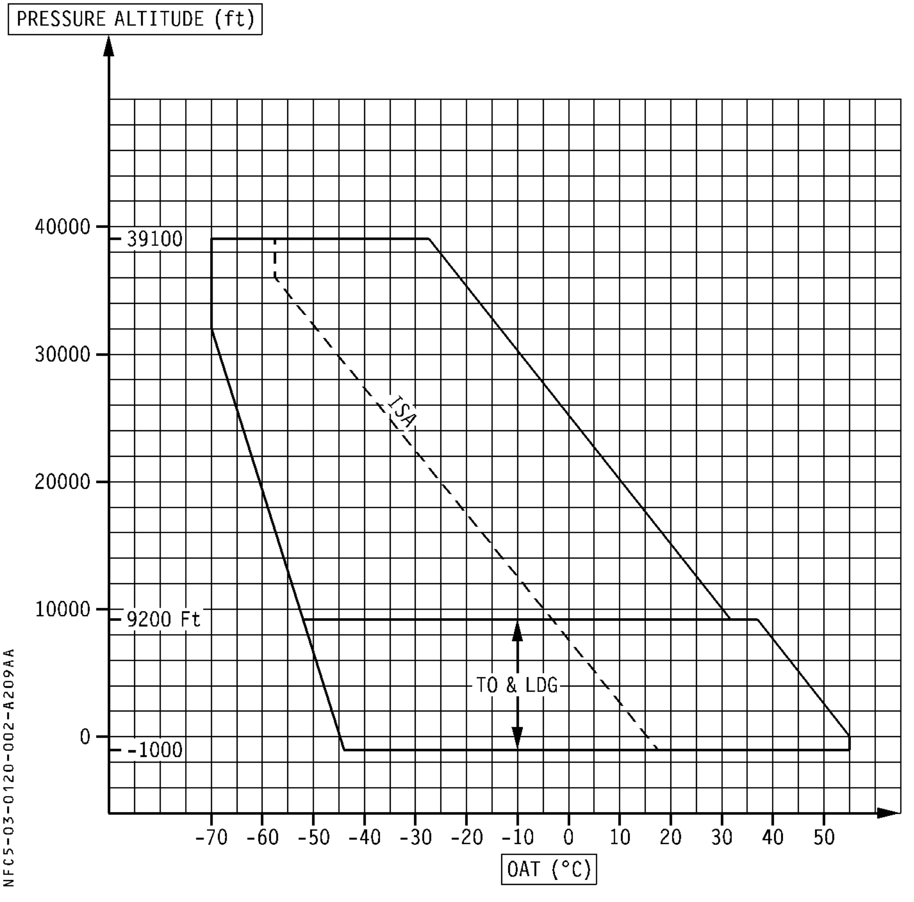
WEIGHT LIMITATIONS

Maximum taxi weight . . . . 68 400 kg (150 794 lb)
Maximum takeoff weight (brake release) . . . . 68 000 kg (149 912 lb)
Maximum landing weight . . . . 61 000 kg (134 480 lb)
Maximum zero fuel weight . . . . 57 000 kg (125 661 lb)
Minimum weight . . . . 35 400 kg (78 042 lb)
In exceptional cases (in flight turn back or diversion), an immediate landing at weight above maximum landing weight is permitted, provided the pilot follows the overweight landing procedure.

FLIGHT MANEUVERING LOAD ACCELERATION LIMITS

Clean configuration . . . . – 1 g to + 2.5 g
Slats and flaps extended . . . . 0 g to + 2 g
Slats extended and flaps retracted . . . . 0 g to + 2 g

ENVIRONMENTAL ENVELOPE



AIRPORT OPERATIONS

- Runway slope (mean) . . . . ± 2 %
- Runway altitude . . . . 9200 feet
- Nominal runway width . . . . 45 meters
- Wind for takeoff and landing :
  - · Maximum crosswind demonstrated for takeoff . . 29 knots gusting up to 38 knots*
  - · Maximum crosswind demonstrated for landing . . 33 knots gusting up to 38 knots*
  - · Maximum tailwind . . . . 10 knots

    * : Maximum crosswind values have been demonstrated with flight controls in normal law, as well as in direct law with and without yaw damper.

R — Wind for passenger / cargo door operation :

R · Maximum wind for passenger door operation : . . . . 65 knots

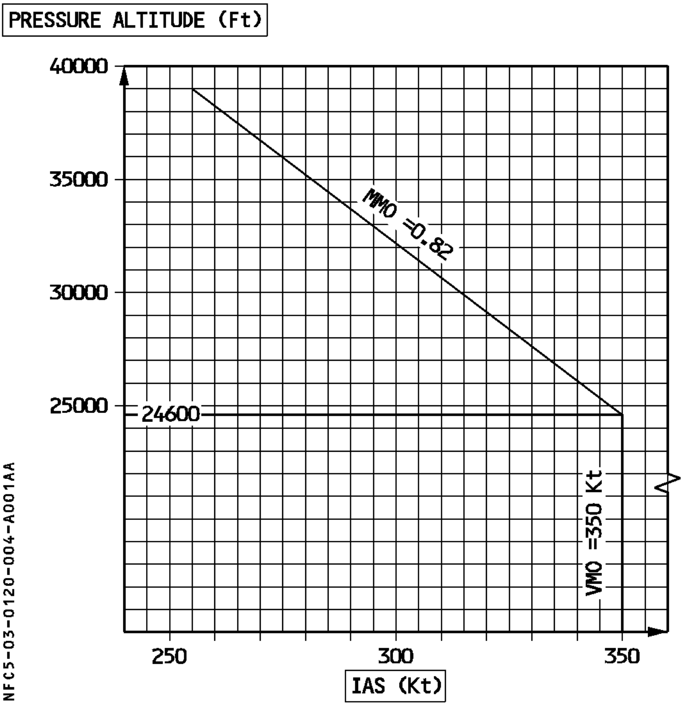
R · Maximum wind for cargo door opening : . . . . 40 knots

R · The cargo door must be closed, before the wind speed exceeds 65 knots.

SPEED LIMITATIONS

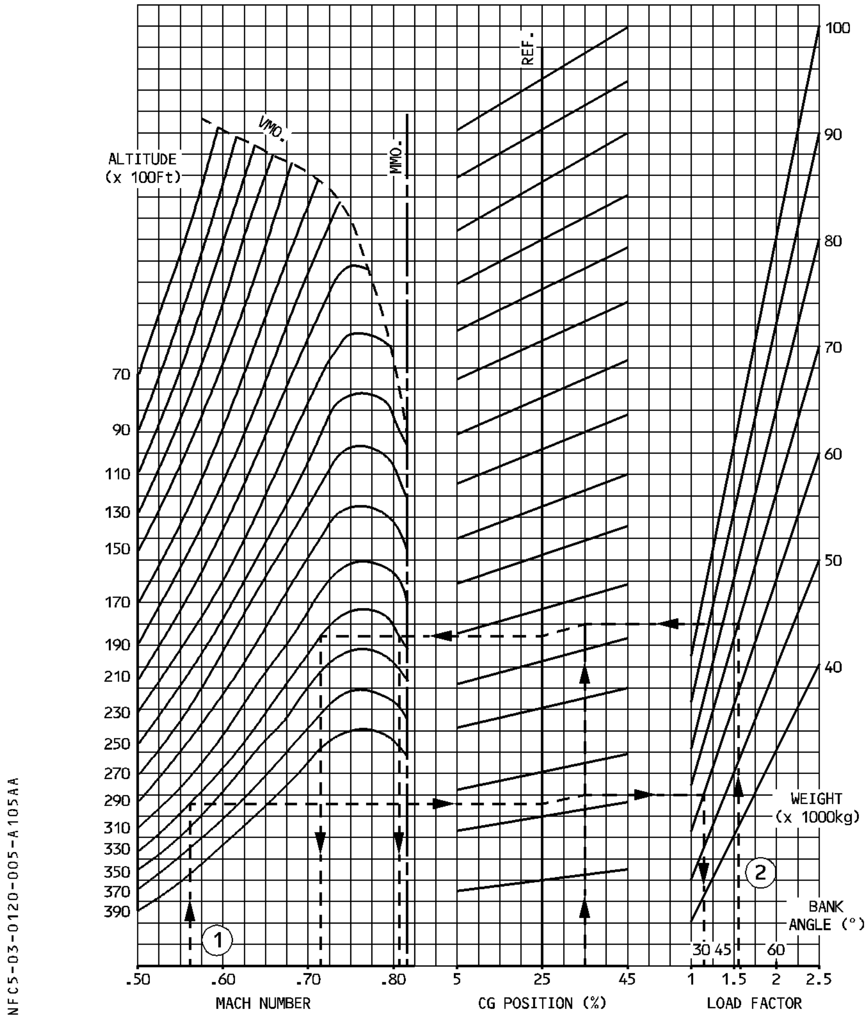
MAXIMUM OPERATING SPEED VMO/MMO

R



The maximum operating limit speed VMO/MMO may not be exceeded deliberately in any regime of flight.

R **BUFFET ONSET**



R Examples :

R 1. Determine Maximum Bank Angle limited by buffet :

R DATA : M = 0.56, FL = 330, CG = 35 %, WEIGHT = 60000 kg

R RESULT : load factor = 1.2 g or 30° bank

R 2. Determine low and high speed limited by buffet :

R DATA : 47° bank or 1.6 g, WEIGHT = 70000 kg, CG = 35%, FL = 330

R RESULT : M = 0.72 (low speed buffet) and M = 0.81 (high speed buffet).

MINIMUM CONTROL SPEEDS

R

Altitude (ft)	VMCA (KT CAS)	VMCG (KT IAS)		
		CONF 1 + F	CONF 2	CONF 3
0	111	107	107	107
2000	109	105.5	105.5	105.5
4000	107	104	104	104
6000	105	102.5	102.5	102.5
8000	103	100	100	100
9200	101.5	98.5	98.5	98.5

MAXIMUM FLAPS/SLATS SPEEDS

LEVER POSITION	SLATS	FLAPS	Ind. on ECAM	MAX SPD	FLIGHT PHASE
1	18	0	1	230	HOLDING
1	18	10	1 + F	215	TAKEOFF
2	22	15	2	200	TAKEOFF/APPROACH
3	22	20	3	185	TAKEOFF/APPROACH/LANDING
FULL	27	40	FULL	177	LANDING

GEAR DOWN SPEEDS

· Maximum speed with landing gear extended (VLE) 280 kt/M.67
· Maximum speed at which the landing gear may be extended (VLO extension) . 250 kt
· Maximum speed at which the landing gear may be retracted (VLO retraction) . 220 kt
· Maximum altitude at which the landing gear may be extended . . . . 25 000 ft

MAXIMUM TIRE SPEED

· Ground speed . . . . 195 kt

WINDSHIELD WIPERS IN USE

· Maximum speed . . . . 230 kt

COCKPIT WINDOW OPEN

· Maximum speed . . . . 200 kt

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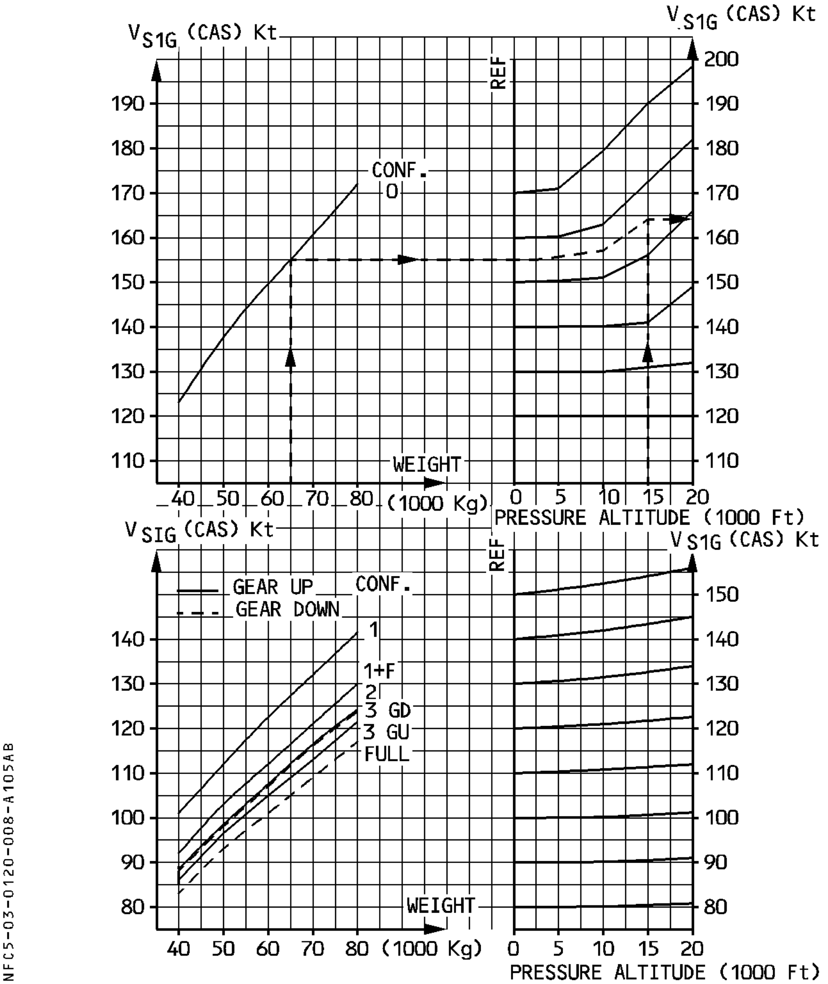
R **STALLING SPEEDS**



R EXAMPLE : DATA : 65000 kg (143299 lb), pressure altitude 15000 ft, clean
R configuration.
R RESULT : VS1G CAS = 164 kt

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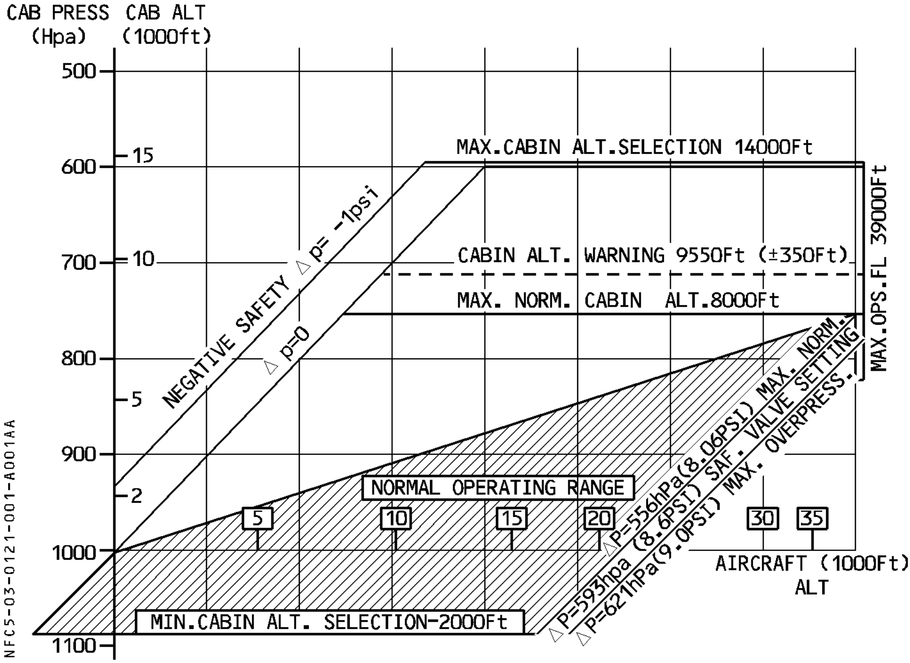
LEFT INTENTIONALLY BLANK

CABIN PRESSURE

- Maximum positive differential pressure . . . . 8.6 psi
- Maximum negative differential pressure . . . . - 1 psi



Note : Max △p and safety valve setting tolerance = ± 7 hPa (0.1 psi)

RAM AIR INLET

Only open if differential pressure is lower than 1 psi.

AIR CONDITIONING WITH LP GROUND UNIT

- Do not use conditioned air simultaneously from packs and LP ground unit (to avoid chattering of the non return valves).
- Airflow supplied by the ground cart shall not exceed 1.2 kg/s (2.60 lb/s).

R

AIR CONDITIONING WITH HP GROUND UNIT

R - Do not use HP ground unit when APU supplies bleed air to avoid bleed system damage.

AVIONICS VENTILATION

During ground operations, limit the aircraft electric power supply with avionics ventilation system in normal configuration as follows :

OAT = 49°C no limitation
OAT = 55°C time limit 2 hours
OAT = 60°C time limit 1 hour
OAT = 64°C time limit 1/2 hour

GENERAL

AUTO PILOT FUNCTION

Minimum height for use of autopilot on takeoff with SRS mode . . . . 100 ft AGL
(An internal FMGS logic prevents the autopilot from engaging during the 5 seconds after liftoff).
Minimum height for use of the autopilot in :
Straight-in non precision approach . . . . applicable MDA (MDH)
Circling approach . . . . applicable MDA - 100 ft (or MDH - 100 ft)
ILS approach with CAT 1 displayed on FMA . . . . 160 ft AGL
Go-around (AP or FD engagement) . . . . 100 ft AGL
All other phases . . . . 500 ft AGL
Use of the AP or FD in OPEN DES or DES mode is not permitted in approach, unless the FCU altitude is set to, or above, MDA (MDH) or 500 feet, whichever is the highest.

AUTOTHRUST FUNCTION

R Use of the autothrust is approved with, or without, AP/FD in selected or managed mode.

FLIGHT MANAGEMENT FUNCTION

R The FMGS lateral and vertical navigation has been certified for after takeoff, en route, and
R terminal area operations, and for instrument approach procedures (except ILS, LOC,
R LOC-BC, LDA, SDF and MLS) and missed approach procedures.
R RNP accuracy with GPS PRIMARY, or radio updating, has been demonstrated to be 0.3 NM
R when AP or FD is used and 1 NM in manual control.
R Without GPS PRIMARY (or GPS deselected or inoperative), the accuracy has been
R demonstrated, provided the appropriate RNP value is checked or entered on the MCDU, and
R HIGH accuracy is displayed.
R Without GPS PRIMARY (or GPS deselected or inoperative), the navigation accuracy is a
R function of ground radio navaid infrastructure, or elapsed time since the last radio update.
R The FMGS is also certified for navigation within BRNAV, PRNAV, and RNP 10 airspace.
R RNP10 oceanic/remote area operations are approved with GPS PRIMARY or, without GPS
R PRIMARY (or GPS deselected or inoperative) provided time limitations in IRS only
R navigation, acceptable to the operational authorities, are established.
R FMGS approval is based on the assumption that the navigation database has been
R validated for intended use.
R Obstacle clearance and adherence to airspace constraints remains the flight crew's
R responsibility.
R Fuel, time predictions/performance information is provided for advisory purposes only.

USE OF NAV AND FINAL APP MODES FOR NON PRECISION APPROACH

R NAV, or NAV and FINAL APP mode may be used for VOR, VOR/DME, NDB, NDB/DME or RNAV (including GPS) approach, but not for ILS, LOC, LOC-BC, LDA, SDF, or MLS final approach.

R For instrument approach procedures not coded in WGS 84 (or equivalent) coordinate system, the GPS must be deselected.

R FINAL APP mode guidance capability with GPS PRIMARY has been demonstrated down to MDH/DH (barometric) 250 feet.

R VOR, VOR/DME, NDB or NDB/DME approach procedures may be performed, in NAV, or NAV and FINAL APP mode, provided AP or FD is used, and :

R – GPS PRIMARY is available. In this case, the reference navaid may be unserviceable, or the airborne radio equipment may be inoperative, or not installed, provided operational approval is obtained.

R – Without GPS PRIMARY :
  - The reference navaid and the corresponding airborne equipment is serviceable, tuned, and monitored during the approach, or
  - The radio navaid coverage supports the RNP value, specified for the approach procedure, and an operational approval is obtained.

R For GPS approach, GPS PRIMARY must be available.

R RNAV approach without GPS PRIMARY may be performed only if the radio navaid coverage supports the RNP value and HIGH accuracy is displayed on the MCDU with the specified RNP, and operational approval is obtained.

R NAV mode may be used in the terminal area, provided :

R – GPS PRIMARY is available, or

R – HIGH accuracy is displayed, and the appropriate RNP is checked or entered on the MCDU, or

R – Navaid raw data is monitored.

R NAV mode may be used after takeoff, provided FMGS runway updating has been checked.

Non Precision Approaches with engine-out

If one engine is inoperative, it is not permittted to use the autopilot to perform NPAs in the following modes : FINAL APP, NAV V/S, NAV/FPA.

Only FD use is authorized.

AUTOMATIC APPROACH, LANDING AND ROLL OUT

CATEGORY II

Minimum decision height . . . . 100 feet AGL
At least one autopilot must be engaged in APPR mode, and CAT 2, CAT 3 SINGLE or CAT 3 DUAL must be displayed on FMA.
If the crew performs an automatic approach without autoland, the autopilot must be disengaged no later than at 80 feet AGL.

CATEGORY III FAIL PASSIVE (SINGLE)

Minimum decision height . . . . 50 feet
At least one autopilot must be engaged in APPR mode, and CAT 3 SINGLE or CAT 3 DUAL must be displayed on FMA.
A/THR must be used in selected or managed speed .

CATEGORY III FAIL OPERATIONAL (DUAL)

A/THR must be used in selected or managed speed .
Alert height . . . . 100 feet
2 autopilots must be engaged in APPR mode and CAT 3 DUAL must be displayed on FMA
Minimum Runway Visual Range . . . . 75 meters
A/THR in selected or managed speed must be used.

ENGINE OUT

CAT II and CAT III fail passive autoland are only approved in configuration 3 and FULL, and if engine-out procedures are completed before reaching 1000 feet in approach.

MAXIMUM WIND CONDITIONS FOR CAT II OR CAT III AUTOMATIC APPROACH LANDING AND ROLLOUT

Head wind : 30 knots
Tail wind : 10 knots
Cross wind : 20 knots

Note : *Wind limitation is based on surface wind reported by the tower. If wind displayed on ND exceeds here-above limitations for autoland but the tower reports surface wind within the limitations then the autopilot can remain engaged. If the tower reports surface wind beyond limitations, only CAT I automatic approach without autoland can be performed.*

AUTOMATIC LANDING

CAT II and CAT III autoland are approved in CONF3 and CONF FULL.
Automatic landing is demonstrated :
- with CAT II and CAT III ILS beam.
- with slope angle within (– 2.5°, – 3.15°) range.
- for airport altitude at or below 9200 feet.
- At or below max landing weight.
- R At approach speed (VAPP) = VLS + wind correction.
R Minimum wind correction 5 kt, maximum wind correction 15 kt.

Automatic rollout performance has been approved on dry and wet runways, but performance on snow covered or icy runway has not been demonstrated.

Note : *Under crew responsability and in case of emergency autoland can be performed up*
R *to Max Takeoff Weight (MTOW).*

AUTOMATIC LANDING IN CAT I OR BETTER WEATHER CONDITIONS

Automatic landing system performance has been demonstrated on CAT II and CAT III ILS runways. However automatic landing in CAT I or better weather conditions is possible on CAT I ground installations or when ILS sensitive areas are not protected if the following precautions are taken :

- The airline has checked that the ILS beam quality and the effect of the terrain profile before the runway have no adverse effect on autopilot guidance. In particular the effect of terrain discontinuities within 300 meters before runway threshold must be evaluated.
- The crew is aware that LOC or GS beam fluctuations, independent of the aircraft system, may occur and the PF is prepared to immediately disconnect the AP and to take the appropriate action should unsatisfactory guidance occur.
- At least CAT2 capability is displayed on FMA and CAT II/III procedures are used.
- Visual references are obtained at a DH appropriate for the CAT I approach being flown or go-around is performed.
- When the crew does not intend to perform an autoland, he should disconnect the AP at or above 80 feet. This altitude being considered as a minimum to take over and feel comfortable.
  Nevertheless, for safety purpose, the AP can be disconnected at anytime.

ELECTRICAL

- MAX continuous load per generator . . . . 100 % (90 kVA)
- MAX continuous load per TR (continuous) . . . . 200 A

LEFT INTENTIONALLY BLANK

FLIGHT CONTROL

Flaps and slats :
Max operating altitude with slats or slats and flaps extended is 20 000 feet.

LEFT INTENTIONALLY BLANK

GENERAL

FUEL AND ADDITIVE SPECIFICATIONS

- See engine manufacturer specification
- The fuel system has been certified for JET A1, JP 8, JET A, JP 5, RT, TS-1, JET B or JP 4.

MAXIMUM ALLOWED WING FUEL IMBALANCE

· INNER TANKS

Tank Fuel Quantity (Heavier tank)	Maximum allowed imbalance
Full (5 350 kg) (11 795 lb)	1 500 kg (3 307 lb)
4 300 kg (9 480 lb)	1 600 kg (3 520 lb)
2 250 kg (4 960 lb)	2 250 kg (4 960 lb)

R The variation is linear between these values
(No limitation below 2 250 kg/4 960 lb)

· OUTER TANKS

Maximum allowed imbalance	530 kg (1 168 lb)*

R * Maximum outer wing tank imbalance (one full/one empty) is allowed provided :

· Fuel content of one side (outer + inner) is equal to the fuel content of the other side (outer + inner),

or

· On the side of the lighter outer tank, the inner tank fuel quantity is higher than the opposite inner tank quantity, up to a maximum of 3000 kg/6614 lb higher.

FUEL TEMPERATURE

	JET A1/ JP 8	JET A	JP 5	RT	TS-1	JET B	JP 4
MINI	– 43°C	– 36°C (1)	– 42°C	– 45°C	– 45°C	– 46°C	– 54°C
MAXI	54°C					49°C	

(1) : For JET A only, if TAT reaches – 34°C, monitor on ECAM FUEL page that fuel temperature remains higher than – 36°C.

MINIMUM FUEL QUANTITY FOR TAKEOFF : 1 500 kg/3 307 lb

WING TK LO LVL warning must not be displayed on ECAM for takeoff.

WHEN USING JP 4 or JET B

Fuel in center tank is to be regarded as unusable if the wing fuel temperature exceeds the following values before engine start and if the given flight level is exceeded before the center tank fuel has been used :

+ 30°C not above FL 350
+ 40°C not above FL 300
+ 49°C not above FL 250

Reason : At high altitude with high fuel temperature, the pressure delivered by the center tank pumps becomes lower than the pressure delivered by the wing tank pumps.

FUEL MANAGEMENT

- Tanks must be emptied in the following order :
  - center tank then wing tanks
- Takeoff on center tank is prohibited

HYDRAULIC

Normal operating pressure 3000 psi ± 200

LEFT INTENTIONALLY BLANK

GENERAL

BRAKES

Maximum brake temperature for takeoff (brake fans (<*|) off) . . . . 300° C

AUTOBRAKE

Use of the autobrake does not relieve the pilot of his responsibility to safely stop within the available runway length, by taking over brake control with brake pedals, if necessary.
The pilot may disengage the automatic braking system, either by pressing the armed mode pushbutton, or by applying firm action on the brake pedals.

PARKING BRAKE

CAUTION
Do not set N1 above 75 % on both engines with the parking brake ON.

TAXI WITH DEFLATED TIRES

R If tire damage is suspected after landing or after a rejected takeoff, an inspection of the tires is required before taxi. If the tire is deflated but not damaged, the aircraft can be taxied at low speed with the following limitations :

1. If one tire is deflated on one or more gears (ie. a maximum of three tires), the speed should be limited to 7 knots when turning.
R 2. If two tires are deflated on the same main gear (the other main gear tires not being
R deflated), speed should be limited to 3 knots and the nose wheel steering angle limited to 30 degrees.

INERTIAL REFERENCE SYSTEM

IRS ground alignment is possible up to 82 degrees latitude.
In NAV mode, the IRS will not provide a valid magnetic heading :

- Above 82 degrees North
- Above 73 degrees North, between 90 degrees and 120 degrees West (magnetic polar region)
- Above 60 degrees South.

Flight outside the above-noted limits is prohibited.

ENHANCED GROUND PROXIMITY WARNING SYSTEM (EGPWS)

- Aircraft navigation is not to be predicated on the use of the terrain display.
  The terrain display is only intended as a situational awareness tool, and may not provide the accuracy on which to solely base terrain avoidance maneuvers.
  The EGPWS database, display, and alerting algorithms, do not currently take into account man-made obstructions.
- R The EGPWS enhanced function should be inhibited (TERR pushbutton to OFF, on the GPWS panel) when the aircraft position is less than 15 NM from the airfield :
  - R For operations to/from runways not incorporated in the EGPWS database.
  - R For specific approach procedures, which have previously been identified as potentially producing false terrain alerts.

COCKPIT FIXED OXYGEN SYSTEM

MINIMUM FLIGHT CREW OXYGEN PRESSURE

REF TEMPERATURE *		°C	– 10	0	10	20	30	40	50
		°F	14	32	50	68	86	104	122
MIN ** BOTTLE PRESSURE (PSI)	2 CREW MEMBERS		656	681	706	731	756	781	806
	2 CREW MEMBERS	+1 OBS	861	893	926	959	992	1024	1057
	2 CREW MEMBERS	+2 OBS	1090	1132	1173	1215	1256	1298	1339

* REF TEMPERATURE :
. on ground : (OAT + COCKPIT TEMP) / 2
. in flight : CAB TEMP (°C) – 10°C
or
CAB TEMP (°F) – 18° F

** MINIMUM BOTTLE PRESSURE TO COVER :
- Preflight checks
- Use of oxygen when only one pilot is in the cockpit
- Unusable quantity (to ensure regulator functioning with minimum pressure)
- Normal system leakage

and

· Protection after loss of cabin pressure with mask regulator on NORMAL (diluted oxygen):
  - During emergency descent for all crew members for 10 minutes
  - During cruise at FL 100 for 2 crew members for 110 minutes (or during cruise at FL 140 for 4 crew members for 54 minutes).

or

· Protection against smoke with 100 % oxygen for all crew members during 15 minutes at 8000 feet cabin altitude.

Note : The above times, which are based on the use of a sealed mask, may be shorter for bearded crew.

GENERAL

OIL QUANTITY

Minimum level before start . . . . APU level indicator at "ADD"

Note : *When the "LOW OIL LEVEL" message appears on the ECAM APU page, sufficient oil is available to operate the APU for the next 10 hours.*

APU STARTER

R After 3 starter motor duty cycles, wait 60 minutes before attempting 3 more cycles.

ROTOR SPEED

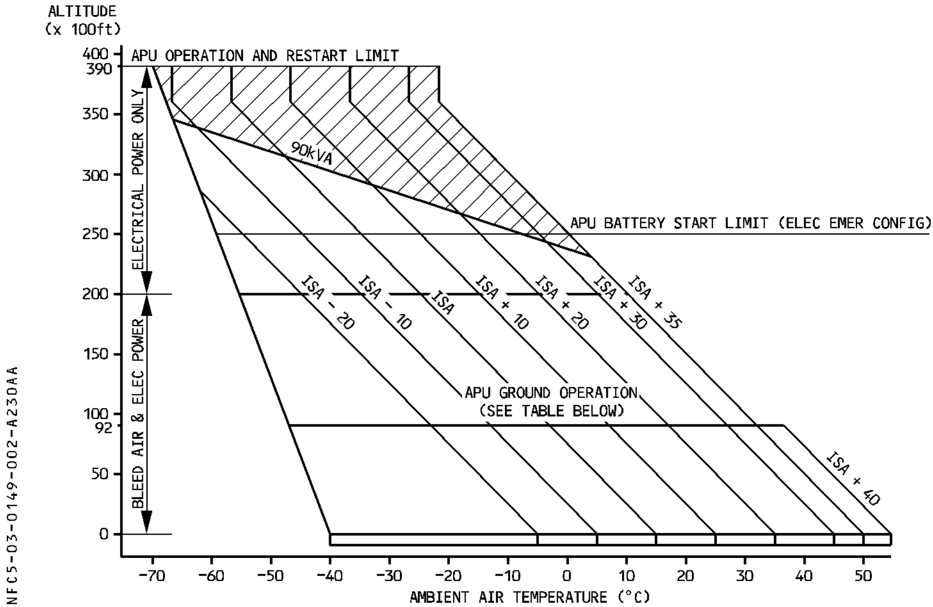
· Maximum N (ECAM display) . . . . 107 %

Note : *The APU automatically shuts down at 107 % N speed displayed on the ECAM. This corresponds to an actual N speed of 105 %.*

EGT

Maximum EGT for start :
· Below 25000 feet . . . . 900° C
· Above 25000 feet . . . . 982° C
Maximum EGT, with APU running :
— 682°C, with 5 seconds confirmation time for shutdown, or
— From 700°C to 742°C for immediate shutdown, depending on the ambient temperature.

ENVELOPE



GENERATOR LOAD IN FLIGHT			
TEMP ▶ MAX ALT (FT) ▼	ISA	ISA + 20	ISA + 35
25000	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)
30000	100 % (90 KVA)	92 % (83 KVA)	84 % (76 KVA)
35000	86 % (78 KVA)	71 % (64 KVA)	67 % (60 KVA)
39000	70 % (63 KVA)	56 % (51 KVA)	53 % (48 KVA)

GENERATOR LOAD ON THE GROUND				
TEMP ▶ MAX ALT (FT) ▼		ISA	ISA + 20	ISA + 40
0	ENG START	100 % (90 KVA)	100 % (90 KVA)	71 % (64 KVA)
	PACKS			39 % (35 KVA *)
9200	ENG START			57 % (51 KVA)
	PACKS			60 % (54 KVA)

(*) : generator load with maximum air conditioning demand.

– Electric power extraction :
  At or below 25000 ft :
  · ISA + 35° and below . . . . 90 kVA
– Air bleed and generator load in flight :

MAXIMUM ALTITUDE FOR BLEED AIR AND GENERATOR LOAD IN FLIGHT			
TEMP ▶ MAX ALT (FT) ▼	ISA	ISA + 20	ISA + 35
ENG START UP TO 20000 ft	58 % (53 KVA)	51 % (46 KVA)	45 % (41 KVA)
ONE PACK UP TO 20000 ft	71 % (64 KVA)	64 % (58 KVA)	61 % (55 KVA)
TWO PACKS UP TO 15000 ft	88 % (80 KVA)	76 % (69 KVA)	64 % (58 KVA)

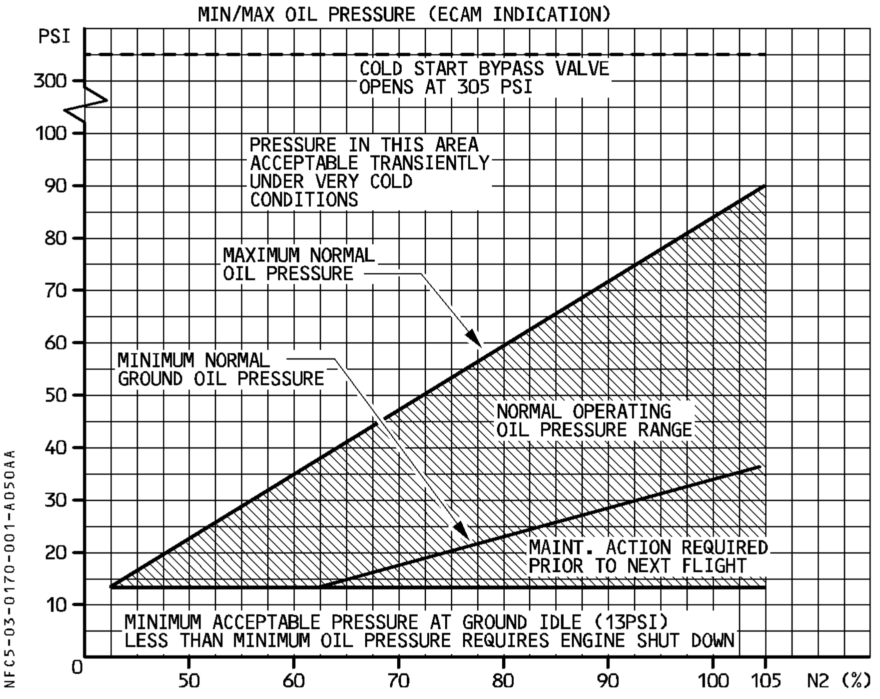
– Air bleed extraction for wing anti-icing is not permitted.

THRUST SETTING/EGT LIMITS

OPERATING CONDITION	TIME LIMIT	EGT LIMIT	NOTE
TAKEOFF and GO-AROUND	5 mn	950° C	
	10 mn		Only in case of engine failure
MCT	Unlimited	915° C	
STARTING		725° C	

OIL

Maximum continuous temperature . . . . 140° C
Maximum transient temperature (15 minutes) . . . . 155° C
Minimum starting temperature . . . . – 40° C
R Minimum temperature for takeoff . . . . – 10° C
Minimum oil quantity . . . . refer to 3.03.04



RPM

N1 max . . . . 104 %

Note : *The N1 limit depends upon ambient conditions and engine airbleed configuration. These may limit the N1 to a value lower than that given above (see 3.05.06).*

N2 max . . . . 105 %

STARTER

- 4 consecutive cycles, each of 2 minutes duration, maximum.
- 20 seconds between cycles to allow for starter relubrication.
- After 4 cycles, 15 minutes to allow starter to cool before attempting a new start or motoring.
- No running engagement of the starter when the N2 is above 20 %.

REVERSE THRUST

- Selecting reverse thrust in flight is prohibited.
- Backing the aircraft with reverse thrust is not permitted.
- Maximum reverse should not be used below 70 knots. (Idle reverse is allowed down to aircraft stop).

REDUCED THRUST TAKEOFF

- Takeoff at reduced thrust is permissible, only if the airplane meets all applicable R performance requirements at the planned takeoff weight, with the operating engines at the thrust available for the assumed temperature.
- Thrust reduction must not exceed 25 % of the full rated takeoff thrust. To meet this requirement, the flexible temperature must not be higher than ISA + 53° C (T MAX FLEX).
  In addition, the flexible takeoff N1 can never go below the maximum climb N1 corresponding to the actual OAT.
- The assumed temperature must not be lower than the flat rating temperature or the actual OAT.
- Takeoff at reduced thrust is not permitted on contaminated runways.
- Takeoff at reduced thrust is allowed with any inoperative item affecting the performance, only if the associated performance shortfall has been applied to meet all performance requirements at the takeoff weight, with the operating engines at the thrust available for the flex temperature.

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02.21 AIR/PRESS/VENT

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02.80 MISCELLANEOUS

02.90 DETAILED CABIN/COCKPIT EVAC PROC

GENERAL

Abnormal and emergency procedures are the actions the crew must take after a failure. These actions retain adequate safety and make the further conduct of the flight easier. The crew uses the "READ and DO" principle (oral reading) in performing them.

PRESENTATION

The presentation of procedures is, as far as practicable, identical to the presentation on ECAM. The abbreviations are identical to those used on the cockpit panels. All actions and information displayed on ECAM are printed in large letters. Other information, not on ECAM, is printed in small letters.
Expanded information, when inserted in the procedure, appears in italics. This information:
- identifies the particular failure
- explains actions for which the reason is not self-evident
- furnishes additional background.

When several procedures appear under the same title, a black square marks the starting point of each procedure.
Only one procedure is applicable at a time.
For example :

NFC5-03-0201-001-A001AA

ANTI ICE CAPT (F/O) (STBY) PROBES		
■ CAPT PROBES	a	procedure to be applied: a or b or c
■ F / O PROBES	b	
■ STBY PROBES	c	

Black squares also indicate parts of a procedure among which only one is applicable.
For example :

NFC5-03-0201-001-B001AA

BRAKES HOT		
– BRK FAN (if installed) . . . . ON	a	procedure to be applied (a + b) or (a + c)
■ ON GROUND	b	
■ IN FLIGHT	c	

The ECAM does not display black squares.

· If an action depends on a precondition, a black dot identifies the precondition. If the precondition appears on ECAM, it appears in large letters. If not, it appears in small letters.
  For example :

NFC5-03-0201-002-A001AA

F / CTL FLAPS FAULT

— FLAPS LEVER . . . . RECYCLE

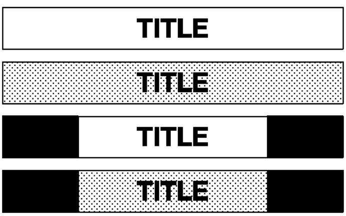
• **If unsuccessful :**

  — GPWS FLAP MODE . . . . OFF

"If unsuccessful" does not appear on ECAM

· Titles of the procedures appear in the following ways :

NFC5-03-0201-002-B001AA



Abnormal procedure displayed on ECAM

Abnormal procedure not displayed on ECAM

Emergency procedure displayed on ECAM

Emergency procedure not displayed on ECAM

TASK SHARING

The general task sharing shown below applies to all procedures.
The pilot flying remains pilot flying throughout the procedure.
PF, the pilot flying, is responsible for :
— thrust levers
— control of flight path and airspeed
— aircraft configuration (request configuration change)
— navigation
— communications.
PNF, the pilot not flying, is responsible for :
— reading aloud the ECAM and checklists
— executing required actions or actions requested by the PF, if applicable
— operating the engine master switch and ENG FIRE pushbutton (monitored by the PF).

R **MEMORY ITEMS**

R The following procedures are to be applied without referring to paper : Windshear ◁* ,
R windshear ahead ◁* , TCAS ◁* , EGPWS ◁* , loss of braking, beginning of EMER DESCENT,
R beginning of UNRELIABLE SPEED INDICATION.

USE OF AUTOPILOT

The autopilot may be used in most failure cases, when available :
- in case of engine failure, including autoland or CAT II/CAT III ILS.
R When performing an engine-out non precision approach, the use of autopilot is not
R permitted in the following modes : FINAL APP, NAV V/S, NAV FPA.
- in case of other failures, down to 500 ft AGL in all modes.
  However, the AP has not been certified in all configurations and its performance cannot be guaranted. If the pilot chooses to use the AP in such circumstances, extra vigilance is required and the AP must be disconnected if the aircraft deviates from the desired or safe flight path.

INITIATION OF PROCEDURES

Procedures are initiated on the pilot flying's command.
No action is taken (apart from cancelling audio warnings through the MASTER WARN light) until :
- the appropriate flight path is established,
- the aircraft is at least 400 feet above the runway if a failure occurs during takeoff, approach or go-around.

A height of 400 feet is recommended because it gives a good compromise between time necessary for stabilization and excessive delay for procedure initiation.
In some emergency cases, provided the appropriate flight path is established, the pilot flying may initiate actions before this height.
If an emergency causes LAND ASAP to appear in red on the ECAM, the pilot flying should land at the nearest suitable airport.
If an abnormal procedure causes LAND ASAP to appear in amber on the ECAM, the crew should consider the seriousness of the situation and the selection of a suitable airport.

LANDING DISTANCE

Any increase in landing distance resulting from an emergency or abnormality must be based on the actual landing distance in configuration FULL (Refer to 3.02.80).

ECAM

Warning inhibition during takeoff

Some warnings (non-inhibited) appear whenever the prompting situation arises ; others (inhibited) do not appear at once if the prompting situation arises during takeoff.

CREW COORDINATION

When carrying out a procedure displayed on ECAM, both pilots must be aware of the present display. Before any "CLEAR" action, the pilots should crosscheck to confirm that there remains no blue message (except in case of no action feedback) that they can eliminate by a direct action.

NO CLEAR ACTION BEFORE CROSS CONFIRMATION

Example of crew coordination and cross confirmation :

WARNING DISPLAY		PILOT FLYING	PILOT NOT FLYING
HYD B RSVR OVHT BLUE ELEC PUMP.....OFF		READ FAILURE TAKE ATC RADIO CTL – REQUEST ECAM ACTION (1)	READ FAILURE – READ ACTION (full line) – PERFORM ECAM ACTION OR REQUEST EXECUTION BY THE PF (thrust levers)
HYD B RSVR OVHT B SYS LO PR	* F/CTL	– CHECK ECAM ACTION COMPLETED – CONFIRM CLEAR	– REQUEST CLEAR
SEAT BELTS	* F/CTL	– CONFIRM CLEAR	– REVIEW ALL AFFECTED EQUIPMENT SHOWN IN AMBER ON F/CTL PAGE – REQUEST CLEAR
STATUS APPR PROC HYD LO PR IF BLUE OVHT OUT : BLUE ELEC PUMP .... ON CAT 2 ONLY SLATS SLOW	INOP SYS CAT 3 BLUE HYD SPLR 3	– CONFIRM CLEAR	– READ STATUS LINE BY LINE – REQUEST CLEAR

For standard calls, refer to 3.03.90.

(1) Although it is the responsibility of the pilot flying to request ECAM actions, this does not preclude the captain from either taking control of the aircraft or ordering ECAM actions he considers to be necessary.

R *Note : ECAM procedures and, STATUS information, supplemented by a PFD/ND check*
R *suffice for handling the fault. However, before applying the ECAM procedures,*
R *the fault should be confirmed on the system display. When ECAM actions have*
R *been performed, and the ECAM STATUS has been reviewed, the crew may refer*
R *to FCOM procedure (3.02) for supplementary information, if time permits.*

REJECTED TAKEOFF

GENERAL

The decision to reject the takeoff and the stop action is made by the captain.
Therefore the captain should keep his hand on the thrust levers until V1 is reached whether he is PF or PNF. As soon as he decides to abort, he calls "stop", takes over, and performs the stop actions.
It is impossible to list all the factors that could lead to the decision to abort the takeoff, but in order to help in the decision process, the ECAM inhibits the warnings that are not paramount from 80 knots to 1500 feet (or 2 minutes after lift-off, whichever occurs first).
Rejected takeoffs have sometimes been hazardous even though the performance was correctly calculated, based on flight tests.
This may be due to the following :
- delay in initiating the stopping procedure,
- tires damaged,
- brakes worn or not working correctly, initial temperature higher than normal,
- brakes not fully applied,
- runway friction coefficient lower than expected,
- error in gross weight determination,
- runway line-up not considered.

The aircraft is certificated according to FAR amendment 25-42, which allows 2 seconds between decision and action, thus improving the safety margin.
Above 100 knots, rejecting the takeoff becomes a serious action that may lead to a hazardous situation. Therefore, as speed approaches V1, the pilot should be "go-minded" if none of the main failures cited below ("Above 100 knots and below V1") has occurred.

REJECTED TAKEOFF (CONT'D)

DECISION MANAGEMENT

- **Below 100 knots** :
  The decision to reject the takeoff may be taken at the Captain's discretion, depending on the circumstances.
  Although we cannot list all the causes, the Captain should seriously consider discontinuing the takeoff, if any ECAM warning is activated.
  Note : *The speed of 100 knots is not critical : It was chosen in order to help the Captain make his decision, and to avoid unnecessary stops from high speed.*
- **Above 100 knots and below V1** :
  Rejecting the takeoff at these speeds is a more serious matter, particularly on slippery runways. It could lead to a hazardous situation, if the speed is approaching V1. Very few situations should lead to the decision to reject the takeoff. The main ones are:
  1. Fire warning or severe damage.
  2. Sudden loss of engine thrust.
  3. Malfunctions or conditions that give unambiguous indications that the aircraft will not fly safely.
  4. ECAM warnings such as :
     . ENG or APU FIRE
     . ENG FAIL
     . CONFIG. (MAIN WARNINGS ONLY)
     . ENG OIL LO PR
     . ENG REV UNLOCKED
     . L + R ELEV FAULT

  Nose gear vibration should not lead to an RTO above 100 knots.
  In case of tire failure between V1 minus 20 knots and V1 :
  Unless debris from the tires has caused serious engine anomalies, it is far better to get airborne, reduce the fuel load, and land with a full runway length available.
  The V1 call has precedence over any other call.
- **Above V1**
  Takeoff must be continued, because it may not be possible to stop the aircraft on the remaining runway.

REJECTED TAKEOFF (CONT'D)

PROCEDURE DURING A REJECTED TAKEOFF

R

CAPT	F/O
Phase 1 – CALL . . . . "STOP" Simultaneously : – THRUST LEVERS . . . . IDLE – REVERSE THRUST . . . . MAX AVAIL.	 – BRAKE RESPONSE . . . . . MONITOR – REVERSE . . . . CONFIRM – ANY AUDIO . . . . CANCEL – ATC . . . . INFORM – ON GROUND EMER/EVACUATION Checklist . . . . LOCATE
Phase 2 Consider positioning the aircraft to keep any possible fire away from the fuselage.	
– PARKING BRAKE . . . . APPLY *Set parking brake ON after aircraft stops.* – PA call . "ATTENTION CREW!AT STATIONS" – CALL . . . . "ECAM ACTIONS"	 – ECAM ACTIONS . . . . INITIATE
The aircraft should remain stationary while the crew evaluates the situation.	
Evacuation phase If required, refer to the ON GROUND EMER/EVACUATION Checklist for evacuation.	 Inform ATC of intention and required assistance.

REVERSERS : Full reverse may be used until coming to a complete stop. But, if there is enough runway available at the end of the deceleration, it is preferable to reduce reverse thrust when passing 70 knots.

Note : 1. If the brake response does not seem appropriate for the runway condition, FULL manual braking should be applied and maintained. If IN DOUBT, TAKE OVER MANUALLY. Do not attempt to clear the runway, until it is absolutely clear that an evacuation is not necessary and that it is safe to do so.

2. If the autobrake is unserviceable, the Captain simultaneously reduces thrust and applies maximum pressure on both pedals.
The aircraft will stop in the minimum distance, only if the brake pedals are maintained fully pressed until the aircraft comes to a stop.

3. If normal braking is inoperative, immediately switch the A/SKID & NOSE WHEEL switch OFF and modulate brake pressure, as required, at or below 1000 PSI.
If the brake pedals were fully pressed when switching the A/SKID & NOSE WHEEL switch OFF, full pressure would be applied to the brakes.

4. After a rejected takeoff, if the aircraft comes to a complete stop using autobrake MAX, release brakes prior to taxi by disarming spoilers.

ENG FAILURE AFTER V1 – CONTINUED TAKEOFF

- If an engine fails after the aircraft passes V1, the takeoff must be continued.
- Use rudder conventionally to stay on the runway centerline.
- At VR, rotate the aircraft smoothly using a continuous pitch rate to a pitch attitude of 12.5 degrees. After lift-off, follow the Speed Reference System (SRS).
- When airborne with a positive rate of climb, select the landing gear up.
- Use rudder to prevent yaw. Shortly after lift-off, β target will appear. Adjust rudder position to zero the β target. Control heading conventionally with bank, keeping the β target at zero with rudder.
- Consider the use of TOGA thrust.
- Consider the use of autopilot.
- At 400 feet minimum, apply the ECAM procedure
- At acceleration height, level off and allow the speed to increase.
  · At F speed select CONF 1.
  · At S speed select CONF 0.
- When the flap handle is at zero, β target reverts to side-slip indication. Center the sideslip indication conventionally.
- At green dot speed (engine-out operating speed in clean configuration) resume the climb using maximum continuous thrust and maintain green dot speed.
  (If already in the FLX/MCT gate, move to CL and back to MCT).
- MAXIMUM TAKEOFF THRUST IS ONLY ALLOWED FOR 10 MINUTES.

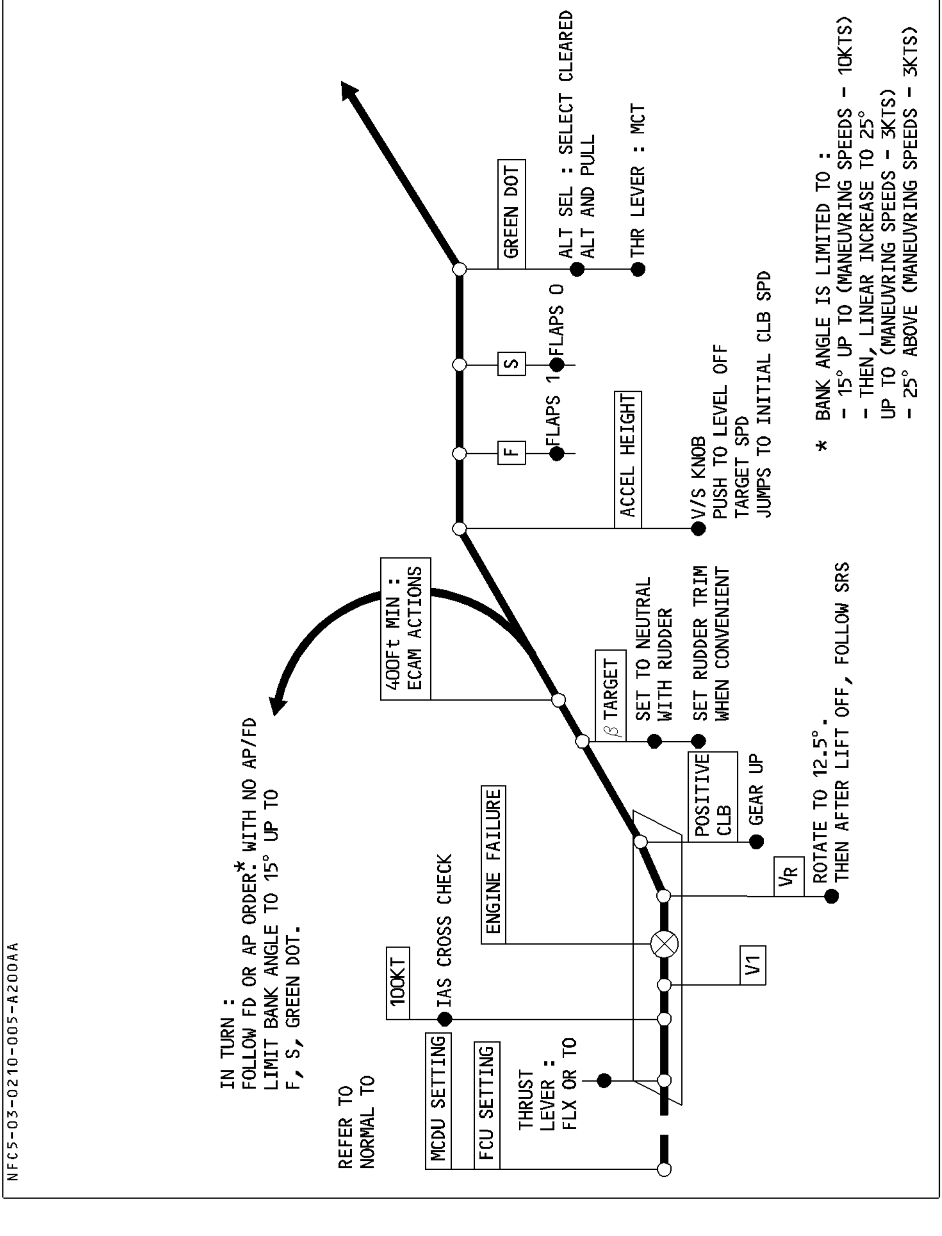
ENGINE FAILURE DURING INITIAL CLIMB-OUT

- Proceed as above. However, if the failure occurs above V2 maintain the SRS commanded attitude (or the speed reached after recovery). In any case, the minimum speed must be equal to V2.

ENG FAILURE AFTER V1 – CONTINUED TAKEOFF (CONT'D)

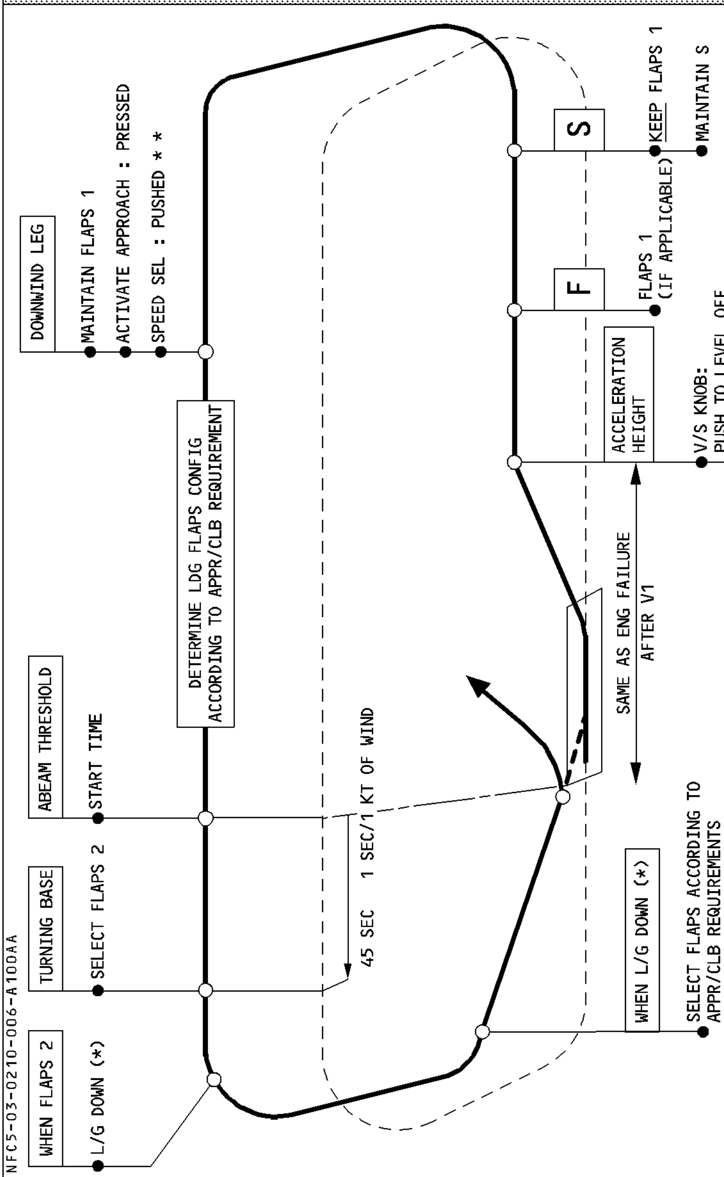
ENGINE OPERATION AT MAX T.O. THRUST IS LIMITED TO 10 MINUTES

R



R

IMMEDIATE VMC LDG FOLLOWING ENG FAILURE ON TO



* AT HIGH ALTITUDE AIRPORT AND HIGH LANDING WEIGHT, DELAY SELECTION OF GEAR DOWN AND LANDING FLAPS/SLATS CONFIGURATION UNTILL FINAL APPROACH.

* * THIS PATTERN ASSUMES THE USE OF MINIMUN GRND SPD (MANAGED). IF NOT, SELECT SPEEDS MANUALLY, F AFTER FLAPS 2 SELECTION, VAPP AFTER LANDING FLAPS SELECTION. SELECTED SPEED MUST BE USED IF THE FLIGHT PLAN HAS NOT BEEN UPDATED WITH THE NEW DESTINATION (MINIMUM GRND SPD NOT CORRECT)

R

APPROACH WITH ONE ENGINE INOPERATIVE

For performance reasons, do not extend flap full until established on a final descent to landing.
If a level off is expected during final approach, perform the approach and landing in CONF 3.

LANDING WITH SLATS OR FLAPS JAMMED

– LANDING CONF . . . . CONF 3

■ **Repeat the following until landing configuration is reached :**

– SPEED SEL . . . . VFE NEXT – 5 KT

Decelerate towards VFE NEXT – 5 KT but not below VLS. In case of turbulence, to avoid VFE exceedance, the pilot may decide to decelerate to a lower speed, but not below VLS.

Note : · *The autopilot may be used down to 500 feet AGL. As it is not tuned for abnormal configurations, its behavior can be less than optimum and must be monitored.*
· *Approach with selected speed is recommended.*
· *A/THR is recommended, except in the case of a G+B SYS LO PR warning.*
· *OVERSPEED warning and VLS, displayed on the PFD, are computed according to the actual flaps/slats position.*
· *VFE and VFE NEXT are displayed on the PFD according to the FLAPS' lever position. If not displayed, use the placard speeds.*
· *If VLS is greater than VFE NEXT (overweight landing case), the FLAPS lever can be set in the required next position, while the speed is reduced to follow VLS reduction as surfaces extend. The VFE warning threshold should not be triggered.*
In this case, disconnect the A/THR. A/THR can be re-engaged when the landing configuration is established.

As speed reduces through VFE NEXT :

– FLAPS LEVER . . . . ONE STEP DOWN

● **When landing configuration is established :**

– DECELERATE TO CALCULATED APPROACH SPEED IN FINAL APPROACH

FOR GO AROUND

The table on page 8 provides the MAX SPEEDS for the abnormal configurations.

■ **IF SLATS FAULT :**

● **FOR CIRCUIT :**

– MAINTAIN SLATS/FLAPS CONFIGURATION
– Recommended speed : MAX SPEED – 10 KT

R ● **FOR DIVERSION**

R – SELECT CLEAN CONFIGURATION
R *Recommended flaps retraction speed is between MAX SPEED – 10 knots and*
R *MAX SPEED.*
R – Recommended diversion speed : MAX SPEED – 10 KT.

LANDING WITH SLATS OR FLAPS JAMMED (CONT'D)

■ **IF FLAPS FAULT :**

● **FOR CIRCUIT :**

– MAINTAIN SLATS/FLAPS CONFIGURATION
– Recommended speed : MAX SPEED – 10 KT

● **FOR DIVERSION :**

● **If FLAPS jammed at 0**

– SELECT CLEAN CONFIGURATION

Note : Recommended speed for slats retraction is between MAX SPEED – 10 KT and MAX SPEED of actual slat/flap position.

– Normal operating speeds

● **If FLAPS jammed > 0**

– MAINTAIN SLAT/FLAP CONFIGURATION
– Recommended speed for diversion : MAX SPEED – 10 KT

Note :
– In the majority of cases, VFE on PFD is equal to the MAX SPEED. In this case, VFE can be used as MAX SPEED. In case the SPD LIM flag is displayed on the PFD, use the MAX SPEED displayed on the ECAM status page.
R *– In some cases, MAX SPEED – 10 knots may be a few knots higher*
R *than the VFE. In this situation, pilot may follow the VFE.*
– In case of a go-around with CONF FULL selected, the L/G NOT DOWN warning is triggered at landing gear retraction.

<table>
<tr><th colspan="6">MAX SPEED</th></tr>
<tr><th>Flaps
Slats</th><th>F = 0</th><th>0 < F ≤ 1</th><th>1 < F ≤ 2</th><th>2 < F ≤ 3</th><th>F > 3</th></tr>
<tr><td>S = 0</td><td>NO LIMITATION</td><td rowspan="2">215 knots</td><td rowspan="2">200 knots</td><td rowspan="2">185 knots</td><td rowspan="2">Not allowed
(177 knots)</td></tr>
<tr><td>0 < S ≤ 1</td><td>230 knots</td></tr>
<tr><td>1 < S ≤ 3</td><td colspan="2">200 knots</td><td>200 knots</td><td>185 knots</td><td>177 knots</td></tr>
<tr><td>S > 3</td><td colspan="2">177 knots</td><td>177 knots</td><td>177 knots</td><td>177 knots</td></tr>
</table>

CAUTION

For flight with SLATS or FLAPS extended, fuel consumption is increased. Refer to the fuel flow indication. As a guideline, determine the fuel consumption in clean configuration at the same altitude without airspeed limitation (e.g. From ALTERNATE FLIGHT PLANNING tables, refer to 2.05.50) and multiply this result by 1.6 (SLATS EXTENDED), or 1.8 (FLAPS EXTENDED, or 2 (SLATS and FLAPS EXTENDED), to obtain the fuel consumption required to reach the destination in the current configuration.

AIR PACK 1(2) OVHT

– PACK (affected) . . . . OFF

High flow is automatically selected on the remaining pack.
Fault light goes out when the overheat disappears.

● **WHEN PACK OVHT OUT :**

– PACK (affected) . . . . ON

STATUS

● **WHEN PACK OVHT OUT :**

– PACK (affected) . . . . ON

INOP SYS

● **If pack not recovered :**

INOP SYS
PACK 1(2)

R

AIR PACK 1(2) FAULT

– PACK (affected) . . . . OFF

STATUS

INOP SYS
PACK 1(2)

AIR PACK 1(2) OFF

R Crew awareness.

One pack is abnormally selected off

STATUS

INOP SYS
PACK 1(2)

AIR PACK 1 + 2 FAULT

– PACK (affected) . . . . OFF

The fault light goes off, when the failure disappears.

– DESCENT TO FL 100/MEA.

Descend to FL 100, or MEA, whichever is higher.

● **WHEN DIFF PR < 1 PSI AND FL BELOW 100 :**

– RAM AIR . . . . ON

MAX FL 100/MEA

● **If FAULT was due to an overheat :**

AIR PACK 1 (2) OVHT

● **WHEN PACK OVHT OUT :**

– PACK (affected) . . . . ON

STATUS

● **If packs not recovered :**

MAX FL 100/MEA

● **If FAULT was due to an overheat :**

● **WHEN PACK OVHT OUT :**

– PACK (affected) . . . . ON

INOP SYS

PACK 1 + 2

AIR PACK 1(2) REGUL FAULT

Pack primary channel, or pack primary and secondary channels fault.

Crew awareness.

STATUS

■ **If the primary channel fails :**

The pack air inlet flap fully opens ; pack flow is fixed at the previous setting.

■ **If the primary and secondary channels fail :**

PACK 1(2) AT FIXED TEMP

The pack outlet temperature is controlled by the pack anti-ice valve and is stabilized to a temperature between 5°C (41°F) and 30°C (86°F) within a maximum of 6 minutes.

INOP SYS

PACK 1(2) REGUL

COND FWD CAB/AFT CAB/CKPT DUCT OVHT

● **WHEN DUCT TEMP < 70 DEG C :**

– HOT AIR . . . . OFF THEN ON

Hot air pressure regulating valve reopens.

● **If system not recovered :**

CAB TEMP BY PACK ONLY

Basic temperature regulation is by packs only (remains automatic).

STATUS

INOP SYS

HOT AIR

COND HOT AIR FAULT

– HOT AIR (if not closed) . . . . OFF

● **IF HOT AIR STILL OPEN and DUCT OVHT persists :**

– PACK 1 . . . . OFF
– PACK 2 . . . . OFF
– DESCENT TO FL 100/MEA
Descend to FL 100, or MEA, whichever is higher.

● **WHEN DIFF PR < 1 PSI AND FL BELOW 100**

– RAM AIR . . . . ON
MAX FL 100/MEA

STATUS

CAB TEMP BY PACK ONLY
(only if HOT AIR closed)
Basic temperature regulation by packs only (remains automatic). R

INOP SYS
PACK 1 + 2
(if PACKS closed)
HOT AIR

COND TRIM AIR SYS FAULT

■ **One trim valve failed :**

A message corresponding to the affected valve is displayed :
AFT CAB TRIM VALVE
FWD CAB TRIM VALVE
CKPT TRIM VALVE

■ **High pressure detected downstream of the hot air pressure regulating valve :**

TRIM AIR HI PR

Note : If the warning and the TRIM AIR HI PR message are triggered when all trim air valves are closed (during the first 30 seconds after the packs are selected on, or in flight, if all zone heating demands are fulfilled), disregard them.

COND AFT CRG ISOL VALVE

Crew awareness

STATUS

INOP SYS
AFT CRG VENT

AIR AFT CRG VENT FAULT

Crew awareness
Failure of ventilation fan.

STATUS

INOP SYS
AFT CRG VENT

COND ZONE REGUL FAULT

Crew awareness.

The hot air pressure regulating valve and trim air valves close.

STATUS

■ **If primary channel failed :**

R CAB ZONE AT FIXED TEMP

Zones are controlled to 24°C (75°F) by the packs through the zone controller secondary channel :

· Pack 1 controls the cockpit.

· Pack 2 controls the cabin.

INOP SYS

■ **If primary and secondary channels failed:**

ENG 1 APPR IDLE ONLY

ENG 2 APPR IDLE ONLY

R *As the FADEC no longer receives a bleed demand correction, only approach idle can be selected.*

PACKS AT FIXED TEMP

The packs are controlled to deliver a fixed temperature of 20°C (68°F) for pack 1, and 10°C (50°F) for pack 2.

INOP SYS

ZONE REGUL

COND L + R CAB FAN FAULT

Both cabin fan motors overheat. Cabin fans stop.

– PACK FLOW . . . . HI

STATUS

INOP SYS

L + R CAB FAN

COND LAV + GALLEY FAN FAULT

Crew awareness.

Cabin zone temperature sensors are normally ventilated by the air extracted by the fan. Therefore, cabin zone temperature regulation is lost.

STATUS

CAB ZONE AT FIXED TEMP

· Cabin zone inlet duct temperature is constant (15°C or 59°F).

R *· Cockpit temperature regulation is normal.*

INOP SYS

GALLEY FAN

LEFT INTENTIONALLY BLANK

CAB PR EXCESS CAB ALT

– CREW OXY MASK (if above FL100) . . . . ON

The recommendation is to descend with autopilot engaged :
· turn ALT selector knob and pull
· turn HDG selector knob and pull
· set target SPD/MACH.

The use of autopilot is also permitted in EXPEDITE mode (<*).

– DESCENT (if above FL100) . . . . INITIATE

● **IF RAPID DECOMPRESSION**

EMER DESCENT FL100/MEA (or minimum obstacle clearance altitude)

– THR LEVERS (if A/THR not engaged) . . . . IDLE

– SPD BRK . . . . FULL

R *Extension of speedbrakes will significantly increase Vls.*
R *In order to avoid autopilot disconnection and automatic retraction of speedbrakes due*
R *to possible activation of angle of attack protection, allow the speed to increase before*
R *starting to use speedbrakes.*

– SPD . . . . MAX/APPROPRIATE

Descend at maximum appropriate speed or, if structural damage is suspected use the flight controls with care and reduce speed as appropriate. Landing gear may be extended below 25000 feet ; speed must be reduced to VLO/VLE.

– SIGNS . . . . ON

– ENG MODE . . . . IGN

– ATC . . . . NOTIFY

Notify ATC of the nature of the emergency and state the intentions.
If ATC cannot be contacted, select ATC code A7700 or transmit a distress message on one of the following frequencies :
(VHF) 121.5 MHz or (HF) 2.182 KHz or 8364 KHz.
To save oxygen, set oxygen diluter selector to N position.
With oxygen diluter left to 100%, oxygen quantity may not be sufficient to cover the entire descent profile.
Ensure that the crew can communicate wearing oxygen masks. Avoid the continuous use of interphone position to minimize the interference from oxygen mask breathing noise.

● **IF CAB ALT > 14 000 FT :**

– PAX OXY MASKS . . . . MAN ON

Note : When descent is established and if time permits select manual mode and check parameters on ECAM CAB PRESS.
R *Notify the cabin crew when a safe flight level has been reached and oxygen*
R *mask use can be stopped.*

CAB PR SYS 1 (2) (1 + 2) FAULT

■ **if one system affected :**

Crew awareness

STATUS

INOP SYS
CAB PR 1 (2)

■ **if both systems affected :**

R *Due to the slow closure of the outflow valve in manual pressurization mode and*
R *depending on the failure, the following procedure may not avoid the depressurization.*

– MODE SEL . . . . MAN

– MAN V/S CTL . . . . AS RQRD

R · *It may take 10 seconds in manual mode before the crew notices a change of the*
R *outflow valve position. Use the cabin V/S indication to confirm the outlfow valve*
R *operation.*

· *Monitor cabin V/S and CAB ALT frequently and adjust as necessary.*
Maintain aircraft altitude at or above cabin altitude.

· *The two safety valves limit △P to 8.6 psi.*

MAN CAB PR CTL

TGT V/S :
CLIMB 500 FT/MIN
DESC 300 FT/MIN

A/C FL	CAB ALT TGT
390	8 000
350	6 500
300	5 000
250	2 500
< 200	0

DURING FINAL APPR :

– V/S CTL . . . . FULL UP

CAUTION
Check that △P is zero before opening the doors.

STATUS

INOP SYS
CAB PR 1 + 2

R
CABIN OVERPRESSURE

R *Apply the following procedure (not displayed on ECAM) in case of total loss of cabin*
R *pressure control leading to overpressure.*

- PACK 1 or 2 . . . . OFF
- BLOWER + EXTRACT . . . . OVRD

  Cabin air is extracted overboard
- △P . . . . FREQUENTLY MONITOR

● **If △P > 9 PSI**

  - PACK 1 + 2 . . . . OFF

    LAND ASAP

Before 10 minutes from landing :

- PACK 1 + 2 . . . . OFF
- BLOWER + EXTRACT . . . . AUTO

CAUTION
Check that △P is zero before opening the doors.

CAB PR LO DIFF PR

– EXPECT HI CAB RATE
– A/C V/S .... REDUCE

CAB PR OUTFLOW VALVE NOT OPEN (on ground)

– MODE SEL .... MAN
– MAN V/S CTL .... FULL UP

R *It may take 10 seconds in manual mode before the crew notices a change of the outflow*
R *valve position.*

● **IF UNSUCCESSFUL** :
  – PACK 1 and 2 .... OFF

CAB PR LDG ELEV FAULT

– LDG ELEV .... MAN ADJUST

Landing field elevation from FMGC is not available. Landing elevation must be manually
R *selected with LDG ELEV selector. Refer to the LDG ELEV indication on the CRUISE page*
R *or CAB PRESS page to adjust the required landing elevator.*
Note : If the landing is performed on QFE, set 0 feet on LDG ELEV selector.

CAB PR SAFETY VALVE OPEN

The failure is probably due to an overpressure.

● **IF DIFF PR ABV 8 PSI :**

– MODE SEL . . . . MAN

– MAN V/S CTL . . . . AS RQRD

If overpressure is confirmed, reduce cabin ΔP.

R *It may take 10 seconds in manual mode before the crew notices a change of the*
R *outflow valve position.*

● **IF UNSUCCESSFUL :**

– A/C FL . . . . REDUCE

STATUS

MAN CAB PR CTL

TGT V/S :
CLIMB 500 FT/MIN
DESC 300 FT/MIN

A/C FL	CAB ALT TGT
390	8 000
350	6 500
300	5 000
250	2 500
< 200	0

● **DURING FINAL APPR :**

– V/S CTL . . . . FULL UP

CAUTION
Check that ΔP is zero before opening the doors.

VENT BLOWER FAULT

– BLOWER . . . . OVRD
The ventilation system is in closed circuit configuration and air from air conditioning is added to the ventilation air.

STATUS

INOP SYS
VENT BLOWER

VENT EXTRACT FAULT

– EXTRACT . . . . OVRD
The ventilation system is in closed circuit configuration and air from air conditioning is added to the ventilation air.

STATUS

INOP SYS
VENT EXTRACT

VENT SKIN VALVE FAULT

● **If INLET valve not fully closed in flight :**
Crew awareness
No action is required, since there is a non return valve at the air inlet.

● **If EXTRACT valve affected :**
– BLOWER . . . . OVRD
– EXTRACT . . . . OVRD
These actions send additional closure signals to the inlet and extract valves.
R *The weather radar image on both NDs may be lost in case of insufficient ventilation.*

● **IF UNSUCCESSFUL :**
MAX FL 100/MEA
– CAB PR MODE SEL . . . . MAN
– MAN V/S CTL . . . . FULL UP
The aircraft is manually depressurized.
It may take 10 seconds in manual mode before the crew notices a change of the outlfow valve position.

STATUS

MAX FL : 100/MEA (or minimum obstacle clearance altitude)

INOP SYS
AVNCS VALVE

VENT AVNCS SYS FAULT

Triggered when the AEVC is not supplied or when valve position disagrees with the commanded position or when the power-up test is not satisfactory.

STATUS

INOP SYS
AVNCS VENT
VENT BLOWER (a)
VENT EXTRACT(a)

(a) If AEVC not supplied.

AUTO FLT YAW DAMPER 1(2)

Crew awareness.

Note : The crew can attempt to reset the affected FAC by using the FAC pushbutton. On the
R *ground only, if the reset is unsuccessful, the taxi and takeoff can be continued with*
R *the failed yaw damper inoperative.*

STATUS

CAT 3 SINGLE ONLY

INOP SYS
CAT 3 DUAL
YAW DAMPER1(2)

AUTO FLT YAW DAMPER SYS

Loss of yaw dampers 1 + 2

– FAC 1 + 2 . . . . OFF THEN ON

● **If fault remains :**

F/CTL ALTN LAW
(PROT LOST)

F/CTL normal laws are lost. All protections, except maneuver protections, are lost.

MAX SPEED . . . . 320 KT

STATUS

MAX SPEED . . . . 320 KT

Speed limited, due to a high-speed protection loss.

APPR PROC
– FOR LDG . . . . USE FLAP 3
– GPWS LDG FLAP 3 . . . . ON
Will be displayed, when flaps in CONF 3.
APPR SPD . . . . VREF + 10 KT
LDG DIST PROC . . . . APPLY
Multiply the landing distance by 1.2.

ALTN LAW : PROT LOST
WHEN L/G DN : DIRECT LAW

At landing gear extension, control reverts to direct law in pitch, as well as in roll (refer to DIRECT LAW procedure 3.02.27).

CAT 1 ONLY

INOP SYS
F/CTL PROT
YAW DAMPER
AP 1 + 2

AUTO FLT RUD TRIM 1(2) FAULT

Crew awareness.

STATUS

CAT 3 SINGLE ONLY

INOP SYS
CAT 3 DUAL
RUD TRIM 1(2)

AUTO FLT RUD TRIM SYS

– FAC 1 + 2 .... OFF THEN ON

STATUS

CAT 1 ONLY

INOP SYS
RUD TRIM
AP 1 + 2

AUTO FLT RUD TRV LIM 1(2)

Crew awareness.

STATUS

INOP SYS
RUD TRV LIM 1(2)

AUTO FLT RUD TRV LIM SYS

RUD WITH CARE ABV 160 KT

Depending on when the failure occurs, the rudder travel limiter system may not be in the correct position for the flight speed. Therefore, rudder inputs must be limited at speeds above 160 knots, so as not to damage structure.

R *At slats' extension, full rudder travel authority may be recovered.*

– FAC 1 + 2 .... OFF THEN ON

STATUS

RUD WITH CARE ABV 160 KT

Note : A CAT 3 approach, without DH, is not permitted.

INOP SYS
RUD TRV LIM

AUTO FLT FAC 1 (2) FAULT

– FAC (affected) . . . . OFF THEN ON

● **IF UNSUCCESSFUL :**

– FAC (affected) . . . . OFF

All functions are performed by the remaining FAC.

STATUS

BOTH PFD ON SAME FAC	INOP SYS
R *Characteristics speeds displayed on the two PFDs are*	CAT 3 DUAL
R *computed in the same FAC.*	FAC 1(2)
CAT 3 SINGLE ONLY	

AUTO FLT FAC 1 + 2 FAULT

RUD WITH CARE ABV 160 KT

Depending on when the failure occurs, the rudder travel limiter system may not be in the correct position for the flight speed. Therefore, rudder inputs must be limited at speeds above 160 knots, so as not to damage structure.

R *At slats' extension, full rudder travel authority is recovered.*

– FAC 1 + 2 .... OFF THEN ON

● **IF UNSUCCESSFUL :**

- – FAC 1 + 2 .... OFF

  With FAC 1 + 2 inoperative, the rudder travel limit system, rudder trim control, yaw damper and PFD characteristic speeds are lost.

F/CTL ALTN LAW

(PROT LOST)

F/CTL normal laws are lost. All protections, except maneuver protections, are lost.

MAX SPEED .... 320 KT

Speed is limited, due to the loss of high-speed protections.

STATUS

MAX SPEED .... 320 KT
RUD WITH CARE ABV 160 KT
APPR PROC
- – FOR LDG .... USE FLAP 3
- – GPWS LDG FLAP 3 .... ON

  Displayed, when flaps in CONF 3.

APPR SPD .... VREF + 10 KT
LDG DIST PROC .... APPLY

Multiply the landing distance by 1.2.

ALTN LAW : PROT LOST
WHEN L/G DN : DIRECT LAW

At landing gear extension, control reverts to direct law in pitch, as well as in roll (refer to the DIRECT LAW procedure 3.02.27)

CAT 1 ONLY

INOP SYS
REAC W/S DET
F/CTL PROT
FAC 1 + 2
AP 1 + 2
A/THR

AUTO FLT FCU 1 + 2 FAULT

– PFD BARO REF : STD ONLY

With both FCU channels failed, the barometer reference automatically goes to 1013 hPa. Use standby altimeter to change this to the actual barometer setting.
In addition :
- *All FCU controls are inoperative.*
- *A/THR, AP 1 + 2, and FD 1 + 2 are not available.*
  (except in LAND or GO AROUND mode where only A/THR is lost).
- *On PFD :*
  - *Altitude alert is inoperative.*
  - *ILS deviation scales are displayed.*
  - *Flight path vector is displayed.*
  - *Mach indication is inoperative.*
  - *FMA is lost except in LAND or GA mode.*
- *On ND :*
  - *ROSE NAV mode with map (80 NM range) is displayed.*
  - *VOR/ADF needles:*
    Needle 1 is related to VOR1 only.
    Needle 2 is related to ADF2 only (ADF1 if ADF2 not installed).
    (VOR selection on DDRMI is not affected)
    (ADF selection on DDRMI (if available) is not affected).
  - *The weather radar image may be lost. If the image remains displayed it must be disregarded. In all cases, red "WXR RNG" message is displayed.*

STATUS

PFD BARO REF : STD ONLY
- **if not in LAND or GA**
  CAT 1 ONLY
- **if in LAND or GA** R
  CAT 2 ONLY

INOP SYS
FCU 1 + 2
AP 1 + 2 (if not LAND or GA)
A/THR
CAT 3 (if in LAND or GA mode)

AUTO FLT FCU 1 (2) FAULT

– BARO REF . . . . X CHECK

As one FCU channel is lost the barometer reference settings on the FCU and PFDs must be crosschecked.

STATUS

INOP SYS
FCU 1 (2)

AUTO FLT AP OFF

This warning is displayed only for involuntary disconnection. For voluntary disconnection a red AP OFF message is displayed in the right lower part of ECAM upper DU.

Crew awareness

STATUS

CAT 1 ONLY (if both AP lost)	INOP SYS (affected) AP

AUTO FLT A/THR OFF

In case of involuntary disconnection, amber "A/THR OFF" and "ENG THRUST LOCKED" messages are displayed in the left lower part of ECAM upper DU.

R *For voluntary disconnection, an amber A/THR OFF message is displayed on the right lower*
R *part of ECAM upper DU.*

– THR LEVERS . . . . MOVE

If the thrust levers are not moved within 5 seconds, the "ENG THRUST LOCKED" warning is displayed (refer to 3.02.70).

STATUS

CAT 2 ONLY	INOP SYS A/THR CAT 3

AUTO FLT A/THR LIMITED

This warning is displayed when A/THR is active and the thrust levers are below the CL detent (or the MCT detent when one engine is out). The caution is repeated every 5 seconds as long as the thrust levers are not moved.

– THR LEVERS . . . . MOVE

Thrust lever(s) must be set in the relevant detent.

WINDSHEAR REAC W/S DET FAULT

Crew awareness

STATUS

INOP SYS
REAC W/S DET

Note : On the ground, this warning may appear spuriously. Flight crew can cancel it by resetting both FACs one after the other:
- *FAC 1: Pull then push AUTO FLT/FAC 1/26VAC and 28VDC circuit breakers B03 and B04 ON 49VU.*
- *FAC 2: Pull then push AUTO FLT/FAC 2/26VAC and 28VDC circuit breakers M18 and M19 on 121VU.*

LOW ENERGY WARNING

The "SPEED SPEED SPEED" synthetic voice sounds every 5 seconds whenever the aircraft energy goes below a threshold under which thrust must be increased in order to recover a positive flight path angle.

R – THR LEVERS .... MOVE FORWARD

Increase the thrust until the warning disappears.

COM CIDS 1 + 2 FAULT

Crew awareness.

Passenger address, cabin and service interphone, and passenger signs are inoperative.

STATUS

INOP SYS

CIDS

COM VHF 1(2)(3)/HF 1(2) EMITTING

1. If any Push To Talk (PTT) transmission selector (sidestick radio selector, hand mike selector, or PTT switch) is jammed in the transmit position, try to release it in order to remove the caution.

R *2. If unsuccessful, deselect the identified failed VHF/HF transmission keys on the associated*
R *Audio Control Panel (ACP) to remove the caution. This ACP should only be used in*
R *reception mode. The associated PTT transmission selectors must not be used.*

Note : In this case, the ACP of the unaffected side may be used to recover the deselected
R *VHF/HF channel.*

3. If no transmission key on the ACP is found in the "transmit" position, pull the affected VHF/HF C/B associated to the ECAM message : COM\HF1 C/B HA 14 on 49 VU, COM NAV\HF2 C/B L13 on 121 VU, COM\VHF\1 C/B G09 on 49 VU, COM NAV\VHF\2 C/B L04 on 121 VU, COM\VHF\3 C/B L05 on 121 VU.

COM ACARS FAULT

No crew action required.

STATUS

INOP SYS

ACARS

ELEC IDG 1(2) OIL LO PR/OVHT

– IDG (affected) . . . . OFF

If the associated engine is running, the IDG (integrated drive generator) must be disconnected from the engine at, or above, idle to prevent damage to the disconnect mechanism.
Press the IDG pushbutton until the GEN FAULT light comes on. However, do not press for more than 3 seconds, to avoid damage to the disengage solenoid.
The IDG FAULT light goes off, when the IDG is disconnected.

STATUS

Note : If available, the APU may be started and the APU GEN used.

R CAT 3 SINGLE ONLY

INOP SYS
MAIN GALLEY
(only if APU GEN is not online)
GEN 1(2)
R CAT 3 DUAL

ELEC GEN 1(2) FAULT

– GEN (affected) . . . . OFF THEN ON

● **IF UNSUCCESSFUL** :
– GEN (affected) . . . . OFF

STATUS

Note : If available, the APU may be started, and the APU GEN used.

CAT 3 SINGLE ONLY

INOP SYS
MAIN GALLEY
(only if APU GEN is not online)
GEN 1(2)
CAT 3 DUAL

ELEC GEN 1(2) OFF

Crew awareness
Turn affected GEN ON, with the applicable pushbutton.

STATUS

CAT 3 SINGLE

INOP SYS
MAIN GALLEY
(only if APU GEN is not online)
GEN 1(2)
CAT 3 DUAL

ELEC APU GEN FAULT

– APU GEN . . . . OFF THEN ON

● **IF UNSUCCESSFUL :**

– APU GEN . . . . OFF

STATUS

INOP SYS
MAIN GALLEY (when only one gen operating)
APU GEN

ELEC BAT 1(2) FAULT

Crew awareness

Battery contactor is opened automatically by battery charge limiter.

STATUS

APU BAT START NOT AVAIL

INOP SYS
BAT 1(2)

ELEC BAT 1(2) OFF

Crew awareness

Battery is abnormally selected off.

STATUS

APU BAT START NOT AVAIL

ELEC BCL 1(2) FAULT

Crew awareness

STATUS

APU BAT START NOT AVAIL

INOP SYS
BCL 1(2)

ELEC AC BUS 1 FAULT

– BLOWER . . . . OVRD

The avionics ventilation system is in the closed circuit configuration.
Air conditioning is added to the ventilation air.

WHEEL N.W. STEER FAULT

VENT EXTRACT FAULT

R – EXTRACT . . . . OVRD

Affected systems
* AVNCS VENT
* HYD
* FUEL
* F/CTL

ELEC AC BUS 1 FAULT (CONT'D)

STATUS

CAB ZONE AT FIXED TEMP
Due to loss of galley fan, pack 1 controller and primary channel of zone controller (See associated procedures)
SLATS SLOW
CAT 2 ONLY

INOP SYS
See below

INOP SYS displayed on ECAM

BLUE HYD	L+R TK PUMP 1	MAIN GALLEY
SPLR 3	CTR TK PUMP 1 ⊲	B ELEC PUMP
ADR 3	VENT BLOWER	BSCU CH 1
RA 1	GALLEY FAN	DMC 3
CAPT TAT	CRG VENT ⊲	GPWS
L WSHLD HEAT	GND COOL ⊲	LAV DET
R L WNDW HEAT	N.W. STEER	PACK 1 REGUL
CAT 3		

Other inoperative systems

Left cabin fan	Engine 1 ignition B	Zone controller prim channel
R Radar 1	EVMU eng 1 and eng 2	
R Stby Pitot/AOA	Hydraulic quantity indication	Partial galley
ACARS ⊲	Printer	PVI ⊲
Brake fans 5, 6, 7 and 8 ⊲	HF 1 ⊲	TCAS ⊲
HUD ⊲		
MCDU 3 ⊲		

Note : The warning may be caused by a failure in a sub BUS. Consequently, only a part of the above-listed systems may be lost.

ELEC AC BUS 2 FAULT

– EXTRACT .... OVRD

The avionics ventilation system is in the closed circuit configuration.
Air conditioning is added to the ventilation air.

L/G LGCIU 2 FAULT

Affected systems
* AVNCS VENT
* FUEL

STATUS

R PACK 2 AT FIXED TEMP

Due to the loss of the pack 2 controller, the anti-ice valve maintains the pack outlet temperature at a constant nominal value of 15° C.

CAT 1 ONLY

INOP SYS
See below

INOP SYS displayed on ECAM

ADR 2	CTR TK PUMP 2 ⊲	RUD TRV LIM 2
ILS 2	LGCIU 2	BSCU CH 2
GPS 2	RA 2	REVERSER 2
Y ELEC PUMP	F/O PITOT	VENT EXTRACT
SDAC 2	F/O AOA	GND COOL ⊲
FWC 2	F/O TAT	PACK 2 REGUL
DMC 2	R WNDW HEAT	MAIN GALLEY
FDIU	CAT 2	YAW DAMPER 2
R WSHLD HEAT	L+R TK PUMP 2	RUD TRIM 2

OTHER INOP SYS

Right cabin fan	MCDU 2	QAR
Brake fans 1, 2, 3 and 4 ⊲	ENG 2 ignition B	ATC 2
ADF 2 ⊲	VOR 2	ECAM lower DU
DME 2	F/O PFD and ND	HF 2 ⊲
RADAR 2 ⊲		

Note : *The warning may be caused by a failure in a sub BUS. Consequently, only a part of the above-listed systems may be lost.*

ELEC AC ESS BUS FAULT

- AC ESS FEED .... ALTN
  AC BUS 2 supplies AC ESS BUS.
- ATC .... SYS 2

AUTO FLT YAW DAMPER 1

AUTO FLT RUD TRIM 1 FAULT

R

AUTO FLT RUD TRV LIM 1

STATUS

CAT 1 ONLY

INOP SYS
See below

INOP SYS displayed on ECAM

ADR 1	CAT 2	GPWS
ILS 1	SDAC 1	YAW DAMPER 1
GPS 1	CAPT PITOT	FWC 1
RUD TRIM 1	CAPT AOA	DMC 1
RUD TRV LIM 1		

Other inoperative systems

RMP's lighting (RMP's still operative)	CAPT ND	DDRMI
VOR 1	CAPT PFD	ENG 1 + 2 IGN A
DME 1	ATC 1	MCDU 1
APU fuel pump	Passenger oxygen masks (auto + manual)	CVR
ECAM upper display		

Note : The warning may be caused by a sub BUS failure. Consequently, only a part of the above-listed systems may be lost.

ELEC AC BUS 2 FAULT

– EXTRACT . . . . OVRD

The avionics ventilation system is in the closed circuit configuration.
Air conditioning is added to the ventilation air.

L/G LGCIU 2 FAULT

Affected systems
* AVNCS VENT
* FUEL

STATUS

R PACK 2 AT FIXED TEMP

Due to the loss of the pack 2 controller, the anti-ice valve maintains the pack outlet temperature at a constant nominal value of 15° C.

CAT 1 ONLY

INOP SYS

See below

INOP SYS displayed on ECAM

ADR 2	CTR TK PUMP 2 ◁	RUD TRV LIM 2
ILS 2	LGCIU 2	BSCU CH 2
GPS 2	RA 2	REVERSER 2
Y ELEC PUMP	F/O PITOT	VENT EXTRACT
SDAC 2	F/O AOA	GND COOL ◁
FWC 2	F/O TAT	PACK 2 REGUL
DMC 2	R WNDW HEAT	MAIN GALLEY
FDIU	CAT 2	YAW DAMPER 2
R WSHLD HEAT	L+R TK PUMP 2	RUD TRIM 2

OTHER INOP SYS

Right cabin fan	MCDU 2	QAR
Brake fans 1, 2, 3 and 4 ◁	ENG 2 ignition B	ATC 2
ADF 2 ◁	VOR 2	ECAM lower DU
DME 2	F/O PFD and ND	HF 2 ◁
RADAR 2 ◁		

Note : The warning may be caused by a failure in a sub BUS. Consequently, only a part of the above-listed systems may be lost.

ELEC AC ESS BUS FAULT

– AC ESS FEED . . . . ALTN

AC BUS 2 supplies AC ESS BUS.

– ATC . . . . SYS 2

AUTO FLT YAW DAMPER 1

AUTO FLT RUD TRIM 1 FAULT

R

AUTO FLT RUD TRV LIM 1

STATUS

CAT 1 ONLY

INOP SYS
See below

INOP SYS displayed on ECAM

ADR 1 ILS 1 GPS 1 RUD TRIM 1 RUD TRV LIM 1	CAT 2 SDAC 1 CAPT PITOT CAPT AOA	GPWS YAW DAMPER 1 FWC 1 DMC 1

Other inoperative systems

RMP's lighting (RMP's still operative)	ECAM upper display	DDRMI
VOR 1	CAPT PFD	ENG 1 + 2 IGN A
MCDU 1	ATC 1	APU fuel pump
CAPT ND	DME 1	Passenger oxygen masks (auto + manual)
CVR	HF 1	ADF 1 ⊲

Note : The warning may be caused by a sub BUS failure. Consequently, only a part of the above-listed systems may be lost.

ELEC AC ESS BUS SHED

ATC . . . . SYS 2

STATUS

INOP SYS
CAPT AOA
See below

Other inoperative systems

MCDU 1	DME 1	CAPT ND
R ATC 1	CVR	ADF 1 ⩤
CAPT AOA heat	APU fuel pump	Passenger oxygen masks (auto + manual)

Note : The warning may be caused by a failure in a sub BUS. Consequently only a part of the systems listed above may be lost.

ELEC DC BUS 1 FAULT

– BLOWER . . . . OVRD
– EXTRACT . . . . OVRD

Avionic ventilation air is supplied air conditioning and exhausted overboard

Affected systems
* AVNCS VENT
* FUEL

STATUS

CAB ZONE AT FIXED TEMP

Due to the loss of the pack 1 controller, the primary channel of the zone controller and the galley fan (See associated procedures)

INOP SYS
See below

INOP SYS displayed on ECAM

ACP 3	CTR TK PUMP 1 ⊲	BSCU CH 1
CAPT STAT HEAT	AVNCS VENT	LAV DET
STBY STAT HEAT	GALLEY FAN	PACK 1 REGUL
L. WSHLD HEAT	GND COOL ⊲	
L. WNDW HEAT	REV 1	

Other inoperative systems

Left cab fan	VHF 3 ⊲	Eng 1 oil press and qty ind.
Zone controller primary channel	RMP 3 ⊲	TPIS ⊲
Sel cal	Hot air	Brake temps ind.
CFDIU	Capt wiper	

Note : The warning may be caused by a failure in a sub BUS. Consequently only a part of the systems listed above may be lost.

ELEC DC BUS 2 FAULT

– AIR DATA SWTG .... F/O
– BARO REF .... CHECK
Since one FCU channel is lost, crosscheck the barometer reference settings on the FCU and PFD.

Affected systems
* CAB PRESS
* FUEL
* WHEEL
* F/CTL

STATUS

LDG DIST PROC .... APPLY
Multiply the landing distance by 1.1, due to the loss of spoilers associated with SEC 2 and 3.
ENG 2 APPR IDLE ONLY
BOTH PFD ON SAME FAC
PACK 2 AT FIXED TEMP
SLATS/FLAPS SLOW
CAT 3 SINGLE ONLY

INOP SYS
See below

INOP SYS displayed on ECAM

SPLR 1+2+5	CAT 3 DUAL	MAIN GALLEY
ELAC 2 (a)	FAC 2	Y ELEC PUMP (if selected ON)
SEC 2 + 3	LTK PUMP 2	BSCU CH 2
VHF 2	RTK PUMP 2	F/O STAT
CTR TK PUMP 2	ENG 1 LOOP B	RWSLHD HEAT
LGCIU 2	ENG 2 LOOP A	RWNDW HEAT
REV 2	PACK 2 REGUL	AP 2
CAB PR 2	FCDC 2	FCU 2

Other inoperative systems

SFCC 2	BMC 2	Brake fan
R cabin fan	Bleed X feed auto control	Eng 2 oil low press and qty ind
F/O wiper	RMP 2	R loudspeaker
F/O rain rplnt	FQI channel 2	rudder trim ind
Eng 1 and 2 fire ext btl 2	zone controller sec	FMGC 2
R Autobrake (due to loss of 2 SECs)	SDCU 2	CDLS

(a) Lost after 30 seconds, but recovered at landing gear extension.

Note : *The warning may be caused by a sub BUS failure. Consequently, only a part of the above-listed systems may be lost.*

ELEC DC ESS BUS FAULT

- VHF 2 or 3 . . . . USE
- AUDIO SWTG . . . . SELECT

  Since ACP 1 and 2 are lost, set AUDIO SWTG selector at CAPT 3 or F/O 3 to recover communications.
- BARO REF . . . . CHECK

  Crosscheck the barometer reference settings on FCU and PFD.
- GPWS . . . . OFF

NAV GPWS FAULT

- GPWS . . . . OFF

FUEL L TANK PUMP 1 LO PR

FUEL R TANK PUMP 1 LO PR

VENT BLOWER FAULT

R Affected systems
* CAB PRESS
* HYD
* F/CTL

ELEC DC ESS BUS FAULT (CONT'D)

STATUS

ENG 1 APPR IDLE ONLY
ENG 2 APPR IDLE ONLY
BOTH PFD ON SAME FAC
SLATS/FLAPS SLOW
CAT 2 ONLY

INOP SYS
See below

INOP SYS displayed on ECAM

B HYD	FAC 1	VENT EXTRACT
SPLR 3	L TK PUMP 1	B ELEC PUMP
VHF 1	R TK PUMP 1	GPWS
ACP 1+2	REV 2	ENG 1 LOOP A
WING A. ICE	ENG 2 START	ENG 2 LOOP B
AP 1	CAB PR 1	FCDC 1
A/THR		CAT 3
FCU 1		

Other inoperative systems

R BRK PRESS indicator		Hyd fire valves Eng 1 and 2
Flight interphone	Standby Horizon	Ram air inlet
EIU 2 (autothrust, eng start and reverser inop)	Standby compass light	ECAM control Panel
Capt rain repellent	HP fuel shut-off valves	Left loudspeaker
Avionics air cond valve	SFCC 1	DC SHED ESS BUS
	RMP 1	

Note : *The warning may be caused by a failure in a sub BUS. Consequently only a part of the systems listed above may be lost.*

ELEC DC ESS BUS SHED

– EXTRACT . . . . OVRD

Cooling air is supplied by the air conditioning system, without overboard extraction.

AVOID ICING CONDITIONS

Affected systems
* AVNCS VENT

STATUS

AVOID ICING CONDITIONS BOTH PFD ON SAME FAC ● **IF A/C ICING SEVERE :** – MIN SPD . . . . ALPHA PROT CAT 3 SINGLE ONLY	INOP SYS WING A. ICE AP 1 FAC 1 CAT 3 DUAL VENT EXTRACT AVNCS VALVE AFT CRG HEAT ◁* FWD CRG HEAT ◁* AFT CRG VENT ◁* FWD CRG VENT ◁* FCDC 1 See below

OTHER INOP SYS

Cabin oxygen mask (auto drop out)	STBY ALTI vib	BMC 1
R X BLEED valve man ctl	Crew oxygen valve	FQ1 channel 1
SDCU 1	FMGC 1	

Note : The warning may be caused by a failure in a sub BUS. Consequently only a part of the systems listed above may be lost.

ELEC DC BUS 1 + 2 FAULT

– BLOWER . . . . OVRD
– EXTRACT . . . . OVRD
– BARO REF . . . . CHECK
Crosscheck the barometer reference settings on the FCU and PFDs.
MAX BRK PR . . . . 1000 PSI
Brake pressure must be limited to approximately 1000 psi, since antiskid is lost.

ELEC DC BAT BUS FAULT

Affected systems
* CAB PRESS
* FUEL
* AIR COND
* BRAKES
* WHEEL
* F/CTL

STATUS

– MAX BRK PR . . . . 1000 PSI
LDG DIST PROC . . . . APPLY
Multiply the landing distance by 1.6, due to the loss of ground spoilers 1+2+5 and antiskid.
ENG 1 APPR IDLE ONLY
ENG 2 APPR IDLE ONLY
BOTH PFD ON SAME FAC
CTR TK (⊛) FUEL UNUSABLE

ELEC DC BUS 1 + 2 FAULT (CONT'D)

STATUS

APU BAT START NOT AVAIL CAB ZONE AT FIXED TEMP PACKS AT FIXED TEMP SLATS/FLAPS SLOW CAT 2 ONLY	INOP SYS See below

INOP SYS displayed on ECAM

SPLR 1 + 2 + 5	CAT 3	GND COOL ◁*
ELAC 2 (a)	FAC 2	MAIN GALLEY
SEC 2 + 3		Y ELEC PUMP
VHF 2	ANTI SKID	BSCU CH 1
ACP 3	N.W. STEER	BSCU CH 2
CAPT STAT heat	LGCIU 2	APU FIRE DET
F/O STAT heat	REVERSER 1 + 2	LAV DET
STBY STAT heat	CAB PRESS 2	ENG 1 LOOP B
WSHLD HEAT	AVNCS VENT	ENG 2 LOOP A
WNDW HEAT	L + R CAB FAN	PACK 1 REGUL
AP 2	GALLEY FAN	PACK 2 REGUL
R FCU 2		L TK PUMP 2
FCDC 2		R TK PUMP 2
		CTR TK PUMPS

Other inoperative systems

Selcal	VHF 3 ◁*	FMGC 2
Brake temp indication	RMP 2	Rudder trim indication
Brake fans ◁*	RMP 3 ◁*	BMC 2
TPIS ◁*	CFDIU	FQI channel 2
Capt and F/O wipers	Right loudspeakers	Eng 1 and 2 fire ext btl 2
Eng 1 and 2 oil pressure and	SFCC 2	X Bleed auto control
R quantity indication	CDLS ◁*	
Autobrake	APU ECB	APU fuel LP valve
Stick and rudder pedals lock (by AP)	Manual pressure control	SDCU 2

(a) Lost after 30 seconds, but is recovered at landing gear extension.

Note : The warning may be caused by a failure in a sub BUS. Consequently, only a part of the above-listed systems may be lost.

ELEC EMER CONFIG

LAND ASAP

MIN RAT SPEED .... 140 KT

CAUTION
The RAT is capable of supplying the EMER GEN down to 125 kt, except during flare.

– GEN 1 + 2 .... OFF THEN ON

● **IF UNSUCCESSFUL :**

- BUS TIE .... OFF

  Setting BUS TIE pushbutton switch to OFF segregates both generator channels.
- GEN 1 + 2 .... OFF THEN ON

  Note : If any generator reset is successful, reset both FAC's.
- EMER ELEC PWR (if EMER GEN not in line) ..... MAN ON
- ENG MODE SEL .... IGN

  Engines are fed by gravity only.

R – VHF1/HF1 ⊲ /ATC1/ .... USE

  Only VHF 1, HF 1 and ATC 1 are supplied in the electrical emergency configuration.

  Note : FMGC1, which is lost temporarily, can be regained by flight crew passing through the MCDU MENU page.

ELEC EMER CONFIG (CONT'D)

FUEL GRVTY FEED

Engines are fed by gravity only. Avoid negative Gs.

PROC : GRVTY FUEL FEEDING

Apply the GRVTY FUEL FEEDING procedure (3.02.28).

- FAC 1 . . . . OFF THEN ON
  The rudder trim is recovered, although no indication is available.
- BUS TIE . . . . ON
- APU (IF AVAIL) . . . . START
  APU start is not available for 45 seconds after the loss of both engine generators. This 45-second delay prevents any interference with emergency generator coupling.
R *If the APU is available, the APU may be started when below FL 250.*
- BLOWER + EXTRACT . . . . OVRD
  Cooling air is supplied by the air conditioning system, and exhausted overboard through the extract valve.

Note : On IAE-powered aircraft, the "EPR MODE FAULT N1 DEGRADED MODE" warning is displayed.

FLT CTL ALTN LAW

(PROT LOST)

MAX SPEED . . . . 320 KT

Speed limited due to the loss of flight control normal laws.

ELEC EMER CONFIG (CONT'D)

STATUS

ECAM lower display is not available. STATUS page is displayed on the upper ECAM display, as long as the STATUS pushbutton is pressed.

MIN RAT SPEED . . . . 140 KT
MAX SPEED . . . . 320 KT
MAX BRK PR . . . . 1000 PSI
FUEL GRVTY FEED
AVOID NEGATIVE G FACTOR

Note : If there are discrepancies between airspeed indications on the Captain's PFD and on the STBY indicator, disregard the STBY indication (probe not deiced).

APPR PROC :
- FOR LDG . . . . USE FLAP 3

ELEC EMER CONFIG (CONT'D)

STATUS

APPR SPD . . . . VREF + 10

Approach speed must be at least minimum RAT speed (140 Knots).

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.9, due to :

- *Antiskid inoperative*
- *Ground spoilers 1 + 2 + 5 inoperative*
- *Landing in Conf 3*

ALTN LAW : PROT LOST
WHEN L/G DN : DIRECT LAW
CTR TK FUEL UNUSABLE
SLATS/FLAPS SLOW

INOP SYS

See below

INOP SYS displayed on ECAM

F/CTL PROT	SPLR 1 + 2 + 5	A/THR
REVERSER 1 + 2	ELAC 2	FUEL PUMPS
ADR 2 + 3	SEC 2 + 3	ANTI SKID
IR 2 + 3	A/CALL OUT	N.W. STEER
RA 1 + 2	AP 1 + 2	

For other systems' status : Refer to the "ELEC EMER CONFIG SYS REMAINING" table.

Note : For go-around procedure, refer to the ESS BUSES ON BAT procedure (see next page).

ELEC ESS BUSES ON BAT

R *DC ESS BUS is supplied by the batteries. AC ESS BUS is also supplied by the batteries, via*
R *the STATIC INVERTER.*

LAND ASAP

– MIN RAT SPD . . . . 140 KT
Displayed, if the RAT is extended.
– EMER ELEC PWR . . . . MAN ON
ESS BUSES are supplied by the emergency generator.

R

ELEC EMER CONFIG SYS REMAINING		EMER GEN RUNNING	BAT ONLY	
			IN FLIGHT	ON THE GROUND
AIR COND PRESS	PRESS AUTO SYS 1	Norm	Norm	Norm
	MAN PRESS CTL	Inop	Inop	Inop (1)
	RAM AIR	Norm	Norm	Norm
	PACK VALVE 1	Norm	Closure Inop	Closure Inop
	PACK VALVE 2	Closure Inop	Closure Inop	Closure Inop (1)
	AVIONIC VENT	Norm	Norm	Partial
	AFT CRG ISOL VALVES	Norm	Inop	Inop
APU	ECB-STARTER	Norm (3)	Inop	Inop (1)
	FUEL LP VALVE	Norm	Norm	Norm
	FUEL PUMP	Norm	Norm	Norm
COM	VHF 1	Norm	Norm	Norm
	RMP 1	Norm	Norm	Norm
	ACP (capt., F/O)	Norm	Norm	Norm
	CIDS	Norm	Norm	Norm
	INTERPHONE	Norm	Norm	Norm
	CVR	Norm	Inop	Inop
	LOUDSPEAKER 1	Norm	Norm	Norm
EIS	PFD 1	Norm	Norm	Norm (2)
	ND 1	Norm	Inop	Inop
	ECAM upper disp.	Norm	Norm	Norm (2)
	DMC 1 or 3	Norm	Norm	Norm (2)
	SDAC 1, FWC 1	Norm	Norm	Norm (2)
	ECAM cont. panel	Norm	Norm	Norm

(1) Restored, when the speed is below 100 knots.
(2) Lost, when the speed is below 50 knots.
(3) For APU start only.

ELEC EMER CONFIG SYS REMAINING CONT'D		EMER GEN RUNNING	BAT ONLY	
			IN FLIGHT	ON THE GROUND
EMER EQPT	CREW OXY	Norm	Norm (4)	Norm (4)
	PAX OXY mask release (auto + man)	Norm	Inop	Inop
	SLIDES ARM/WARN	Norm	Norm	Norm
FLT INS	CLOCKS	Norm	Norm	Norm
FIRE	ENG 1 LOOP	A only	A only	A only
	ENG 2 LOOP	B only	B only	B only
	APU LOOP	Inop	Inop	Inop (1)
	CARGO SMOKE DET	Channel 1	Inop	Inop
	ENG FIRE EXT.	Bottle 1 only	Bottle 1 only	Bottle 1 only
	APU FIRE EXT.	Squib A only	Squib A only	Squib A only
	CARGO FIRE EXT.	Inop	Inop	Inop (1)
	APU AUTO EXT.	Inop	Inop	Inop (1)
FLT CTL	ELAC	N°1 only	N°1 + 2	N°1 + 2 (3)
	SEC	N°1 only	N°1	N°1 (3)
	FCDC	N°1 only	Inop	Inop
	SFCC	N°1 only	N°1 only	N°1 only
	Flaps pos ind	Norm	Norm	Norm (2)
FMGS	FMGC (NAV FUNCTION)	N°1 only	Inop	Inop
	MCDU	N°1 only	Inop	Inop
	FAC	N°1 only	Inop	Inop
	FCU	ch 1 only	ch 1 only	ch 1 only
FUEL	LP VALVE	Norm	Norm	Norm
	FQI channel 1	Norm	Inop	Inop
	X FEED VALVE	Norm	Inop	Inop
	TRANSFER VALVE	Norm	Inop	Inop

(1) Restored, when the speed is below 100 knots.
R (2) Lost, when the speed is below 50 knots.
(3) Lost, 30 seconds after the last engine shutdown.
(4) Crew oxygen valve inoperative.

R

ELEC EMER CONFIG SYS REMAINING (cont'd)		EMER GEN RUNNING	BAT ONLY	
			IN FLIGHT	ON THE GROUND
HYD	FIRE VALVES	Norm	Norm	Norm
ICE-RAIN	WING A. ICE	Norm	Inop	Inop
	ENG A.ICE VALVE	OPEN	OPEN	OPEN
	CAPT PITOT	Norm	Norm	Norm (1)
	CAPT AOA	Norm	Inop	Inop
	RAIN REPELLENT (Capt)	Norm	Norm	Norm
L/G	LGCIU SYS 1	Norm	Norm	Norm
	BRK PRESS IND	Norm	Norm	Norm
	PARK BRK	Norm	Norm	Norm
LIGHTS	EMER CKPT	Norm	Norm	Norm
	EMER CAB	Norm	Norm	Norm
NAV	IR	N°1 only (2)	N°1 only (2)	N°1 only (2)
	ADR	N°1 only	N°1 only	N°1 only
	ADF ◁	N°1 only	Inop	Inop
	VOR/MMR	N°1 only	N°1 only	N°1 only (1)
	DME	N°1 only	Inop	Inop
	VOR/DDRMI	Norm	Norm	Norm (1)
	ATC	N°1 only	Inop	Inop
	STBY HORIZON	Norm	Norm	Norm
	STBY COMP (LT)	Norm	Norm	Norm
	STBY ALTI (VIB)	Norm	Inop	Inop

(1) lost when speed below 50 kt
(2) IR 2 and IR 3 are lost 5 minutes after failure of main generators but if IR 3 replaces IR 1 (ATT-HDG selector at CAPT 3), IR 3 remains supplied.

ELEC EMER CONFIG SYS REMAINING (cont'd)		EMER GEN RUNNING	BAT ONLY	
			IN FLIGHT	ON THE GROUND
PNEU	ENG 1 BLEED	Norm	BMC 1 inop	BMC 1 inop
	ENG 2 BLEED	BMC 2 inop	BMC 2 inop	BMC 2 inop
	APU BLEED	Inop	Inop	Inop (1)
	X BLEED (man ctl)	Norm	Inop	Inop
PWR PLT	FADEC	A + B (2)	A + B (2)	A + B (2)
	IGNITION	A only	A only	A only
	HP FUEL VALVE closure	Norm	Norm	Norm
MISC	MECH HORN	Norm	Norm	Norm

(1) restored when speed below 100 kt
(2) channels A and B self powered above 12 % N2. If N2 below 12 % only channel A is powered.

ELEC GEN 1(2) or APU GEN OVERLOAD

– GALLEY .... OFF

STATUS

INOP SYS
GALLEY

ELEC TR 1(2) or ESS TR FAULT

CAT 3 SINGLE (if TR2 FAULT)

STATUS

INOP SYS
ESS TR or TR1(2)
CAT 3 DUAL (if TR2 FAULT)

R

ELEC DC BAT BUS FAULT

Crew awareness

STATUS

APU BAT START NOT AVAIL
ECB is no longer supplied

INOP SYS
APU FIRE DET
See below

OTHER INOP SYS

APU ECB	Fwd (aft) cargo heat controller ◁*	APU fuel LP valve
Stick and rudder pedals lock (by AP)	Fwd cargo isol valves ◁*	Manual pressure control
Fwd (aft) cargo fire ext ◁*		

Note : The warning may be caused by a failure in a sub BUS. Consequently, only a part of the above-listed systems may be lost.

ELEC DC EMER CONFIG

LAND ASAP

Triggered if DC BUS 1, DC BUS 2 and DC ESS BUS are lost. In addition, DC BAT BUS is lost.

– EMER ELEC PWR . . . . MAN ON

Emergency generator supplies DC ESS BUS.
But DC BUS 1, DC BUS 2 and DC BAT BUS are still not supplied.

ELEC DC BUS 1 + 2 FAULT

– BLOWER . . . . OVRD
– EXTRACT . . . . OVRD
– BARO REF . . . . CHECK

Crosscheck the barometer reference settings on FCU and PFD's.

MAX BRK PR . . . . 1000 PSI

Brake pressure must be limited to approximately 1000 psi since antiskid is lost.

ELEC DC BAT BUS FAULT

Affected systems
* CAB PRESS
* HYD
* FUEL
* AIR COND
* BRAKES
* WHEEL
* F/CTL

STATUS

R MIN RAT SPEED . . . . 140 KT
R PROC : GRVTY FUEL FEEDING
R MAX BRK PR . . . . 1000 PSI
R FUEL GRVTY FEED
R LDG DIST PROC . . . . APPLY
R *Multiply the landing distance by 1.6.*
R *Ground spoilers 1 + 2 + 5 and antiskid are inoperative.*
R ENG 1 APPR IDLE ONLY
R ENG 2 APPR IDLE ONLY

ELEC DC EMER CONFIG (CONT'D)

STATUS

BOTH PFD ON SAME FAC
CTR TK ⋞ FUEL UNUSABLE
APU BAT START NOT AVAIL
CAB ZONE AT FIXED TEMP
PACKS AT FIXED TEMP
SLATS/FLAPS SLOW
CAT 2 ONLY

ELEC DC EMER CONFIG (CONT'D)

STATUS

INOP SYS
See below

INOP SYS displayed on ECAM

R	FCU 2	GALLEY FAN	SPLR 1 + 2 + 5
	CAT 3	CRG HEAT ◁	ELAC 2
	FAC 2	GND COOL ◁	SEC 2 + 3
	FUEL PUMPS	MAIN GALLEY	VHF 2
R	ANTI SKID	ACP 3	N.W. STEER
	Y ELEC PUMP	CAPT STAT	LGCIU 2
	BSCU CH 1	F/O STAT	REVERSER 2
R	BSCU CH 2	STBY STAT	CAB PRESS 2
	APU FIRE DET	WSHLD HEAT	AVNCS VENT
	LAV DET	WNDW HEAT	VENT BLOWER
R	ENG 1 LOOP B	PACK 1 REGUL	ENG 2 LOOP A
	L+R CAB FAN	PACK 2 REGUL	AP2
R	FCDC 2	GPS 1 + 2 ◁	

R *Note : To verify the other INOP SYS not displayed on the ECAM, refer to the DC BUS 1+2*
R *and DC BAT BUS procedures.*

ELEC STAT INV FAULT

Crew awareness.

ELEC EMER GEN 1 LINE OFF

With the GEN 1 LINE pushbutton (on EMER ELEC PWR panel) at the OFF position, GEN 1 line contactor is open and GEN 2 supplies the AC BUS 1 channel.

Crew awareness.

Select GEN 1 LINE pushbutton to ON.

C/B TRIPPED

If one green circuit breaker is tripped, one of the following warning messages appears after one minute, depending on the location of the affected C/B.

C/B TRIPPED ON OVHD PNL

C/B TRIPPED ON L(R) ELEC BAY

C/B TRIPPED REAR PNL J-M or N-R or S-V or W-Z

R *Note : Do not re-engage a circuit breaker that has tripped by itself, unless the Captain (using*
R *his/her emergency authority) judges it necessary for the safe continuation of the*
R *flight. This procedure should be adopted only as a last resort, and only one*
R *re-engagement should be attempted.*
R *On the ground, do not re-engage any wing tank fuel pump circuit breaker. For all other*
R *circuit breakers, if the flight crew coordinates the action with maintenance, they may*
R *re-engage a tripped C/B, provided the cause of the tripped C/B is identified.*

ENG 1(2)/APU FIRE LOOP A (B) FAULT

No crew action required in flight.

STATUS

INOP SYS

R ENG 1(2) LOOP A(B)
or APU LOOP A(B)

ENG 1(2)/APU FIRE DET FAULT

Loss of both fire detection loops.

Crew awareness.

STATUS

INOP SYS

FIRE DET 1(2)
or APU FIRE DET

ENG 1(2) FIRE (on ground)

R – THR LEVERS . . . . IDLE

Full reverse may be used to stop the aircraft.

- **WHEN A/C IS STOPPED** :
  - – PARKING BRK . . . . ON
  - – ENG MASTER (affected) . . . . OFF

    Associated LP and HP valves close.
  - – ENG FIRE P/B (affected) . . . . PUSH

    · Aural warning stops.

    · ENG FIRE pushbutton remains on, as long as a fire is detected.

    · FADEC is no longer supplied. So, the THR LEVERS .... IDLE line reappears, even if the thrust levers are at idle.
  - – AGENT 1 + 2 . . . . DISCH
  - – ENG MASTER (opposite side) . . . . OFF

  The following items are not displayed on the ECAM, if the APU is not running :
  - – ATC (VHF 1) . . . . NOTIFY

    Notify ATC of the nature of the emergency, and state intentions.

    Only VHF1 is available on batteries.
  - – CABIN CREW (PA) . . . . ALERT
  - **IF EVAC RQRD** :
    - – EVAC COMMAND . . . . ON
    - – APU MASTER SW . . . . OFF
    - – BAT 1 + 2 (if time permits before leaving aircraft) . . OFF

      Batteries are left ON, until leaving the aircraft, to ensure cabin communications.

      Note : Keep the batteries on, for at least 10 seconds after switching the 2nd ENG MASTER to OFF, to allow the fuel LP valves to close completely.

R

ENG 1(2) FIRE (in flight)

LAND ASAP

– THR LEVER (affected) . . . . IDLE
– ENG MASTER (affected) . . . . OFF
LP and HP valves close.
– ENG FIRE P/B (affected) . . . . PUSH
· Aural warning stops.
· ENG FIRE pushbutton remains on, as long as a fire is detected.
· FADEC is no longer supplied. So, the THR LEVER ... IDLE line reappears, even if the thrust lever is at idle.
– AGENT 1 AFT 10 S . . . . DISCH
The 10–second delay allows N1 to decrease, reducing nacelle ventilation, and thereby increasing the effect of the agent.
Automatic countdown on the ECAM.
– ATC . . . . NOTIFY
Notify ATC of the nature of the emergency, and state intentions

● **IF FIRE AFTER 30 S :**
– AGENT 2 . . . . DISCH
Discharge the second agent, if the fire warning remains 30 seconds after the discharge of the first agent.

ENG 1(2) **SHUTDOWN**

Do not attempt to restart the engine.
For the after ENG SHUTDOWN procedure, see the ENG section. (Refer to 3.02.70).

APU FIRE

LAND ASAP

– APU FIRE P/B . . . . PUSH
· APU LP valve closes.
· Aural warning stops.
· APU FIRE pushbutton remains on, as long as a fire is detected.
– AGENT AFT 10 S . . . . DISCH
The 10–second delay allows the airflow to decrease, which increases the effect of the agent.
Automatic countdown on the ECAM.
– MASTER SW . . . . OFF
Do not attempt to restart the APU.

STATUS

INOP SYS
APU

SMOKE/AVNCS SMOKE

This procedure is applicable in case of suspected smoke from the avionics compartment, air conditioning, or cabin equipment. The flight crew should apply this paper procedure, if smoke is detected with or without "AVIONICS SMOKE" ECAM activation.
This paper procedure includes all the steps of the AVIONICS SMOKE ECAM procedure. Therefore, if the ECAM procedure is displayed, it may be applied, if smoke from avionics is suspected. However, if non-avionics smoke is suspected, the flight crew will refer to the paper procedure.
The procedure layout is organized as follows :
- *The first lines (before the text box) correspond to immediate actions, which must be performed by the crew as soon as smoke is detected (with or without ECAM activation, whatever the smoke source). These immediate actions enable the crew to quickly refer to the steps, most commonly adopted in smoke-related cases.*
- *The text box indicates the immediate procedure to be applied by the crew when, at any time of the procedure, the smoke is so dense that they are no longer able to determine the smoke source and smoke removal is required.*
- *The last part of the procedure corresponds to specific actions to be applied by the crew, once the smoke source has been identified.*

In case of a CARGO or LAVATORY SMOKE ECAM warning, without any smoke detected in the cockpit/cabin, directly apply the CARGO or LAVATORY ECAM procedure. Note that these warnings may be caused by some other source, that should ordinarily, first be detected by the flight crew/avionics smoke detector.

LAND ASAP

● **IF PERCEPTIBLE SMOKE, APPLY IMMEDIATELY :**

If smoke is confirmed, the following procedure must be applied.
- OXY MASK/GOGGLE ON/100%/EMERG
  Ensure crew communication is established. Avoid continuous use of the interphone to minimize interference from the oxygen mask breathing noise.
  Turn the emergency knob to remove condensation or smoke from the mask.
- CAB FANS . . . . OFF
  To prevent smoke from entering the cockpit and cabin.
- BLOWER . . . . OVRD
- EXTRACT . . . . OVRD
  Avionics ventilation air is supplied by the air conditioning system and extracted overboard.
- GALLEY & CAB . . . . OFF
- FAULTY EQUIPT (if identified) . . . . ISOLATE

SMOKE/AVNCS SMOKE (CONT'D)

NFC5-03-0226-005-A100AA

● IF DENSE SMOKE, at any time of the procedure :
- DESCENT for smoke removal .... INITIATE
- SMOKE/TOXIC FUMES REMOVAL .... APPLY
- ELEC EMER CONFIG .... CONSIDER
  Refer to the end of the procedure to set ELEC EMER CONFIG.

Guidelines to determine smoke origin :
- *If smoke initially comes out of the cockpit's ventilation outlets, or if smoke is detected in the cabin following an engine or APU problem, the crew may suspect AIR COND SMOKE. In addition, very shortly after, several SMOKE warnings (cargo, lavatory, avionics) will be triggered. The displayed ECAM procedures must be applied.*
- *If only the AVIONICS SMOKE warning is triggered, the crew may suspect AVIONICS SMOKE.*
- *If the AVIONICS SMOKE warning is triggered while an equipment is declared faulty, the crew may suspect that smoke is coming from this equipment.*
- *Avionics or forward galley smoke may be smelt, or may enter in the cockpit before ECAM warning activation.*

■ **IF AIR COND SMOKE SUSPECTED :**
- APU BLEED .... OFF
- EXTRACT .... AUTO
- BLOWER .... AUTO

  Note : When both BLOWER and EXTRACT are in the OVRD position, a single pack may not be able to maintain the cabin pressure.
- PACK 1 .... OFF

● **If smoke persists :**
- PACK 1 .... ON
- PACK 2 .... OFF
- CRG FWD (AFT) ISOL VALVE ⊲* .... ON

  To prevent a cargo smoke warning from being triggered by smoke coming from the cabin.

● **If smoke still persists :**
- PACK 2 .... ON

  If the crew suspects that the smoke does not come from Pack 2, the normal pack configuration can be restored.
- EXTRACT .... OVRD
- BLOWER .... OVRD

- SMOKE/TOXIC FUMES REMOVAL .... CONSIDER

⇩

SMOKE/AVNCS SMOKE (CONT'D)

R ■ **IF CAB EQUIPMENT SMOKE SUSPECTED :**

● **If smoke persists :**

– EMER EXIT LIGHT . . . . ON
– BUS TIE . . . . OFF
– GEN 2 . . . . OFF

Loss of the ECAM lower display, and the F/O's PFD and ND.

● **If smoke still persists, or before L/G extension:**

– GEN 2 . . . . ON
– BUS TIE . . . . AUTO

All busbars recovered when GEN 2 restored. But, TR2 remains inop.

– SMOKE/TOXIC FUMES REMOVAL . . . . CONSIDER

● **IF AVIONICS SMOKE WARNING still persists after 5 min :**

– ELEC EMER CONFIG . . . . SET

● **IF SMOKE disappears within 5 minutes :**

– NORMAL VENTILATION . . . . RESTORE

To set EMER ELEC CONFIG :

– EMER ELEC GEN 1 LIN . . . . OFF

GEN 1 LINE contactor opens. GEN 1 remains running and supplies one fuel pump in each wing tank. AC BUS 1 is supplied by GEN 2 through the bus tie contactor.

– EMER ELEC PWR . . . . MAN ON

RAT is extended and the emer gen is connected to the aircraft network. Check emergency generator parameters on the ECAM ELEC page (displayed automatically).

● **WHEN EMER GEN AVAIL :**

– APU GEN . . . . OFF
– GEN 2 . . . . OFF

ELEC **EMER CONFIG**

MIN RAT SPEED . . . . 140 KT

Note : The electrical configuration is the same as for loss of both generators (except that one fuel pump in each wing tank remains supplied).

– VHF 1/HF1 (◁*)/ATC 1 . . . . USE

Only VHF 1, HF 1 ◁, and ATC 1 are supplied in this configuration. Notify the ATC of the nature of the emergency, and state intentions. If there is no contact with the ATC, switch to code A7700, or transmit a distress message on one of the following frequencies : VHF 121.5 MHz, HF 2182 kHz, or 8364 kHz.*

SMOKE/AVNCS SMOKE (CONT'D)

– FAC 1 . . . . OFF THEN ON

Rudder trim is recovered, despite the fact that no indication is available.

● **BEFORE L/G EXTENSION**

Restore normal electrical supply for landing.

– GEN 2 . . . . ON

– EMER ELEC GEN 1 LIN . . . . ON

F/CTL ALTN LAW

(PROT LOST)

Flight control normal laws and associated protections are lost. Only the load factor limitation, and the high and low speed stability remain (ALTN law with reduced protection).

R MAX SPEED . . . . 320 KT

STATUS

ECAM lower display is not available. STATUS page is displayed on the upper ECAM display, as long as the STATUS pushbutton is pressed.

MIN RAT SPEED . . . . 140 KT

MAX SPEED . . . . 320 KT

MAX BRK PR . . . . 1000 PSI

SMOKE/AVNCS SMOKE (CONT'D)

STATUS

– FOR LDG . . . . USE FLAPS 3
– GPWS LDG FLAP 3 . . . . ON
APPR SPD . . . . VREF + 10 KT
LDG DIST PROC . . . . APPLY
Multiply the landing distance by 1.9.
ENG 1 + 2 APPR IDLE ONLY
ENG 1 + 2 N1 DEGRADED MODE
(IAE powered aircraft ⊲*)
ALTN LAW : PROT LOST
WHEN L/G DN : DIRECT LAW
CTR TK (⊲*) FUEL UNUSABLE
INCREASED FUEL CONSUMP
SLATS/FLAPS SLOW
CAT 1 ONLY
APPR PROC

- **BEFORE L/G EXTENSION**
  – GEN 2 . . . . ON
  – EMER ELEC GEN 1 LINE . . . . . . ON
- **After recovery of normal electrical supply, the following STATUS will be displayed :**
  MIN RAT SPEED . . . . 140 KT
  It will disappear at landing gear extension.
  MAX SPEED . . . . 320 KT
  – FOR LDG . . . . USE FLAPS 3
  – GPWS LDG FLAP 3 . . . . ON
  Will be displayed when flaps in CONF3.
  APPR SPD . . . . VREF + 10 KT
  LDG DIST PROC . . . . APPLY
  Multiply the landing distance by 1.2.
  ALTN LAW : PROT LOST
  Flight controls remain in alternate law, due to the loss of IR 2 and 3.
  WHEN L/G DN : DIRECT LAW
  At landing gear extension, control reverts to direct law in pitch, as well as in roll (refer to the DIRECT LAW procedure 3.02.27).

INOP SYS

See ELEC EMER CONFIG SYS REMAINING, 3.02.24 (except for fuel pumps)

SMOKE/TOXIC FUMES REMOVAL

- *Use the smoke removal procedure if there is dense smoke, toxic fumes (smell), or if smoke generation cannot be stopped.*
  If a scent similar to orange peels pervades the cockpit, suspect a toxic leak of rain repellent fluid. If the scent is similar to pine needles, suspect a non-toxic leak ⊲.*
- *If there is smoke in the cabin, it may be necessary to make a PA announcement to minimize apprehension.*

– OXY MASK/GOGGLE . . . . ON/100 %/EMERG
Ensure crew communication is established. Avoid continuous use of the interphone to minimize interference from the oxygen mask breathing noise.
Turn the emergency knob to remove condensation or smoke from the mask.
– SEAT BELTS/NO SMOKING . . . . ON

● **If fuel vapors :**
– CAB FANS . . . . ON
The recirculating air ventilates the air mixer bay and other fuselage area, preventing fuel vapors from accumulating and the risk of explosion. Passenger health is not affected.
– PACK 1+2 . . . . OFF

R ● **If no fuel vapor :**
R – CAB FANS . . . . OFF
R *To prevent smoke from entering the cockpit and cabin.*
R – PACK FLOW . . . . HI
R *To provide maximum airflow from the packs.*
R *Do not shut down the air conditioning packs, and do not reduce ventilation in an*
R *attempt to smother the fire.*
R *Do not deploy oxygen masks, if fire is suspected in the cabin.*

– LDG ELEV . . . . 10000 FT/MEA
– DESCENT (FL 100 or MEA or minimum obstacle clearance altitude) . . . . INITIATE
Since the most effective means of smoke removal is use of the ram air, descent is initiated to FL100, or the MEA, or the minimum obstacle clearance altitude, while the cabin altitude is increased to 10000 feet or MEA.
The increase in cabin altitude also reduces, at least temporarily, the smoke concentration.
Cabin depressurization starts when descent is initiated.
Passenger oxygen, as required by regulation.
– ATC . . . . NOTIFY

⇩

SMOKE/TOXIC FUMES REMOVAL (CONT'D)

R ● **At FL100, or MEA :**
R – PACKS 1 + 2 . . . . OFF
R – MODE SEL . . . . MAN
R – MAN V/S CTL . . . . FULL UP
– RAM AIR . . . . ON

At FL100, or MEA, or minimum obstacle clearance altitude, it is possible to open the
R *RAM AIR valve when ΔP is 1 psi or below. Opening the RAM AIR allows flying with*
R *both packs OFF.*

● **If cockpit window opening is required :**

Unless smoke pervades the cockpit, do not open the cockpit window to evacuate the smoke.

MAX SPD . . . . 200 KT
– HEADSETS . . . . ON
– COCKPIT WINDOW . . . . OPEN

CAUTION
Due to the increased noise level, pay particular attention to visual warnings.

SMOKE FWD (AFT) CARGO SMOKE

LAND ASAP

Note : *If the warning has been displayed temporarily, and no crew action has been taken, normal cargo ventilation may be recovered when ventilation is required for livestock transportation :*

R *C/B of CARGO VENT controller (S20 on 122VU, or C7 on 49VU, as installed .... PULL then PUSH*

– AFT ISOL VALVE (if aft affected) .... OFF

If not automatically closed :

– AGENT .... DISCH

If the SMOKE warning is displayed on the ground with the cargo doors open, do not initiate AGENT DISCH. Request the ground crew to investigate and eliminate the smoke source.

Note : *Expect the SMOKE warning to remain after agent discharge, even if the smoke source is extinguished. Gases from the smoke source are not evacuated, and smoke detectors are also sensitive to the extinguishing agent.*
Order the ground crew not to open the door of the affected cargo compartment, unless the passengers have disembarked and fire services are present.

STATUS

INOP SYS
AFT CRG VENT
AFT CRG HEAT ⊲*
(if aft affected)

CARGO SMOKE FWD (AFT) BTL SQUIB FAULT

Crew awareness.

SMOKE FWD (AFT) CRG DET FAULT

● **IF NO LIVE STOCK :**

– AFT ISOL VALVE (if aft affected) .... OFF

STATUS

INOP SYS
FWD (AFT)
CRG DET

SMOKE LAV + CRG DET FAULT

Both SDCU channels fail. Cargo and toilet smoke detection are lost.

- **IF NO LIVE STOCK** :
  - AFT ISOL VALVE .... OFF

STATUS

INOP SYS

SDCU

SMOKE LAVATORY SMOKE

Crew awareness.

Maintain contact with the cabin crew to follow up on the status of the fire, and consider emergency descent and SMOKE/TOXIC FUMES REMOVAL.

SMOKE LAVATORY DET FAULT

Toilet smoke detection is lost.

Crew awareness.

STATUS

INOP SYS

LAV DET

F/CTL FLAPS FAULT/LOCKED

● **If flaps locked :**

– WING TIP BRK ON or ALIGNMENT FAULT

– MAX SPEED . . . . See page 3

Limit speed to the VFE corresponding to the next flap position.

– FLAPS LEVER (if flaps not locked) . . . . RECYCLE

● **If unsuccessful :**

See FCOM 3.02.10 for LANDING WITH SLATS OR FLAPS JAMMED.

The autopilot may be used down to 500 feet AGL. As it is not tuned for the abnormal configurations, its behaviour can be less than optimum and must be monitored.

STATUS

APPR PROC

– FOR LDG (if flaps ≤ 3) . . . USE FLAP 3

Do not select CONF FULL so as not to degrade handling qualities.

– FLAPS (if flaps>3) .. KEEP CONF FULL

– GPWS FLAP MODE (if flaps < 3) . OFF

– GPWS LDG FLAP 3 (if flaps ≥ 3) . . ON

APPR SPD . . . . See page 3

LDG DIST PROC (see page 3) . . . . APPLY

Landing distance increases due to increase in approach speed.

ENG 1 APPR IDLE ONLY (only in case of FLAPS FAULT)

ENG 2 APPR IDLE ONLY (only in case of FLAPS FAULT)

INCREASED FUEL CONSUMP (see page 3)

CAT 1 ONLY (a)

INOP SYS

FLAPS

AP 1+2 (a)

A/THR (a)

Moreover, both FDs are lost (a)

(a) If both flap channels fault.

F/CTL SLATS FAULT/LOCKED

– WING TIP BRK ON (if slats locked)
– MAX SPEED . . . . See page 3
Speed is limited to the VFE corresponding to the next slat position.
– FLAPS LEVER (if slats not locked) . . . . RECYCLE

● **If unsuccessful :**
See FCOM 3.02.10 for LANDING WITH SLATS OR FLAPS JAMMED.
The autopilot may be used down to 500 feet AGL. As it is not tuned for the abnormal configurations, its behavior could be less than optimum and must be monitored.
Note : 1. If there is a SLATS FAULT after both slat channels fail, alternate law becomes active (see associated procedure).
R R *2. If the slats are locked in clean configuration (<18°), alternate law without protection is selected.*

● **If slats not at zero :**
– FUEL MODE SEL . . . . MAN
To allow CTR TK feeding.
– CTR TK PUMPS . . . . AS RQRD
Set CTR TK PUMPS to OFF when CTR TK is empty or during approach.

STATUS

R APPR PROC	INOP SYS
– FOR LDG . . . . USE FLAP 3	F/CTL PROT (a)
Do not select CONF FULL, so as not to degrade handling qualities.	SLATS
– CTR TK PUMPS . . . . OFF	AP 1 + 2 (a)
– GPWS LDG FLAP 3 . . . . ON	A/THR (a)
APPR SPD . . . . See page 3	Moreover, both FDs are lost (a).
LDG DIST PROC (see page 3) . . . . APPLY	
Landing distance increases due to an increase in approach speed.	
CTR TK FEED : MAN ONLY	
● **If both slat channels fail or slats are locked in clean configuration :**	
ALTN LAW : PROT LOST	
WHEN L/G DN : DIRECT LAW	
INCREASED FUEL CONSUMP (see page 3)	
CAT 1 ONLY (a)	

(a) If both slat channels fail.

R

FLAPS/SLATS FAULT/LOCKED

<table>
<tr><th colspan="6">MAX SPEED</th></tr>
<tr><th>Flaps (1)
Slats (1)</th><th>F = 0</th><th>0 < F ≤ 1</th><th>1 < F ≤ 2</th><th>2 < F ≤ 3</th><th>F > 3</th></tr>
<tr><td>S = 0</td><td>NO LIMITATION</td><td rowspan="2">215 kt</td><td rowspan="3">200 kt</td><td rowspan="3">185 kt</td><td rowspan="2">Not allowed
(177 kt)</td></tr>
<tr><td>0 < S ≤ 1</td><td>230 kt</td></tr>
<tr><td>1 < S ≤ 3</td><td colspan="2">200 kt</td><td></td></tr>
<tr><td>S > 3</td><td colspan="5">177 kt</td></tr>
</table>

<table>
<tr><th colspan="6">APPR SPD and LDG DIST</th></tr>
<tr><th>Flaps (1)
Slats (1)</th><th>F = 0</th><th>0 < F < 1</th><th>1 ≤ F < 2</th><th>2 ≤ F < 3</th><th>F ≥ 3</th></tr>
<tr><td>S = 0</td><td>VREF + 60 (Appr)
VREF + 50
(Touch Down)
DIST × 1.7</td><td></td><td rowspan="2">VREF + 30
DIST × 1.4</td><td rowspan="2">VREF + 25
DIST × 1.35</td><td rowspan="2">(FLAPS > 3
not
allowed)
VREF + 25
DIST × 1.35</td></tr>
<tr><td>0 < S < 1</td><td colspan="2">VREF + 45
DIST × 1.6</td></tr>
<tr><td>1 ≤ S ≤ 3</td><td colspan="2" rowspan="2">VREF + 25
DIST × 1.35</td><td rowspan="2">VREF + 15
DIST × 1.2</td><td rowspan="2">VREF + 10
DIST × 1.15</td><td>VREF + 10
(2)
DIST × 1.15</td></tr>
<tr><td>S > 3</td><td>VREF + 5
DIST × 1.1</td></tr>
</table>

(1) Slats/Flaps position displayed on upper ECAM display
(2) VREF + 5 if slats are in CONF 3

CAUTION

For flight with SLATS or FLAPS extended, fuel consumption is increased. Refer to fuel flow indication.
As a guideline, determine the fuel consumption in clean configuration at same altitude without airspeed limitation (e.g. from ALTERNATE FLIGHT PLANNING tables) and multiply this result by 1.6 (SLATS EXTENDED) or 1.8 (FLAPS EXTENDED) or 2 (SLATS and FLAPS EXTENDED) to give the fuel consumption required to reach the destination in the current configuration.

SLATS and FLAPS FAULT in conf 0

– FLAPS LEVER . . . . RECYCLE

● **If both slat channels fail :**

F/CTL ALTN LAW

(PROT LOST)
MAX SPEED . . . . 320 KT

STATUS

APPR PROC

R – FOR LDG . . . . USE FLAP 1

With FLAPS lever set at 1, AP/FD GO AROUND mode is available.

– CTR TK PUMPS . . . . OFF

– GPWS FLAP MODE . . . . OFF

APPR SPD . . . . VREF + 60 KT

Approach with A/THR in selected mode is recommended.

● **If both slat channels fail :**

ALTN LAW : PROT LOST
WHEN L/G DN : DIRECT LAW

● **AT 300 FT AGL :**

TARGET SPD . . . . VREF + 50

Reduce speed between 500 and 300 feet to reach VREF + 50 knots at runway threshold and disconnect A/THR, as the target speed may be below VLS.

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.7 due to an increase in approach speed.

ENG 1 APPR IDLE ONLY (b)
ENG 2 APPR IDLE ONLY (b)
INCREASED FUEL CONSUMP
CAT 1 ONLY (a)

INOP SYS

F/CTL PROT (c)
SLATS
FLAPS
AP 1 + 2 (a)
A/THR (a)
Moreover, both FDs are lost (a)

(a) If both slat or flap channels fail.
(b) only in case of FLAPS FAULT.
R (c) If both slat channels fail.

CONFIG SLATS (FLAPS) NOT IN T.O CONFIG

Crew awareness.

F/CTL SLAT SYS 1(2) FAULT

Crew awareness

STATUS

SLATS SLOW

F/CTL FLAP SYS 1(2) FAULT

● **If FLAP sys 1 fault**
– GPWS FLAP MODE . . . . OFF

STATUS

ENG 1(2) APPR IDLE ONLY
FLAPS SLOW

F/CTL SLAT (FLAP) TIP BRK FAULT

Failure of one slat or flap wingtip brake.
Crew awareness

F/CTL L (R) SIDESTICK FAULT

Crew awareness

F/CTL FLAP ATTACH SENSOR

Failure of flap attachment failure detection sensor.
Crew awareness

F/CTL ELAC 1 (2) FAULT

■ **One computer failed :**

CAUTION
Do not reset ELAC, if uncommanded maneuvers occurred during the flight.

– ELAC (affected) . . . . OFF THEN ON

Note : 1. In some sidestick transducer failure cases, ELAC 1(2) FAULT is triggered without the proc., and FAULT lt on associated pb does not come on.
2. ELAC FAULT may be triggered during engine start, due to the electrical transient. To recover the affected ELAC on the ground, if the reset was unsuccessful, switch OFF the G, Y and B HYD PUMPS (PARKING BRK ON), wait 1minute, then reset the ELAC pushbutton. After 8 seconds (end of power up test indicated by the disappearance of the ELAC FAULT warning), switch the G, Y and B HYD PUMPS to ON/AUTO.
R *3. If the ELAC 1 computer is reset on ground, the pitch trim returns to the*
R *ground setting position (0°).*

● **IF UNSUCCESSFUL :**

– ELAC (affected) . . . . OFF

Functions are performed by the other ELAC. LAF is degraded (A320 with LAF only).

STATUS

CAT 3 SINGLE ONLY

INOP SYS
ELAC 1(2)
CAT 3 DUAL

■ **Both computers failed :**

– ELAC 1 . . . . OFF THEN ON

R *Note : If the ELAC 1 computer is reset on ground, the pitch trim returns to the ground*
R *setting position (0°).*

– ELAC 2 . . . . OFF THEN ON

● **If both ELAC FAULT remain :**

– ELAC 1 . . . . OFF
– ELAC 2 . . . . OFF

F/CTL ALTN LAW

(PROT LOST)

Pitch and roll normal laws are lost : Refer to F/CTL ALTN LAW procedure. THS motor 1 and both ailerons are lost. LAF is degraded and uses spoilers only (A320 only).

MAX SPEED . . . . 320 KT

F/CTL ELAC 1 (2) FAULT (CONT'D)

STATUS

MAX SPEED . . . . 320 KT
APPR PROC
– FOR LDG . . . . USE FLAP 3
Do not select CONF FULL so as not to degrade handling qualities.
– GPWS LDG FLAP 3 . . . . ON
Will be displayed when flaps in CONF 3
APPR SPD . . . . VREF + 10 KT
LDG DIST PROC . . . . APPLY
Multiply the landing distance by 1.2.
ALTN LAW : PROT LOST
WHEN L/G DOWN : DIRECT LAW
At landing gear extension, control reverts to direct law in pitch as well as in roll (Refer to DIRECT LAW procedure).
CAT 1 ONLY

INOP SYS
F/CTL PROT
L + R AIL
ELAC 1 + 2
AP 1 + 2

F/CTL ELAC 1(2) PITCH FAULT

Crew awareness
Pitch function is achieved by the other ELAC.

STATUS

CAT 3 SINGLE ONLY

INOP SYS
ELAC PITCH (if ELAC 1 and 2 PITCH FAULT)
CAT 3 DUAL

F/CTL SEC 1 (2)(3) FAULT

– SEC (affected) . . . . OFF THEN ON

● **IF UNSUCCESSFUL** :

– SEC (affected) . . . . OFF

Associated spoilers are lost.

If all spoilers are inoperative (3 SECs failed), roll direct law and pitch alternate law become active.

– SPD BRK (if SEC 1 affected) . . . . DO NOT USE

VLS would not be corrected, if speedbrakes 2 extend (no speedbrake position sent to FACs).

F/CTL ALTN LAW (b)

(PROT LOST) (b)

STATUS

– SPD BRK . . . . DO NOT USE

(If SEC 1 is affected).

– FOR LDG . . . . USE FLAP 3 (b)

APPR SPD . . . . VREF + 10 (b)

LDG DIST PROC . . . . APPLY

(Not displayed, if only SEC 2 is affected).

SEC 1 or 3 . . . . X 1.1

R SEC 1 + 2 or 2 + 3 . . . . X 1.1

R SEC 1 + 3 . . . . X 1.2

SEC 1 + 2 + 3 . . . . X 1.4

ALTN LAW : PROT LOST(b)

WHEN L/G DN : DIRECT LAW (b)

INOP SYS

F/CTL PROT (b)
SPLR (associated)
SEC (affected)
REVERSER 1(2)(a)

(a) If at least 2 SECs fail, the autobrake is lost.
If SEC 1 + 2 fail, reverser 1 is not available for landing.
If SEC 1 + 3 fail, reverser 2 is not available for landing.

(b) If SEC 1 + 2 + 3 fail.

CONFIG SPD BRK NOT RETRACTED

Crew awareness

F/CTL DIRECT LAW

PFD displays « USE MAN PITCH TRIM » in amber. See FCOM 3.04.27 for flight characteristics.

(PROT LOST)

R *Note : In case of GPWS (EGPWS ⊲*) alerts, since protections are lost respect stall warning*
R *when applying the GPWS (EGPWS ⊲*) procedure.*

MAX SPEED 320/.77

Speed is limited due to the loss of high-speed protection. Do not exceed M .77 so as not to degrade handling qualities.

– MAN PITCH TRIM (except if HYD Y + G SYS LO PR) . . . USE

Automatic trim is inoperative in direct law.

MANEUVER WITH CARE

R *Use small control inputs at high speed, since in direct law the controls are powerful. Use of*
R *manual thrust is recommended. Avoid large thrust changes.*

USE SPD BRK WITH CARE

At high Mach numbers use speedbrakes with care to avoid too strong nose up changes.

STATUS

MAX SPEED 320/.77
MANEUVER WITH CARE
USE SPD BRK WITH CARE
APPR PROC
– FOR LDG . . . . USE FLAPS 3
– GPWS LDG FLAP 3 . . . . ON
MAN PITCH TRIM . . . . USE
APPR SPD . . . . VREF + 10
LDG DIST PROC . . . . APPLY
Multiply the landing distance by 1.2
DIRECT LAW

INOP SYS
F/CTL PROT

CONFIG L (R) SIDESTICK FAULT

BY TAKE OVER

The warning is triggered when on the ground if either stick is inoperative (takeover pushbutton pressed more than 30 seconds).

– L (R) TAKEOVER . . . . DEPRESS

The affected stick becomes operative.

CONFIG PITCH TRIM NOT IN T.O RANGE

Crew awareness

F/CTL ALTN LAW

See FCOM 3.04.27 for flight characteristics.
With autopilot engaged, the FMGC (AP mode) controls the aircraft.
(PROT LOST)
All protections, except maneuver protections, are lost.
Depending on the failure, static stability may be introduced.
Note : In case of GPWS (EGPWS ⊲) alerts, since protections are lost, respect stall warnings when applying the GPWS (EGPWS ⊲) procedure.

MAX SPEED . . . . 320 KT
(320/.77 if dual hydraulic system low pressure).
Speed is limited to 320/.82 or 320/.77 for dual hydraulic failure due to the loss of high-speed protection.
– SPD BRK (if L or R elevator fault) . . . . DO NOT USE

STATUS

MAX SPEED . . . . 320 KT
(320/.77 if dual hydraulic system low pressure).
– SPD BRK (if L or R elevator fault) . . . DO NOT USE
APPR PROC
– FOR LDG . . . . USE FLAP 3
– GPWS LDG FLAP 3 . . . . ON
APPR SPD . . . . VREF + 10
LDG DIST PROC . . . . APPLY
Multiply the landing distance by 1.2.

● **if no AP engaged :**
WHEN L/G DN : DIRECT LAW
At landing gear extension, control reverts to direct law in pitch as well as in roll.
See DIRECT LAW procedure.

● **if AP engaged :**
WHEN L/G DN AND AP OFF : DIRECT LAW
If autopilot is disengaged :
– Before landing gear extension, flight control alternate law is active.
– After landing gear extension, flight control direct law is active.
See DIRECT LAW procedure.

ALTN LAW : PROT LOST

INOP SYS
F/CTL PROT

CONFIG RUD TRIM NOT IN T.O RANGE

Crew awareness.

F/CTL FCDC FAULT

■ **FCDC 1(2) FAULT :**

Crew awareness

STATUS

INOP SYS
FCDC 1(2)

■ **FCDC 1 + 2 FAULT :**

– MONITOR F/CTL OVHD PNL

F/CTL data on the ECAM is lost.
Control laws remain normal.
Note : When both FCDCs fail :
- *F/CTL warnings are not available on the ECAM.*
- *Stall warning may be triggered as in alternate or direct law (it may occur at speeds greater than Vα max).*
- *Bank and pitch limits are no longer displayed on the PFD.*
- *Vα prot, Vα max are lost on the PFD.*
- *Vsw, displayed on the PFD, corresponds to the stall warning of the alternate and direct law.*

STATUS

F/CTL INDICATIONS LOST

INOP SYS
FCDC 1 + 2

F/CTL AIL SERVO FAULT

Crew awareness

LAF is degraded (A320 only).

F/CTL L (R) AIL FAULT

Crew awareness

LAF is degraded and uses spoilers only (A320 only).

STATUS

R *Note : With one or both aileron fault(s), fuel consumption*
R *increases by approximately 6 %.*

INOP SYS
L (R) AIL

F/CTL L + R ELEV FAULT

MAX SPEED 320/.77
Due to loss of high speed protections.
– MAN PITCH TRIM .... USE
Only manual trim is available for pitch control.
– SPD BRK .... DO NOT USE
Do not use speedbrakes, because it is difficult to control the induced pitch moment with manual pitch trim only.

STATUS

MAX SPEED 320/.77
SPD BRK .... DO NOT USE
APPR PROC
R – LDG CONF 3 .... USE FLAP 3
R *Do not select CONF FULL so as not to degrade handling qualities.*
– GPWS LDG FLAP 3 .... ON
Will be displayed when flaps in CONF 3.
– MAN PITCH TRIM .... USE
APPR SPD .... VREF + 10
LDG DIST PROC .... APPLY
Multiply the landing distance by 1.2 due to the increase in approach speed.
PITCH MECH BACK UP
ROLL DIRECT LAW
CAT 1 ONLY

INOP SYS
L + R ELEV
ELAC PITCH
LAF (A320 with LAF only)
AP 1 + 2

F/CTL ELEV SERVO FAULT

Crew awareness
The remaining servojack controls the elevator.

CAUTION
Do not use speedbrakes above 350 KT/M 0.82 (VMO/MMO).

STATUS

CAT 3 SINGLE ONLY

INOP SYS
CAT 3 DUAL

F/CTL L (R) ELEV FAULT

F/CTL ALTN LAW (PROT LOST)

Note : If the L(R) elevator fails, the ELACs loose pitch control through the elevator. Therefore the SECs control pitch in alternate law. This is not the case if the right elevator is lost due to the failure of B+Y hydraulic circuits. Pitch normal law remains active in ELAC.

MAX SPEED .... 320 KT

Speed is limited because of the loss of high-speed protection.

– SPD BRK .... DO NOT USE

STATUS

MAX SPEED .... 320 KT
SPD BRK .... DO NOT USE
APPR PROC
- FOR LDG .... USE FLAP 3
  Do not select CONF FULL so as not to degrade handling qualities.
- GPWS LDG FLAP 3 .... ON
  Will be displayed when flaps in CONF 3.

APPR SPD .... VREF + 15 KT
LDG DIST PROC .... APPLY
Multiply the landing distance by 1.2.
ALTN LAW : PROT LOST
WHEN L/G DN : DIRECT LAW
At landing gear extension, control reverts to direct law in pitch as well as in roll. Refer to DIRECT LAW procedure.
CAT 1 ONLY

INOP SYS
F/CTL PROT
L (R) ELEV
ELAC PITCH
AP 1 + 2

F/CTL SPLR FAULT

Loss of one or more spoilers.

R *Note : If heavy vibrations are felt, CONF 3 may be used for landing in order to reduce the*
R *buffeting.*

– SPD BRK (if spoilers 3 + 4 affected) .... DO NOT USE

Do not use speedbrakes since using only surfaces n° 2 is not efficient and would activate the SPD BRK DISAGREE caution.

STATUS

● **if spoilers 3 + 4 affected**
- SPD BRK .... DO NOT USE

LDG DIST PROC .... APPLY
See GND SPLR FAULT below.

INOP SYS
SPLR (affected)
SPD BRK (if spoilers 2 + 3 + 4 affected)

F/CTL GND SPLR / 1 + 2 / 3 + 4 / FAULT

Crew awareness

- **GND SPLR FAULT** :

  Loss of ground spoiler function in SEC 1 + 3 or 1 + 2 or 2 + 3 or 1 + 2 + 3.

- **GND SPLR 1 + 2 (3 + 4) FAULT** :

  Loss of ground spoiler function in SEC 3 (or 1).

STATUS

LDG DIST PROC . . . . APPLY *Mutilply the landing distance by :* *1.1 if one (except N° 5) or two spoilers are affected.* *1.2 if three or more spoilers are affected.*	INOP SYS GND SPLR (affected)

F/CTL SPD BRK DISAGREE

■ **Surfaces 3 + 4 affected**

Surfaces position not in agreement with handle position.

– SPD BRK LEVER . . . . RETRACT
– SPD BRK . . . . DO NOT USE

STATUS

– SPD BRK . . . . DO NOT USE	INOP SYS SPD BRK 3 + 4

■ **Surfaces 2 + 3 + 4 affected** :

After automatic retraction (due to activation of alpha protection or slats/flaps in configuration FULL), surface position is not in agreement with handle position.

– SPD BRK LEVER . . . . RETRACT

F/CTL SPD BRK FAULT or SPD BRK 2 (3 + 4) FAULT

Loss of speedbrake surfaces, due to failure of speedbrake lever transducer(s). In addition, associated ground spoilers are available only through reverse selection.

– SPD BRK (if SPD BRK 3 + 4 affected) . . . . DO NOT USE

Do not use speedbrakes since using only surfaces n° 2 is not efficient and would activate the SPD BRK DISAGREE caution.

STATUS

R LDG DIST PROC . . . . APPLY

If reversers are not used, multiply the landing distance by
1.1 if speedbrake 2 (3 + 4) are affected,
1.2 if all speedbrakes are affected.

INOP SYS

SPD BRK
(affected)

F/CTL SIDESTICK PRIORITY

A failure is detected in the sidestick priority logic circuit.

– CHECK PRIORITY LOGIC

Check the integrity of flight control priority, as follows (not displayed on ECAM) :

– ELAC 1 . . . . OFF THEN ON

R *Note : When the ELAC 1 computer is reset on ground, the pitch trim returns to the*
R *ground setting position (0°).*

– ELAC 2 . . . . OFF THEN ON

● **If the warning disappears :**

– CAPT TAKE OVER pb . . . . PRESS (at least 3 seconds)

Check that the :

– Aural "priority left" message is activated.

– F/O red arrow light is on.

– CAPT TAKE OVER pb . . . . RELEASE

– F/O TAKE OVER pb . . . . PRESS (at least 3 seconds)

Check that the :

– Aural "priority right" message is activated

– CAPT red arrow light is on.

– F/O TAKE OVER pb . . . . RELEASE

– Check that the warning does not reappear.

Note : There is no need to move the sidestick for the check.

● **If the warning does not disappear, or if the warning reappears after the above check :**

Maintenance action is due.

F/CTL STABILIZER JAM

When the ELACs detect a stabilizer jam, the pitch control law reverts to alternate law.

– MAN PITCH TRIM . . . . CHECK

The force needed on the PITCH TRIM wheel may be higher than during pre-takeoff manual setting.

● **IF MAN TRIM AVAIL** :

– TRIM FOR NEUTRAL ELEV

If manual pitch trim is available, trim to maintain the elevator at the zero position (indications on ECAM F/CTL page).

F/CTL ALTN LAW

(PROT LOST)
MAX SPEED . . . . 320 KT

STATUS

APPR PROC :

– FOR LDG . . . . USE FLAP 3

Do not select configuration FULL so as not to degrade the handling qualities.

– GPWS LDG FLAP 3 . . . . ON

Will be displayed when flaps in CONF 3

● **IF MAN TRIM NOT AVAIL** :

● **WHEN CONF 3 AND VAPP** :

– L/G . . . . DN

Landing gear extension is delayed in order to delay the switching to direct law.

APPR SPD : . . . . VREF + 10 KT
LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.2.

ALTN LAW : PROT LOST
WHEN L/G DN : DIRECT LAW

At landing gear extension, control reverts to direct law in pitch as well as in roll. Refer to DIRECT LAW procedure.

CAT 1 ONLY

INOP SYS

F/CTL PROT
STABILIZER
ELAC PITCH
AP 1 + 2

R
STABILIZER JAM

R *The ELACs may not detect a stabilizer jam when the pitch trim wheel is jammed.*
R *The flight control normal law remains active in this case and there is no ECAM warning.*
R *Apply the following procedure.*
R – AP . . . . OFF
R – MAN PITCH TRIM . . . . CHECK
R *The pitch trim wheel may not be fully jammed, the force needed may be higher than*
R *pre-takeoff manual setting.*
R ● **IF MAN TRIM AVAIL** :
R – TRIM FOR NEUTRAL ELEV
R *If manual pitch trim is available, trim to maintain the elevator at the zero position*
R *(indications on ECAM F/CTL page).*
R <u>APPR PROC</u>
R ● **IF MAN TRIM NOT AVAIL** :
R – FOR LDG . . . . USE FLAP 3
R *Do not select configuration full so as not to degrade the handling qualities.*
R – GPWS LDG FLAP 3 . . . . ON
R CAT 1 ONLY

F/CTL RUDDER JAM

Rudder jamming may be detected by undue (and adverse) pedal movement during rolling maneuvers.
This is because the yaw damper orders can no longer be sent to the rudder, but are fed back to the pedals.
Use ECAM F/CTL page for a visual check of the rudder position.

FOR APPROACH

- AVOID LANDING WITH CROSSWIND from the side where the rudder is deflected.
- MAX CROSSWIND 15 KT
- FOR LDG . . . . USE NORMAL CONF
- SPEED AND TRAJECTORY . . . . STABILIZE ASAP

ON GROUND

- DIFFERENTIAL BRAKING . . . . USE ASAP

  Do not use asymmetric reverse thrust.
  Use nosewheel steering handle below 70 knots.

R

ACTIVE CONTROL LAW

ACTIVE LAW ▶ / SYS FAILED ▼	PITCH LAW	PITCH PROTEC	ROLL	YAW
ELAC 1 or 2 or SEC 1 or 2	NORM	NORM	NORM	NORM
ELAC 1 and 2 or both ailerons	ALTN	REDUCED	DIRECT	ALTN
2 SEC	NORM	NORM	NORM	NORM
3 SEC	ALTN	REDUCED	DIRECT	ALTN
2 FAC	ALTN	REDUCED	DIRECT	MECH
Yaw damper	ALTN	REDUCED	DIRECT	MECH
2 SFCC (slat channel)	ALTN	NO	DIRECT	ALTN
2 ADR or 2 IR (2nd self detected)	ALTN	REDUCED	DIRECT	ALTN
2 ADR (2nd not self detec.)	ALTN	NO – – – – – REDUCED (1)	DIRECT	ALTN
2 IR (2nd not self detec.)	DIRECT – – – – – ALTN (2)	NO – – – – – REDUCED (2)	DIRECT	MECH – – – – – ALTN
3 ADR	ALTN	NO	DIRECT	MECH
3 IR	DIRECT	NO	DIRECT	MECH
2 RADIO ALT	NORM – – – – – DIRECT (4)	NORM – – – – – NO (4)	NORM – – – – – DIRECT (4)	NORM – – – – – MECH (4)
SPOILER 4 or 5 or (4 and 5)	NORM	NORM	NORM	NORM
All SPOILERS	ALTN	REDUCED	DIRECT	ALTN
1 AIL SERVO or 1 AILERON	NORM	NORM	NORM	NORM
1 ELEV SERVO	NORM	NORM	NORM	NORM
1 ELEVATOR	ALTN	NO	DIRECT	ALTN
THS (jammed) (5)	NORM	NORM	NORM	NORM
	ALTN	REDUCED	DIRECT	ALTN
HYD G or Y or B	NORM	NORM	NORM	NORM
HYD G + Y	ALTN	REDUCED	DIRECT	MECH
HYD G + B	ALTN	REDUCED	DIRECT	ALTN
HYD Y + B	NORM	NORM	NORM	NORM
on BATTERIES	ALTN	REDUCED	DIRECT	MECH
on EMER GEN	ALTN	REDUCED	DIRECT	MECH – – – – – ALTN (3)

(1) in case of AOA disagree.
(2) after the faulty IR is selected off.
(3) after FAC 1 is reset.
(4) when landing gear down (or CONF 2 if both LGCIUs faulty).
(5) depending where the failure is, control law may revert to alternate law.

ELEVATORS AND STABILIZER CONTROL AFTER FAILURE

	LEFT ELEVATOR		THS	RIGHT ELEVATOR	
	BLUE	GREEN	GREEN AND YELLOW	YELLOW	BLUE
NORM OPERATION		ELAC2	ELAC2	ELAC2	
SINGLE FAILURE					
ELAC2	ELAC1		ELAC1		ELAC1
ELAC1		ELAC2	ELAC2	ELAC2	
SEC2		ELAC2	ELAC2	ELAC2	
SEC1		ELAC2	ELAC2	ELAC2	
G	ELAC1		ELAC1		ELAC1
Y	ELAC1		ELAC1		ELAC1
B		ELAC2	ELAC2	ELAC2	
DOUBLE FAILURE					
ELAC2 + ELAC1		SEC2	SEC2	SEC2	
+ SEC2	ELAC1		ELAC1		ELAC1
+ SEC1	ELAC1		ELAC1		ELAC1
+ G	ELAC1		ELAC1		ELAC1
+ Y	ELAC1		ELAC1		ELAC1
+ B		SEC2	SEC2	SEC2	
ELAC1 + SEC2		ELAC2	ELAC2	ELAC2	
+ SEC1		ELAC2	ELAC2	ELAC2	
+ G	SEC1		SEC2	SEC2	
+ Y		SEC2	SEC2		SEC1
+ B		ELAC2	ELAC2	ELAC2	
SEC2 + SEC1		ELAC2	ELAC2	ELAC2	
+ G	ELAC1		ELAC1		ELAC1
+ Y	ELAC1		ELAC1		ELAC1
+ B		ELAC2	ELAC2	ELAC2	
SEC1 + G	ELAC1		ELAC1		ELAC1
+ Y	ELAC1		ELAC1		ELAC1
+ B		ELAC2	ELAC2	ELAC2	
G + Y	ELAC1		inop		ELAC1
B + G	Damped		ELAC2	ELAC2	
B + Y		ELAC2	ELAC2	Damped	

R

	LEFT ELEVATOR		THS	RIGHT ELEVATOR	
	BLUE	GREEN	GREEN AND YELLOW	YELLOW	BLUE
TRIPLE FAILURE					
ELAC2					
ELAC1 + SEC2	SEC1		SEC1		SEC1
+ SEC1		SEC2	SEC2	SEC2	
+ G	SEC1		SEC2	SEC2	
+ Y		SEC2	SEC2		SEC1
+ B		SEC2	SEC2	SEC2	
SEC2 + SEC1	ELAC1		ELAC1		ELAC1
+ G	ELAC1		ELAC1		ELAC1
+ Y	ELAC1		ELAC1		ELAC1
+ B	Centered		Mechanical	Centered	
SEC1 + G	ELAC1		ELAC1		ELAC1
+ Y	ELAC1		ELAC1		ELAC1
+ B		SEC2	SEC2	SEC2	
G + Y	ELAC1		inop		ELAC1
B + G	Damped		SEC2	SEC2	
B + Y		SEC2	SEC2	Damped	
ELAC1					
SEC2 + SEC1		ELAC2	ELAC2	ELAC2	
+ G	SEC1		SEC1		SEC1
+ Y	SEC1		SEC1		SEC1
+ B		ELAC2	ELAC2	ELAC2	
SEC1 + G	Damped		SEC2	SEC2	
+ Y		SEC2	SEC2	Damped	
+ B		ELAC2	ELAC2	ELAC2	
G + Y	SEC1		inop		SEC1
B + G	Damped		ELAC2	ELAC2	
B + Y		ELAC2	ELAC2	Damped	
SEC2					
SEC1 + G	ELAC1		ELAC1		ELAC1
+ Y	ELAC1		ELAC1		ELAC1
+ B		ELAC2	ELAC2	ELAC2	
G + Y	ELAC1		inop		ELAC1
B + G	Damped		ELAC2	ELAC2	
B + Y		ELAC2	ELAC2	Damped	
SEC1					
G + Y	ELAC1		inop		ELAC1
B + G	Damped		ELAC2	ELAC2	
B + Y		ELAC2	ELAC2	Damped	

FUEL L (R) TK PUMP 1 + 2 LO PR

■ **Center tank not empty** :

- FUEL MODE SEL (if CTR TK not feeding) . . . . MAN
  Setting FUEL MODE SEL to MAN will allow center tank pumps to run.
- TK PUMP 1 (affected) . . . . OFF
- TK PUMP 2 (affected) . . . . OFF

● **WHEN TK (affected) FUEL RQRD** :
  Apply GRVTY FUEL FEEDING procedure.
  - TK (affected) FEED . . . . GRVTY ONLY
  - PROC : GRVTY FUEL FEEDING

STATUS

R – TK (affected) GRVTY FEED ONLY	INOP SYS TK PUMPS (affected)

■ **Center tank empty** :

- FUEL X FEED (if above FL150) . . . . ON
- ENG MODE SEL . . . . IGN
  The selection of continuous relight protects against flame-out, caused by possible fuel supply surging.
- TK PUMP 1 (affected) . . . . OFF
- TK PUMP 2 (affected) . . . . OFF

● **If FUEL X FEED off** :
  As long as fuel X feed is closed, associated engine is fed by gravity only.
  - PROC : GRVTY FUEL FEEDING
    Apply GRVTY FUEL FEEDING procedure.

  AVOID NEGATIVE G FACTOR
  Avoiding negative g factors will prevent fuel surging and, therefore, reduce the risk of engine malfunction.

● **WHEN TK (affected) FUEL RQRD** :
  - TK (affected) FEED . . . . GRVTY ONLY
    Apply GRVTY FUEL FEEDING procedure.
    Fuel from the affected tank may be used immediately, if there is no ceiling limitation for gravity fuel feeding.

STATUS

TK (affected) GRVTY FEED ONLY	INOP SYS TK PUMPS (affected)

FUEL L (R) TK PUMP 1 + 2 LO PR (CONT'D)

R ● **When reaching FL 150 :**
R *FUEL L(R) TK PUMP 1 + 2 LO PR caution is automatically recalled.*
– ENG MODE SEL . . . . IGN

● **WHEN TK (affected) FUEL RQRD :**
– TK (affected) FEED . . . . GRVTY ONLY
– FUEL X FEED . . . . OFF
– PROC : GRVTY FUEL FEEDING
AVOID NEGATIVE G FACTOR

STATUS

– PROC : GRVTY FUEL FEEDING
AVOID NEGATIVE G FACTOR
TK (affected) GRVTY FEED ONLY

INOP SYS
TK PUMPS
(affected)

FUEL L (R) TK PUMP 1(2) LO PR

– TK PUMP (affected) . . . . OFF

STATUS

INOP SYS
TK PUMP
(affected)

FUEL L (R) WING TK LO LVL

CAUTION
Do not apply this procedure if a fuel leak is suspected. Refer to FUEL LEAK procedure.

- **If center tank not empty** :
  - FUEL MODE SEL .... MAN
- **IF FUEL UNBALANCE**
  - FUEL X FEED .... ON
  - TK PUMP 1 (on side with LO LVL) .... OFF
  - TK PUMP 2 (on side with LO LVL) .... OFF

  Note : TK PUMP 1+2 (on side with LO LVL) LO PR warning will be triggered.

STATUS

R CTR TK FEED : MAN ONLY (if center tank not empty)	INOP SYS TK PUMPS

FUEL L + R WING TK LO LVL

LAND ASAP

- FUEL MODE SEL (if center tank not empty) .... MAN
- ALL TK PUMPS .... ON

  All pumps in center tank and in wing tanks will run.
- FUEL X FEED .... OFF

FUEL L (R) XFR VALVE CLOSED

Note : When fuel quantity in affected wing reaches low level, corresponding WING TK LO LVL warning is triggered.

OUTER TK UNUSABLE (affected side)

STATUS

OUTER TK UNUSABLE (affected side)

FUEL L (R) XFR VALVE OPEN

Crew awareness

STATUS

INOP SYS
L (R) CELL VALVE

FUEL X FEED VALVE FAULT

Crew awareness

If valve failed open, maintain fuel balance with selective use of pumps.

If valve failed closed and if unable to maintain an acceptable balance, land as soon as possible.

STATUS

INOP SYS

FUEL X FEED

FUEL L (R) OUTER TK LO TEMP

R ■ **on the ground before takeoff :**

– DELAY T.O

Do not takeoff until temperatures are within limits.

■ **in flight**

Crew awareness

Consider descending to a lower altitude and/or increasing Mach to increase TAT.

FUEL L (R) INNER TK LO TEMP

R ■ **on the ground before takeoff :**

– DELAY T.O

Do not takeoff until temperatures are within limits.

■ **in flight**

Crew awareness

Consider descending to a lower altitude and/or increasing Mach to increase TAT.

FUEL L (R) OUTER (INNER) TK HI TEMP

– GALLEY . . . . OFF

Reducing electrical loads reduce heat emitted by IDG.

■ **on the ground :**

– LIMITED TAXI TIME

● **if temp reaches 60° C in outer cell or 54° C in inner cell :**

– DELAY T.O.

– ENG MASTER (affected side) . . . . OFF

■ **in flight :**

– ENG F. FLOW (affected side) . . . . INCREASE

Disconnect autothrust. Adjust the thrust lever to increase fuel flow through the IDG oil heat exchanger and decrease the temperature of the fuel returning to the outer cell.

● **IF TEMP ABV 65 DEG C in outer cell or 57 DEG C in inner cell**

– APU . . . . AS RQRD

APU if available may be started and APU GEN used to allow IDG disconnection.

● **if opposite GEN avail :**

– IDG (affected side) . . . . OFF

FUEL FQI CH 1(2) FAULT

Crew awareness

FUEL ENG 1(2) LP VALVE OPEN

Crew awareness

FUEL APU LP VALVE FAULT

Crew awareness

FUEL CTR TK PUMP 1(2) LO PR

– FUEL X FEED . . . . ON
– CTR TK PUMP (affected) . . . . OFF

FUEL X FEED may be switched OFF when the center tank is empty to avoid possible fuel imbalance (if performance of pumps of one wing differs from that of other wing).

STATUS

INOP SYS
CTR TK PUMP 1(2)

FUEL CTR TK PUMPS LO PR

R *Selecting FUEL MOD SEL to MAN position will prevent repetitive triggering of the warning.*

– CTR TK PUMP 1 . . . . OFF
– CTR TK PUMP 2 . . . . OFF
– CTR TK UNUSABLE

Gravity feeding from the center tank is not possible (no by-pass valve fitted on the center tank pumps).

STATUS

CTR TK FUEL UNUSABLE

INOP SYS
CTR TK PUMPS

FUEL AUTO FEED FAULT

– FUEL MODE SEL . . . . MAN

The center tank pumps will run and feed the engines.

■ **Fuel in one wing tank < 5000 kg (11000 lb) and in center tank > 250 kg (550 lb) :**

– CTR TK PUMP 1 . . . . ON
– CTR TK PUMP 2 . . . . ON

When the center tank is empty, CTR TK PUMP LO PR warning will come on.

■ **CTR TK PUMPS running after slat extension or LO LVL in center tank**

– CTR TK PUMP 1 . . . . OFF
– CTR TK PUMP 2 . . . . OFF

STATUS

CTR TK FEED : MAN ONLY

FUEL LEAK

A fuel leak may either be detected by :

R *· The sum of FOB and F.USED significantly less than FOB at departure, or decreasing, or*
· Passenger observation (fuel spray from engine or wing tip), or
· Total fuel quantity decreasing at an abnormal rate, or
· A fuel imbalance, or
· A tank emptying too fast (leak from engine, or a hole in a tank), or
· A tank overflowing (due to a pipe rupture in a tank), or
R *· An excessive fuel flow (leak from engine), or*
R *· A fuel smell in the cabin.*

If visibility permits, a visual check from the cabin may enable identification of the leak source.

WHEN A LEAK IS CONFIRMED

LAND ASAP

■ **LEAK FROM ENGINE :**

– THR LEVER (of affected engine) . . . . IDLE
– ENG MASTER (of affected engine) . . . . OFF
R – FUEL XFEED . . . . USE AS RQRD

The crossfeed valve can now be selected open for re-balancing, or to allow use of the fuel from both wings. Do not restart the engine.

■ **LEAK NOT FROM ENGINE or LEAK NOT LOCATED :**

– FUEL X FEED . . . . MAINTAIN CLOSED

The crossfeed valve must remain closed to prevent the leak from affecting both sides.

– DESCEND TO GRVTY FUEL FEEDING CEILING (FL100 IF JET B)

See the gravity fuel feeding procedure.

– ENG MODE SEL . . . . IGN
– ALL TK PUMPS (when gravity ceiling is reached) . . . . OFF

In almost all cases, switching the pumps off will prevent any further loss of fuel. All pumps must be switched off, even if the leak is from one wing only, as there are some failures on one side that will result in fuel loss from the other side.

– AVOID NEGATIVE G FACTOR

FUEL LEAK (CONT'D)

CAUTION
R Do not open the FUEL X-FEED, even if requested by another ECAM procedure.
R Do not apply the FUEL IMBALANCE procedure : Even with a fuel imbalance of one
R wing full/one wing empty, no special procedure required for approach and landing.

- **If one engine flames out when there is still fuel in the feeding tank :**
  - LEAK FROM ENGINE proc . . . . APPLY
  - ALL TK PUMPS . . . . ON

  Note : The flameout is due to air suction from a leak from the engine.

FOR LANDING

CAUTION
– Notify the ATC, and do not use reverse

FUEL IMBALANCE

– FOB . . . . CHECK

Compare the FOB + FU with the FOB at departure. If the difference is significant, or if the FOB + FU decreases, suspect a fuel leak.

CAUTION
A fuel imbalance may indicate a fuel leak.
Do not apply this procedure, if a fuel leak is suspected. Refer to the FUEL LEAK procedure.

– FUEL X FEED . . . . ON

- **On the lighter side and in the center tank :**
  - FUEL PUMPS . . . . OFF
- **When fuel is balanced :**
  - FUEL PUMPS (WING + CTR) . . . . ON
  - FUEL X FEED . . . . OFF

Note : There is no requirement to correct an imbalance, until the ECAM fuel advisory is displayed.

FUEL CTR TK PUMPS OFF

The center tank pumps pushbuttons are OFF, with slats retracted.

– CTR TK PUMP 1 .... ON
– CTR TK PUMP 2 .... ON

GRVTY FUEL FEEDING

– ENG MODE SEL .... IGN
AVOID NEGATIVE G FACTOR

● **DETERMINE GRAVITY FEED CEILING** :
Depending on when the fuel pumps have failed, the flight altitude must be limited to the following values :

Flight conditions at time of gravity feeding	Gravity feed ceiling
Flight time above FL300 greater than 30 minutes (Fuel deaerated)	Current FL*
Flight time above FL300 lower than 30 minutes (Fuel non-deaerated)	FL 300*
Aircraft flight level never exceeded FL300 (Fuel non-deaerated)	FL150*, or 7000 ft above takeoff airport, whichever is higher

* For JET B, gravity feed ceiling is FL100 in all cases.
DESCEND TO GRVTY FEED CEILING (if applicable).

● **WHEN REACHING GRVTY FEED CEILING** :
– FUEL X FEED .... OFF

R ● **IF NO FUEL LEAK AND FOR AIRCRAFT HANDLING** :
R If no fuel leak and for flight with only one engine running, this engine being fed by gravity, apply the following :
– FUEL X FEED .... ON
– BANK ANGLE .... 1° WING DOWN ON LIVE ENGINE SIDE
The fuel from the wing tank on the engine running side is used.
– RUDDER TRIM .... USE
Use rudder trim to maintain constant course and neutral stick.

● **WHEN FUEL UNBALANCE REACHES 1000 kg (2200 lbs)** :
– BANK ANGLE . 2° or 3° WING DOWN ON LIVE ENG SIDE
Fuel from the opposite wing tank is used, until fuel imbalance is reduced to 0.

HYD B RSVR LO AIR PR/OVHT/LO LVL

■ **RSVR OVHT or LO LVL :**

– BLUE ELEC PUMP . . . . OFF

■ **RSVR LO AIR PR :**

● **IF PRESS FLUCTUATES :**

– BLUE ELEC PUMP . . . . OFF

B SYS LO PR

Affected systems

* F/CTL

STATUS

■ **Sys lost by RSVR LO AIR PR :**

The probability of cavitation increases with altitude. Therefore, it may be possible to restore the system after descending to a lower altitude.

APPR PROC HYD LO PR

– BLUE ELEC PUMP . . . . AUTO

● **If sys not recovered :**

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.1.

SLATS SLOW

CAT 3 SINGLE ONLY

■ **Sys lost by RSVR OVHT :**

APPR PROC HYD LO PR

● **IF BLUE OVHT OUT**

– BLUE ELEC PUMP . . . . AUTO

● **If sys not recovered :**

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.1.

SLATS SLOW

CAT 3 SINGLE ONLY

INOP SYS

BLUE HYD
SPLR 3
CAT 3 DUAL
B ELEC PUMP

■ **Sys lost by RSVR LO LVL :**

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.1.

SLATS SLOW

CAT 3 SINGLE ONLY

INOP SYS

BLUE HYD
SPLR 3
CAT 3 DUAL
EMER GEN
B ELEC PUMP

HYD G RSVR LO AIR PR/OVHT/LO LVL

■ **RSVR OVHT or LO LVL :**

– PTU . . . . OFF
– GREEN ENG 1 PUMP . . . . OFF

■ **RSVR LO AIR PR :**

● **IF PRESS FLUCTUATES :**

– PTU . . . . OFF
– GREEN ENG 1 PUMP . . . . OFF

R G ENG 1 PUMP LO PR

R G SYS LO PR

Affected systems
R *WHEEL
R *F/CTL

HYD G RSVR LO AIR PR/OVHT/LO LVL (CONT'D)

STATUS

■ **sys lost by RSVR LO AIR PR :**

R APPR PROC HYD LO PR

The probability of cavitation increases with altitude. Therefore, it may be possible to restore the system after descending to a lower altitude.

– GREEN ENG 1 PUMP . . . . ON

– PTU . . . . AUTO

● **IF HYD NOT RECOVERED :**

– L/G . . . . GRVTY EXTN

Refer to 3.02.32

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.1, due to a partial loss of ground spoilers.

SLATS/FLAPS SLOW

CAT 3 SINGLE ONLY

■ **sys lost by RSVR OVHT :**

R APPR PROC HYD LO PR

● **IF GREEN OVHT OUT**

– GREEN ENG 1 PUMP . . . . ON

– PTU . . . . AUTO

● **IF HYD NOT RECOVERED :**

– L/G . . . . GRVTY EXTN

Refer to 3.02.32

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.1, due to a partial loss of ground spoilers.

SLATS/FLAPS SLOW

CAT 3 SINGLE ONLY

■ **sys lost by RSVR LO LVL :**

– L/G . . . . GRVTY EXTN

Refer to 3.02.32

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.1, due to a partial loss of ground spoilers.

SLATS/FLAPS SLOW

CAT 3 SINGLE ONLY

INOP SYS

GREEN HYD
SPLR 1 + 5
CAT 3 DUAL
N.W. STEER
AUTO BRK
NORM BRK
L/G RETRACT
REVERSER 1
YAW DAMPER 1

HYD Y RSVR LO AIR PR/OVHT/LO LVL

● **RSVR OVHT or LO LVL**
- PTU .... OFF
- YELLOW ENG 2 PUMP .... OFF
- YELLOW ELEC PUMP .... OFF

● **RSVR LO AIR PR**
- ● **IF PRESS FLUCTUATES :**
  - PTU .... OFF
  - YELLOW ENG 2 PUMP .... OFF
  - YELLOW ELEC PUMP .... OFF

R Y ENG 2 PUMP LO PR

R Y SYS LO PR

Affected systems
*F/CTL

HYD Y RSVR LO AIR PR/OVHT/LO LVL (CONT'D)

STATUS

■ **sys lost by RSVR LO AIR PR :**

The probability of cavitation increases with altitude. Therefore it may be possible to restore the system after descending to a lower altitude.

APPR PROC HYD LO PR

– YELLOW ENG 2 PUMP .... ON

– PTU .... AUTO

● **if sys not recovered** :

LDG DIST PROC .... APPLY

Multiply the landing distance by 1.1 due to partial loss of ground spoilers.

FLAPS SLOW

CAT 3 SINGLE

■ **sys lost by RSVR OVHT :**

APPR PROC HYD LO PR

● **IF YELLOW OVHT OUT**

– YELLOW ENG 2 PUMP .... ON

– PTU .... AUTO

● **if not recovered** :

LDG DIST PROC .... APPLY

Multiply the landing distance by 1.1 due to partial loss of ground spoilers.

FLAPS SLOW

CAT 3 SINGLE

■ **sys lost by RSVR LO LVL :**

LDG DIST PROC .... APPLY

Multiply the landing distance by 1.1 due to partial loss of ground spoilers.

FLAPS SLOW

CAT 3 SINGLE

R *Note : Following a yellow hydraulic system failure, the*
R *parking brake may be inoperative due to a yellow*
R *accumulator low pressure.*

INOP SYS

YELLOW HYD
SPLR 2 + 4
CAT 3 DUAL
ALTN BRK
REVERSER 2
CARGO DOOR (if LO LVL)
YAW DAMPER 2

HYD G + B SYS LO PR

Note : If green system has been lost because of fluid low level or overheat, "HYD PTU FAULT" should appear demanding that the flight crew switches the PTU OFF.

LAND ASAP

- **if blue sys lost by ELEC PUMP LO PR**
  - RAT . . . . MAN ON

  MIN RAT SPD . . . . 140 KT
- Affected PUMPS . . . . OFF
- MANEUVER WITH CARE

F/CTL ALTN LAW

(PROT LOST)

The flight control normal laws and associated protections are lost. Only load factor limitation is furnished (alternate law without protection).

MAX SPEED 320/.77

Speed is limited due to loss of high speed protection.

- SPD BRK . . . . DO NOT USE

■ **if blue sys recovered :**

See procedure for single failure

■ **if blue sys not recovered :**

(Refer to 3.02.10) LANDING WITH SLATS OR FLAPS JAMMED.

Affected systems
R * WHEEL
R * F/CTL

HYD G + B SYS LO PR (CONT'D)

STATUS

MIN RAT SPD (if RAT out) . . . . 140 KT
(if B PUMP LO PR)
MAX SPEED 320/.77
MANEUVER WITH CARE
R – SPD BRK . . . . DO NOT USE
APPR PROC DUAL HYD LO PR (line not displayed for a double LO LVL) :

- **if sys lost by RSVR LO AIR PR** :
  - – related PUMPS . . . . ON
  - – PTU (if green affected) . . . . . AUTO
- **if sys lost by RSVR OVHT** :
  - **IF BLUE OVHT OUT** :
    - – BLUE ELEC PUMP . . . . . . AUTO
  - **IF GREEN OVHT OUT** :
    - – GREEN ENG 1 PUMP . . . . . . ON
    - – PTU . . . . AUTO

HYD G + B SYS LO PR (CONT'D)

STATUS

- **IF HYD NOT RECOVERED (line not displayed for a double LO LVL) :**
  - ATHR . . . . OFF
    Select the target speed on the FCU. Due to the loss of slats and some flight control surfaces, the A/THR may not satisfactorily maintain the speed.
  - FOR LDG . . . . USE FLAP 3
  - GPWS LDG FLAP 3 . . . . ON
- **WHEN SPD 200 KT (displayed when slats are retracted)**
  - L/G . . . . GRVTY EXTN
    Refer to 3.02.32.
    Extend landing gear at 200 knots to improve controllability when on single elevator.

APPR SPD . . . . VREF + 25 KT
Approach speed must be increased due to loss of ailerons and slats.
LDG DIST PROC . . . . APPLY
Multiply the landing distance by 1.5 due to increase of approach speed and partial loss of ground spoilers.
ALTN LAW : PROT LOST
WHEN L/G DN : DIRECT LAW
At landing gear extension control reverts to direct law in pitch as well as in roll. (See DIRECT LAW procedure 3.02.27)
FLAPS SLOW
CAT 1 ONLY

INOP SYS
G + B HYD
F/CTL PROT
L ELEV
L + R AIL
SPLR 1+3+5
ELAC 1
SLATS
AP 1 + 2
N.W. STEER
AUTO BRK
NORM BRK
L/G RETRACT
REVERSER 1
EMER GEN
(if B RSVR LO LVL)
B ELEC PUMP
YAW DAMPER 1

HYD G + Y SYS LO PR

LAND ASAP

– Affected PUMPS .... OFF

● **if yellow sys lost by ENG 2 PUMP LO PR**

R – YELLOW ELEC PUMP .... ON

MANEUVER WITH CARE

F/CTL ALTN LAW
(PROT LOST)

Flight control normal laws and associated protections are lost. Only load factor limitation, high and low speed stability are provided (alternate law with reduced protection).

MAX SPEED 320/.77

Speed is limited due to loss of high speed protection.

■ **if yellow sys recovered :**

Refer to procedure for single failure

■ **if yellow sys not recovered**

R *Refer to 3.02.10 LANDING WITH SLATS OR FLAPS JAMMED.*

Affected systems
* F/CTL
* WHEEL

HYD G + Y SYS LO PR (CONT'D)

STATUS

MAX SPEED 320/.77
MAX BRK PR . . . . 1000 PSI
MANEUVER WITH CARE
R APPR PROC DUAL HYD LO PR (line not
R displayed for a double LO LVL)

- **if sys lost by RSVR LO AIR PR** :
  - related PUMP . . . . ON
  - R PTU (if no RSVR OVHT and no RSVR
    R LO LVL) . . . . AUTO
- **if sys lost by RSVR OVHT** :
  - **IF GREEN OVHT OUT** :
    - GREEN ENG 1 PUMP . . . . . . ON
    - R PTU (if no Y RSVR OVHT and no
      R RSVR LO LVL) . . . . AUTO
  - **IF YELLOW OVHT OUT** :
    - YELLOW ENG 2 PUMP . . . . . ON
    - R PTU (if no G RSVR OVHT and no
      R RSVR LO LVL) . . . . AUTO

R **● IF HYD NOT RECOVERED (line not**
R **displayed for a double LO LVL)** :
- FOR LDG . . . . USE FLAP 3
- GPWS FLAP MODE . . . . OFF

HYD G + Y SYS LO PR (CONT'D)

STATUS

● **WHEN CONF 3 AND VAPP :**

– L/G . . . . GRVTY EXTN

(Refer to 3.02.32). Being stabilized at VAPP before selecting the gear down enables the aircraft to be trimmed for approach.

APPR SPD . . . . VREF + 25 KT

Approach speed must be increased, due to the loss of flaps.

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 2.3, due to the increase in approach speed, loss of antiskid, and partial loss of ground spoilers.

ALTN LAW : PROT LOST

WHEN L/G DN : DIRECT LAW

At landing gear extension, control reverts to direct law in pitch as well as in roll (see DIRECT LAW procedure 3.02.27). A slight transient pitch up may occur, depending on the frozen THS position.

BRK Y ACCU PR ONLY

7 full brake applications are available.

SLATS SLOW

CAT 1 ONLY

Note : *Following a yellow hydraulic system failure, the parking brake may be inoperative due to yellow accumulator low pressure.*

INOP SYS

G + Y HYD
F/CTL PROT
STABILIZER
REVERSER 1 + 2
SPLR 1+2+4+5
FLAPS
YAW DAMPER
AP 1 + 2
ANTI SKID
N.W. STEER
L/G RETRACT
CARGO DOOR
(if Y RSVR LO LVL)

HYD B + Y SYS LO PR

Note : If the yellow system has been lost by low level or overheat, "HYD PTU FAULT" should appear to demand the PTU switch at OFF.

LAND ASAP

● **if yellow sys lost by ENG 2 PUMP LO PR :**
– YELLOW ELEC PUMP . . . . ON

● **if blue sys lost by ELEC PUMP LO PR :**
– RAT . . . . MAN ON
MIN RAT SPD . . . . 140 KT

– Affected PUMPS . . . . OFF
MAX SPEED 320/.77

Note : Flight controls remain in normal law

– MANEUVER WITH CARE

■ **if blue or yellow sys recovered**

See procedure for single failure

■ **if neither system recovered**

Affected systems
* F/CTL

HYD B + Y SYS LO PR (CONT'D)

STATUS

MIN RAT SPD . . . . 140 KT
(If B PUMP LO PR)
MAX SPEED 320/.77
MANEUVER WITH CARE
APPR PROC : DUAL HYD LO PR (line not displayed for dual LO LVL)

- **If sys lost by RSVR LO AIR PR**
  - Related PUMP . . . . ON
  - PTU (if yellow affected) . . . . AUTO
- **If sys lost by RSVR OVHT**
  - **IF BLUE OVHT OUT**
    - BLUE ELEC PUMP . . . . AUTO
  - **IF YELLOW OVHT OUT**
    - YELLOW ENG 2 PUMP . . . . . ON
    - PTU . . . . AUTO
- **IF HYD NOT RECOVERED (line not displayed for dual LO LVL) :**
  - L/G . . . . GRVTY EXTN

    Landing gear is extended by gravity to preserve green system integrity (Refer to 3.02.32).

  LDG DIST PROC . . . . APPLY

  Multiply the landing distance by 1.1, due to a partial loss of ground spoilers.

  SLATS/FLAPS SLOW

  CAT 1 ONLY

R *Note : Following a yellow hydraulic system failure, the*
R *parking brake may be inoperative due to yellow*
R *accumulator low pressure.*

INOP SYS

B + Y HYD
R ELEV
SPLR 2+3+4
SPD BRK
AP 1 + 2
ALTN BRK
CARGO DOOR
(if Y RSVR LO LVL)
REVERSER 2
B ELEC PUMP
EMER GEN
(if B RSVR LO LVL)
YAW DAMPER 2

HYD Y ELEC PUMP LO PR or OVHT

If the ELEC PUMP overheats, or if the Y ELEC PUMP fails, while the Y ENG PUMP and the PTU are inoperative :

– YELLOW ELEC PUMP .... OFF

Y SYS LO PR

Affected systems
*F/CTL

STATUS

APPR PROC HYD LO PR
R IF YELLOW OVHT OUT
– YELLOW ENG 2 PUMP .... ON
– PTU .... AUTO
The above two lines are only displayed in case of an electrical pump overheat.
LDG DIST PROC .... APPLY
Multiply the landing distance by 1.1, due to the loss of ground spoilers 2 and 4.
FLAPS SLOW
R CAT 3 SINGLE ONLY

INOP SYS
YELLOW HYD
SPLR 2 + 4
CAT 3 DUAL
ALTN BRK
REVERSER 2
Y ELEC PUMP
YAW DAMPER 2

HYD G (Y) ENG 1(2) PUMP LO PR

– ENG PUMP (affected) . . . . OFF

■ **PTU operative**

STATUS

INOP SYS
G (Y) ENG 1(2) PUMP

■ **PTU inoperative**

G (Y) SYS LO PR

Note : If yellow system is affected, the yellow elec pump may be used

Affected systems
* WHEEL
(if G SYS affected)
* F/CTL

STATUS

● **G sys lost**

– L/G . . . . GRVTY EXTN
LDG DIST PROC . . . . APPLY
Multiply the landing distance by 1.1 due to the loss of ground spoilers 1 + 5.
SLATS/FLAPS SLOW
CAT 3 SINGLE

INOP SYS
GREEN HYD
SPLR 1 + 5
CAT 3 DUAL
N.W. STEER
AUTO BRK
NORM BRK
L/G RETRACT
REVERSER 1
PTU
G ENG 1 PUMP
YAW DAMPER 1

● **Y sys lost :**

LDG DIST PROC . . . . APPLY
Multiply the landing distance by 1.1 due to the loss of ground spoilers 2 + 4.
FLAPS SLOW
CAT 3 SINGLE
R *Note : Following a yellow hydraulic system failure, the*
R *parking brake may be inoperative due to a yellow*
R *accumulator low pressure.*

INOP SYS
YELLOW HYD
SPLR 2 + 4
CAT 3 DUAL
ALTN BRK
REVERSER 2
PTU
Y ENG 2 PUMP
YAW DAMPER 2

HYD PTU FAULT

Note : This warning is triggered, if the second engine is started within 40 seconds, following the end of the cargo doors operation. In this case, reset the warning by switching the yellow elec pump ON, then OFF.

● **If green or yellow reservoir low level and system low press:**
– PTU . . . . OFF

STATUS

INOP SYS
PTU

HYD RAT FAULT

Crew awareness.

STATUS

INOP SYS
RAT

HYD B ELEC PUMP LO PR or OVHT

– BLUE ELEC PUMP . . . . OFF

B SYS LO PR

Affected systems
*F/CTL

STATUS

APPR PROC HYD LO PR
● **IF BLUE OVHT OUT**
– BLUE ELEC PUMP . . . . AUTO
LDG DIST PROC . . . . APPLY
Multiply the landing distance by 1.1, due to the loss of ground spoiler 3.
SLATS SLOW
CAT 3 SINGLE ONLY

INOP SYS
BLUE HYD
SPLR 3
CAT 3 DUAL
B ELEC PUMP

ANTI ICE L (R) WINDSHIELD (WINDOW)

Crew awareness.

R *Note : If the air conditioning packs are selected OFF and the warning is triggered on the*
R *ground when OAT is greater than 40°C or when the cockpit window/windshield is*
R *directly heated by the sun : Reset WHC1 C/B (X13 on 122VU) if the left side is affected, WHC2 C/B (W13 on 122VU) if the right side is affected, five minutes after both air conditioning packs are selected on.*

STATUS

INOP SYS

L (R) WSHLD (WNDW) HEAT

ANTI ICE L + R WINDSHIELD

No crew action required in flight.

STATUS

INOP SYS

WSHLD HEAT

ANTI ICE CAPT PITOT or L (R) STAT

Failure of probe heating.

– AIR DATA SWTG . . . . CAPT

ADR 3 supplies data to PFD 1 and ND 1.

When ADR 3 is selected on captain side, deicing of pitot associated with ADR 1 is lost.

Note : AIR DATA SWTG should not be selected to CAPT 3 if ADR 3 is not available.

STATUS

INOP SYS
CAPT PITOT/
L STAT/
R STAT

ANTI ICE F/O PITOT or L (R) STAT

Failure of probe heating.

– AIR DATA SWTG . . . . F/O

ADR 3 supplies data to PFD 2 and ND 2.

Note : AIR DATA SWTG should not be selected to F/O 3 if ADR 3 is not available.

STATUS

INOP SYS
F/O PITOT/
L STAT/
R STAT

ANTI ICE CAPT (F/O) AOA or TAT

Crew awareness

STATUS

INOS SYS

R CAPT (F/O) AOA/TAT

ANTI ICE STBY PITOT or L (R) STAT or AOA

Crew awareness

If standby instruments are used, monitor air data information.

STATUS

INOP SYS

STBY PITOT/ L(R) STAT/ AOA

R
DOUBLE PROBE HEAT FAILURE

In case of double failure of pitot or alpha probe heaters in icing conditions, the choice made by the computers among the 3 ADR values is erroneous.

- **If icing conditions cannot be avoided :**
  - One of affected ADRs . . . . OFF

    There will be a disagreement between the two remaining ADRs : see F/CTL ADR DISAGREE (3.02.34).

ANTI ICE CAPT (F/O) (STBY) PROBES

■ **CAPT PROBES fault :**

– AIR DATA SWTG . . . . CAPT

Note : AIR DATA SWTG should not be selected to CAPT 3 if ADR 3 is not available.

STATUS

INOP SYS
CAPT PROBES

■ **F/O PROBES fault :**

– AIR DATA SWTG . . . . F/O

Note : AIR DATA SWTG should not be selected to F/O 3 if ADR 3 is not available.

STATUS

INOP SYS
F/O PROBES

■ **STBY PROBES fault :**

Crew awareness

STATUS

INOP SYS
STBY PROBES

ANTI ICE ENG 1 (2) VALVE CLSD

AVOID ICING CONDITIONS

STATUS

AVOID ICING CONDITIONS

INOP SYS
ENG 1 (2) A. ICE

ANTI ICE ENG 1 (2) VALVE OPEN

THRUST LIM PENALTY

STATUS

THRUST LIM PENALTY

ANTI ICE ICE DETECTED

In flight, ice is detected.

- ENG 1 ANTI ICE . . . . ON
- ENG 2 ANTI ICE . . . . ON

ANTI ICE DETECT FAULT

Both ice detectors failed.

- ANTI ICE . . . . AS RQRD

STATUS

INOP SYS
ICE DETECT

SEVERE ICE DETECTED

In flight, severe ice is detected.

- WING ANTI ICE . . . . ON
- ENG MODE SEL . . . . IGN

  This line does not normally appear since continuous ignition has already been selected with the "ICE DETECTED" warning (selection of ENG ANTI ICE).

WING ANTI ICE L (R) VALVE OPEN

■ **Failure detected on ground :**

- WING ANTI ICE . . . . OFF
- ENG BLEED (affected side) . . . . OFF
- X BLEED (if not closed) . . . . SHUT
- APU BLEED (if left wing affected and if APU running) .. OFF

WAI AVAIL IN FLT

STATUS

WAI AVAIL IN FLT	INOP SYS ENG 1 (2) BLEED PACK 1 (2)

● **After takeoff when above 1500 feet (automatic recall) :**

WAI AVAIL IN FLT

- ENG BLEED . . . . ON
- WING ANTI ICE . . . . AS RQRD

  Wing anti ice is available if needed and anyway is continually on, on failed side.
- THRUST LIM PENALTY

STATUS

R THRUST LIM PENALTY

● **After landing (automatic recall) :**

- WING ANTI ICE . . . . OFF
- ENG BLEED (affected side) . . . . OFF
- X BLEED (if not closed) . . . . SHUT
- APU BLEED (if left wing affected) . . . . OFF

STATUS

INOP SYS
ENG 1 (2) BLEED
PACK 1 (2)

WING ANTI ICE L (R) VALVE OPEN (CONT'D)

■ **Failure detected in flight :**

WAI AVAIL IN FLT

– WING ANTI ICE . . . . AS RQRD

Wing anti-ice is available if needed and anyway is continually on on failed side.

– THRUST LIM PENALTY

STATUS

THRUST LIM PENALTY
WAI AVAIL IN FLT

● **After landing (automatic recall) :**

– ENG BLEED (affected side) . . . . OFF
– X BLEED (if not closed) . . . . SHUT
– APU BLEED (if left wing affected) . . . . OFF
– WING ANTI ICE . . . . OFF

STATUS

INOP SYS
ENG 1(2) BLEED
PACK 1 (2)

WING ANTI ICE OPEN ON GND

Following ground test the valves are still open after 35 seconds.

– WING ANTI ICE . . . . OFF

STATUS

WAI AVAIL IN FLT

WING ANTI ICE SYS FAULT

● **If one wing valve remains closed when the wing anti-ice is turned on :**

– WING ANTI ICE . . . . OFF

AVOID ICING CONDITIONS

STATUS

● **If one wing valve remains closed when the wing anti ice is turned on :**

● **IF A/C ICING SEVERE**

– MIN SPD . . . . ALPHA PROT

Never fly below Vα prot since the margin versus stall may be reduced.

R *Note : If ice accretion, the approach speed must not*
R *be lower than :*
R *– VLS + 5 knots in configuration full and the*
R *landing distance must be multiplied by 1.1.*
R *– VLS + 10 knots in configuration 3 and the*
R *landing distance must be multiplied by*
R *1.15.*

INOP SYS

WING ANTI ICE

● **If the wing anti-ice is turned on after one engine shutdown or after the loss of one bleed :**

– X BLEED . . . . OPEN

R *Note : The affected pack has to be selected OFF due to precooler performance.*

WING ANTI ICE L (R) HI PR

THRUST LIM PENALTY

STATUS

THRUST LIM PENALTY

INOP SYS

WAI REGUL

RECORDER DFDR FAULT

Crew awareness.

STATUS

INOP SYS
DFDR

RECORDER FDIU FAULT

Crew awareness.

STATUS

INOP SYS
FDIU

FWS SDAC 1(2) FAULT

Crew awareness

STATUS

INOP SYS
SDAC 1(2)

FWS SDAC 1 + 2 FAULT

– MONITOR OVERHEAD PANEL
Amber cautions are lost. Aircraft status on the ECAM STATUS page is lost.
Only red warnings, engine and fuel parameters, and slat/flap positions are available on the upper ECAM DU.

R – ECAM ENG FUEL F/CTL WHEEL (L/G pos ind) SYS PAGES
R AVAIL.

STATUS

Note : Although this failure does not affect engine idle, the "ENG 1 APPR IDLE ONLY" and "ENG 2 APPR IDLE ONLY" messages are displayed. Disregard them.

INOP SYS
SDAC 1 + 2

EIS DMC 1(2)(3) FAULT

■ **DMC 1**

– EIS DMC SWITCH . . . . CAPT

DMC 3 replaces DMC 1.

■ **DMC 2**

– EIS DMC SWITCH . . . . F/O

DMC 3 replaces DMC 2.

■ **DMC 3**

Crew awareness.

STATUS

INOP SYS
DMC 1(2)(3)

FWS FWC 1(2) FAULT

Crew awareness.

STATUS

CAT 3 SINGLE ONLY

INOP SYS
R CAT 3 DUAL
R FWC 1(2)

FWS FWC 1 + 2 FAULT

– MONITOR SYS
R – MONITOR OVERHEAD PANEL

NOT AVAIL
R ECAM WARN
ALTI ALERT
STATUS
A/CALL OUT
MEMO

ECAM cautions and warnings, aural warnings, master caution and warning lights are lost. ECAM system pages are still available. Therefore cockpit panels must be monitored for local warnings and ECAM system pages must be regularly called for system checks.

DISPLAY UNIT FAILURE

■ **AFFECTED DU IS BLANK or DISPLAY IS DISTORTED :**

– DU (affected) . . . . AS RQRD
The DU can be switched off.
– ECAM/ND XFR (if ECAM DUs affected) . . . . USE
Transfer SD to F/O or CAPT ND.
– PFD/ND XFR (if EFIS DUs affected) . . . . USE

■ **DIAGONAL LINE ON THE AFFECTED DU :**

R *This failure may be due to a DMC FAULT or a communication interruption between the*
R *DMC and DU.*
– EIS DMC SWITCHING . . . . AS RQRD
● **If unsuccessful :**
– DU (affected) . . . . OFF THEN ON
R *Note : ND display may disappear, in case too many waypoints and associated*
R *information are displayed. Reduce the range, or deselect WPT or CSTR, and*
R *the display will automatically recover after about 30 seconds.*

■ **INVERSION OF EWD AND SD :**

R – ECAM UPPER DISPLAY . . . . OFF THEN ON
The same action on the EIS DMC SWITCHING selector produces the same effect.

ECAM SINGLE DISPLAY

Only the EWD is available. No SD on the other DUs.

■ **To call a SYS page :**

– PRESS AND MAINTAIN SYS page key on the ECP.

■ **OVERFLOW ON THE STATUS page :**

– PRESS AND MAINTAIN STS KEY ON ECP
First page of STATUS is displayed.
– RELEASE IT, THEN PRESS AGAIN WITHIN 2 SECONDS
Second page of STATUS is displayed.
– CONTINUE UNTIL THE OVERFLOW ARROW DISAPPEARS.
When the STS key is released for more than 2 seconds, EWD is displayed again.

L/G SHOCK ABSORBER FAULT

■ **Shock absorber not extended after liftoff :**

MAX SPEED 280/.67
– L/G . . . . KEEP DOWN

STATUS

MAX SPEED 280/.67	INOP SYS
– L/G . . . . KEEP DOWN	L/G RETRACT
INCREASED FUEL CONSUMP	

Flight with landing gear extended has a significant effect on fuel consumption and climb gradient (see "SPECIAL OPERATIONS" - FLIGHT WITH GEAR DOWN).

R *Note : If WHEEL N.W. STEER FAULT is also displayed, then the nose wheels may be at*
R *maximum deflection. (turned 90 degrees from center). During landing, delay nose*
R *wheel touchdown for as long as possible.*

■ **Shock absorber extended on the ground :**

Crew awareness.

L/G GEAR NOT UPLOCKED

This warning appears if the landing gear sequence is not completed after 30 seconds.

■ **L/G doors closed :**

AVOID EXCESS G FACTOR

Because the gear rests on the doors, avoid excessive load factors in order not to damage door structure.

L/G GEAR NOT UPLOCKED (CONT'D)

■ **L/G doors not closed :**

MAX SPEED 220/.54
– L/G . . . . RECYCLE

● **IF UNSUCCESSFUL :**

– L/G . . . . DOWN
MAX SPEED 280/.67

STATUS

	INOP SYS
MAX SPEED 280/.67	L/G RETRACT
INCREASED FUEL CONSUMP	

R *Note : – Flight with landing gear extended has a significant effect on fuel consumption*
R *and climb gradient (see "SPECIAL OPERATIONS" - FLIGHT WITH GEAR DOWN*
R *- FCOM 2.04.25). Multiply fuel consumption by approximately 2.8. Disregard*
R *FM fuel predictions.*
R *– Other predictions should also be disregarded (altitude, speed and time),*
R *except time predictions at waypoints when in cruise.*
R *– Do not use managed speed (except in approach) and CLB and DES autopilot*
R *modes.*

L/G GEAR NOT DOWNLOCKED

This warning appears, if the landing gear sequence is not completed after 30 seconds.

– L/G lever . . . . RECYCLE

● **IF UNSUCCESSFUL :**

– L/G . . . . GRVTY EXTN
Rotate the handle clockwise about 3 turns until reaching the mechanical stop. See the procedure on the next page.

STATUS

	INOP SYS
– L/G . . . . GRVTY EXTN	CAT 3 DUAL
CAT 3 SINGLE ONLY	N.W. STEER
If gravity extension is unsuccessful, see "LDG WITH ABNORMAL L/G" procedure.	

Note : As nose gear doors remain open, hydraulic power for nosewheel steering is lost.

L/G GRAVITY EXTENSION

– GRAVITY GEAR EXTN handcrank . . . . PULL AND TURN
Rotate the handle clockwise 3 turns until reaching the mechanical stop, even if resistance is felt.
– L/G lever . . . . DOWN
The landing gear lever should be confirmed in the DOWN position for the following reasons :
· To turn off the UNLK lights on the landing gear indication panel.
· To prevent the L/G CTL message from appearing on the WHEEL page.
· To minimize the risk of landing gear retraction on the ground, due to an unknown system fault, when the freefall system is reset.
– GEAR DOWN indications (if available) . . . . CHECK
Note : 1. Depending on aircraft speed, the display may show the landing gear doors in the amber transit position.
2. In the event of gravity extension, caused by the failure of both LGCIUs, landing gear position indications on the ECAM are lost. LDG GEAR lights on the LDG GEAR control panel remain available, if LGCIU 1 is electrically-supplied.
R *3. The LGCIU 2 FAULT or BRAKES BSCU CH 1(2) FAULT warning may be spuriously triggered after a gravity extension.*
4. If the three green downlock arrows are not on, it is possible that the handcrank is not at the mechanical stop. Check that the handcrank is firmly against the mechanical stop.

CAUTION
Nosewheel steering is lost.

■ **If successful :**
Do not reset the freefall system. This will avoid such undesirable effects as further loss of fluid, in the event of a leak, or possible landing gear unlocking, in the event of a gear selector valve jamming in the UP position.
Note : The freefall system may be reset in flights used for training. If the green hydraulic system is available, resetting the freefall system allows the landing gear doors to be closed and the nosewheel steering to operate.
The flight crew should not reset the freefall system on ground after the flight.

■ **If unsuccessful :**
– LDG WITH ABNORMAL L/G procedure . . . . APPLY

L/G DOORS NOT CLOSED

- **If aircraft speed is below 220 knots and the L/G lever is UP**:
  - L/G . . . . RECYCLE
- **IF UNSUCCESSFUL** :

  MAX SPEED 250/.60

STATUS

MAX SPEED 250/.60	INOP SYS
INCREASED FUEL CONSUMP	L/G DOOR

L/G GEAR UPLOCK FAULT

– L/G . . . . KEEP DOWN

The landing gear must be left down to avoid structural damage, because the uplock device will stay in the locked position.

MAX SPEED 280/.67

STATUS

MAX SPEED 280/.67	INOP SYS
– L/G . . . . KEEP DOWN	L/G RETRACT
INCREASED FUEL CONSUMP	

Flight with the landing gear extended has a significant effect on fuel consumption and
R *climb gradient (see "SPECIAL OPERATIONS" - FLIGHT WITH GEAR DOWN). Multiply fuel*
R *consumption by approximately 2.8.*

L/G SYS DISAGREE

Disagreement between the landing gear positions are detected by LGCIU 1 and LGCIU 2. Provided there is no other L/G ECAM warning, the landing gear position is in agreement with the landing gear lever position.

Crew awareness.

L/G LGCIU 1(2) FAULT

■ **one LGCIU faulty :**

– GPWS (if LGCIU 1 affected) . . . . OFF

If LGCIU 1 is lost, GPWS receives "L/G in up position" information even if the landing gear is down.
Setting the GPWS SYS pushbutton to OFF will prevent untimely warnings during the approach.

STATUS

ENG 1(2) APPR IDLE ONLY
When idle is selected on the ground with slats extended, only approach idle is available.

INOP SYS
LGCIU 1(2)
REV 1(2)
GPWS (if LGCIU 1 fault)

■ **both LGCIUs faulty :**

Normal landing gear control and position indications are lost. LDG GEAR lights on LDG GEAR control panel remain available if LGCIU 1 is electrically supplied.

– L/G . . . . GRVTY EXTN

See the L/G GRAVITY EXTENSION procedure.

– GPWS . . . . OFF

As LGCIU 1 is lost, GPWS receives "L/G in up position" information even if the landing gear is down.
Setting the GPWS SYS pushbutton to OFF will prevent untimely warnings during approach.

STATUS

– L/G . . . . GRVTY EXTN
L/G CONTROL NOT AVAIL
ENG 1 APPR IDLE ONLY
ENG 2 APPR IDLE ONLY
CAT 1 ONLY

INOP SYS
REVERSER 1 + 2
AP 1 + 2 (except in LAND mode)
A/THR
N.W STEER
LGCIU 1 and 2
GPWS

Note : 1. The partial spoiler extension (⊲) at landing when only one main landing gear is compressed is not available. The spoilers extend normally on ground when wheel speed greater than 72 knots.*
2. Depending on the LGCIU failure, only a part of the above systems may be lost.

L/G GEAR NOT DOWN

Select landing gear down.

LDG WITH ABNORMAL L/G

The procedure is intended for use when the nose or main landing gear fail to extend and/or lock down following the application of the L/G GRVTY EXTN procedure.
It is preferable to use any available landing gear, rather than carry out a belly landing.
Under these circumstances, a hard surface runway landing is recommended.
Full advantage should be taken of any foam, spread on the runway.

PREPARATION

- CABIN CREW . . . . NOTIFY
  Notify the cabin crew of the nature of the emergency encountered and state intentions. Specify the amount of available preparation time.
- ATC . . . . NOTIFY
  Notify ATC of the nature of the emergency and state intentions.
  Consider fuel reduction to a safe minimum. This reduces VREF and, consequently, the load factor at impact and the energy to be dissipated.
- GALLEY . . . . OFF

● **If NOSE L/G abnormal**
  - CG location (if possible) . . . . AFT
    · 10 passengers from front to rear about + 4 %
    · 10 passengers from mid to rear about + 2.5 %

● **If one MAIN L/G abnormal**
  - FUEL IMBALANCE . . . . CONSIDER
    Open the fuel X-FEED valve and switch off the pumps on the side with landing gear normally extended.

- OXYGEN CREW SUPPLY . . . . OFF
- SEAT BELTS/NO SMOKING . . . . ON
- CABIN and COCKPIT . . . . PREPARE
  · Loose equipment secured.
  · Survival equipment prepared.
  · Belts and shoulder harnesses locked.

APPROACH

- GPWS SYS . . . . OFF
- L/G lever . . . . CHECK DOWN

R - GRVTY GEAR EXTN handcrank .. TURN BACK TO NORMAL
R *Rotating three turns back to normal may, in certain cases, pressurize the landing gear down actuators, thereby reducing the probability of gear collapse after touchdown.*

LDG WITH ABNORMAL L/G (CONT'D)

– AUTOBRAKE . . . . DO NOT ARM

R *Manual braking will enable better pitch and roll control. Moreover, with at least one*
R *main landing gear in the abnormal position the autobrake cannot be activated (ground*
R *spoilers not armed).*

– EMER EXIT LT . . . . ON

– CABIN REPORT . . . . OBTAIN

● **If one or both MAIN L/G abnormal**

– A/SKID & N/S STRG . . . . OFF

R *With one main landing gear not extended, the reference speed used by the*
R *anti-skid to detect a wheel blockage is not correctly initialized. Consequently, the*
R *anti-skid must be switched off to prevent permanent brake release.*

– MAX BRAKE PR 1000PSI

R *Modulate the brake pressure to 1000 psi because the anti-skid is off.*

– GROUND SPOILERS . . . . DO NOT ARM

R *To keep as much roll authority as possible for maintaining the wings level.*
R *Ground spoiler extension would prevent spoilers from acting as roll surfaces.*

BEFORE LANDING

– RAM AIR . . . . ON

To ensure full depressurization of the aircraft before impact.

– BRACE FOR IMPACT . . . . ORDER

FLARE, TOUCH DOWN AND ROLL OUT

Engines should be shut down sufficiently early to ensure fuel is shut off before the nacelles impact, but sufficiently late to ensure adequate hydraulic supplies for the flight controls.

Engine pumps continue to supply adequate hydraulic pressure for 30 seconds after engine shutdown.

– REVERSE . . . . DO NOT USE

R *Do not use reverse to prevent ground spoiler extension, and because the engine will*
R *touch the ground during roll-out.*

● **if NOSE L/G abnormal**

– NOSE . . . . MAINTAIN UP

After touchdown, keep the nose off the runway by the use of the elevator. Then, lower the nose on to the runway before elevator control is lost.

– BRAKES (compatible with elevator efficiency) . . . APPLY

– ENG MASTERS . . . . OFF

Shutdown the engines before nose impact.

LDG WITH ABNORMAL L/G (CONT'D)

● **If one MAIN L/G abnormal**

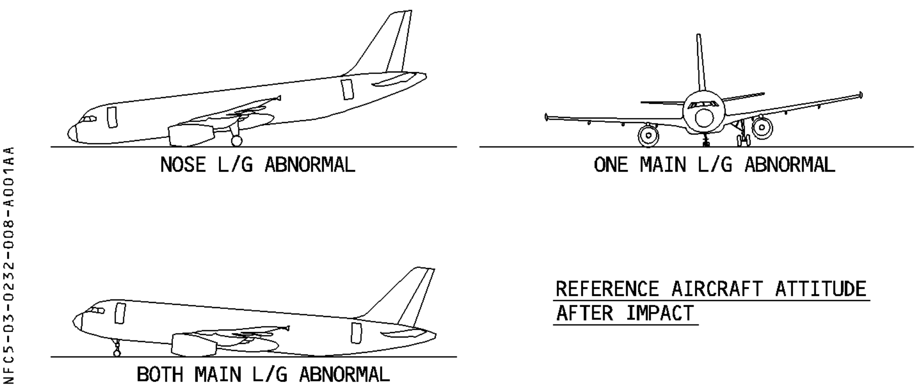
- ENG MASTERS . . . . OFF
  At touchdown, shut down both engines.
- FAILURE SIDE WING . . . . MAINTAIN UP
  Use roll control, as necessary, to maintain the unsupported wing up as long as possible.
- DIRECTIONAL CONTROL . . . . MAINTAIN
  Use rudder and brakes (maximum 1000 psi) to maintain the runway axis as long as possible.

● **If both MAIN L/G abnormal**

- ENG MASTERS . . . . OFF
  Shut down the engines in the flare, before touchdown.
- PITCH ATTITUDE (at touchdown) . . NOT LESS THAN 6°

WHEN A/C STOPPED

- ENG (all) and APU FIRE pushbutton . . . . PUSH
  Pressing the ENG FIRE pushbutton shuts off the related hydraulic pressure within a short time.
- ALL ENG and APU AGENT . . . . DISCH
- R EVACUATION . . . . INITIATE
  · *Announce : "PASSENGER EVACUATION" over the Passenger Address system, and press the EVAC COMMAND pushbutton.*
  · *All emergency and passenger doors may be used to evacuate the aircraft.*



CONFIG PARK BRAKE ON

Check that the parking brake handle is in the OFF position. If warning stays on, check that the brake pressure is at zero on the BRAKES PRESSURE indicator.

WHEEL N.W. STEER FAULT

STATUS

CAT 3 SINGLE ONLY

Note : Use differential braking to steer the aircraft during taxi.

Note : If the L/G SHOCK ABSORBER FAULT is also displayed, then the nose wheels may be at maximum deflection. (turned 90 degrees from center). During landing, delay nosewheel touchdown as long as possible.

INOP SYS

CAT 3 DUAL
N.W. STEER

BRAKES A/SKID NWS FAULT or ANTI SKID/NWS OFF

Either both BSCU channels are failed, or the A/SKID & NOSE WHEEL switch is OFF.

MAX BRK PR . . . . 1000 PSI

Monitor brake pressure on the BRAKES PRESS indicator. Limit brake pressure to approximately 1000 psi and, at low ground speed, adjust brake pressure as required. Avoid landing on an icy runway.

STATUS

MAX BRK PR . . . . 1000 PSI

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.4.

CAT 3 SINGLE ONLY

Note : 1. Autobrake is lost.

R *2. As specified in the QRH 5.04, automatic rollout is*
R *not authorized.*

INOP SYS

CAT 3 DUAL
ANTI SKID
N.W. STEER
BSCU CH 1
BSCU CH 2

BRAKES BSCU CH 1(2) FAULT

Crew awareness.

STATUS

INOP SYS

BSCU CH 1(2)

BRAKES HOT

– BRK FAN (if installed) . . . . ON

Note : If the caution is displayed during taxi in, brake fan selection should be delayed for a minimum of about 5 minutes, or done just before stopping at the gate (whichever occurs first), to allow thermal equalization and stabilization, and thus avoid oxidation of brake surface hot spots.

■ **On ground :**

– DELAY T.O. FOR COOL

· *Delay takeoff, until the brake temperature is below 300° C with the brake fans OFF, and 150°C with the brake fans ON (⊲*).*
· *Refer to 3.04.32 for brake temperature limitations requiring maintenance actions.*
· *If the BRAKES HOT message is still on when the aircraft is parked, the flight crew should not set the PARKING BRK ON.*

■ **In flight :**

● **IF PERF PERMITS :**

– L/G . . . . DN FOR COOL
MAX SPEED 250/.60

· *If performance permits, the landing gear should be extended or, if already extended, it should remain so, to improve brake cooling.*
· *Reduce speed to 220 knots, for landing gear retraction, when the brake temperature is within limits.*

STATUS

MAX SPEED 280/.67

As long as the landing gear is extended, limit the speed to 280kt/M.67.
For landing gear retraction when the brake temperature is within limits, reduce the speed to 220 knots.

BRAKES AUTO BRK FAULT

BRAKE RELEASED

The AUTOBRAKE FAULT warning may be due to a failure of the autobrake mode itself, or to a brake released condition. The crew should, therefore, be prepared to counter a possible slight lateral drift at landing, by using the rudder.

STATUS

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.2, due to a possible brake release condition.

INOP SYS
AUTO BRK

LOSS OF BRAKING

- **IF AUTOBRAKE IS SELECTED :**
  - BRAKE PEDALS .... PRESS
    This will override the autobrake.
- **IF NO BRAKING AVAILABLE :**
  - REV .... MAX
  - BRAKE PEDALS .... RELEASE
    Brake pedals should be released when the A/SKID & N/W STRG selector is switched OFF, since the pedal force or displacement produces more braking action in alternate mode than in normal mode.
  - A/SKID & N/W STRG .... OFF
    Braking system reverts to alternate mode.
  - BRAKE PEDALS .... PRESS
    Apply brake with care, since initial pedal force or displacement produces more braking action in alternate mode than in normal mode.
  - MAX BRK PR .... 1000 PSI
    Monitor brake pressure or BRAKES PRESS indicator. Limit brake pressure to approximately 1000 psi and, at low ground speed, adjust brake pressure as required.
  - **If STILL NO BRAKING :**
    - PARKING BRAKE .... USE
      Use short successive parking brake applications to stop the aircraft. Brake onset asymmetry may be felt at each parking brake application. If possible, delay the use of the parking brake until low speed, to reduce the risk of tire burst and lateral control difficulties.

WHEEL HYD SEL FAULT

R *Failure of normal brake selector valve, or the steering selector valve, in the open position.*
R *– If the normal brake selector valve is failed open, full green hydraulic pressure is present*
R *at normal servovalves' entry.*
R *Nosewheel steering remains available.*
R *– On ground, do not tow the aircraft with the green hydraulic system pressurized :*
R *Nosewheel steering remains pressurized, and so towing may either break the towbar*
R *shear pin, or the nose gear (if towbarless towing).*
R *– Selecting A/SKID & N/W STRG OFF, or resetting the BSCU, will cause the nosewheel to*
R *go to maximum deflection.*

– A/SKID & N/W STRG .... KEEP ON
As long as antiskid is operative, brake pressure is regulated by normal servovalves.

NAV HDG DISCREPANCY

– HDG . . . . X CHECK
Compare the 3 IR headings on ADIRS CDU or crosscheck with standby compass.
– ATT HDG SWTG . . . . AS RQRD
Select IR 3 (if available) to faulty side.

NAV ATT DISCREPANCY

– ATT . . . . X CHECK
Crosscheck with standby horizon.
– ATT HDG SWTG . . . . AS RQRD
Select IR 3 (if available) to faulty side.

NAV ALTI DISCREPANCY

Crew awareness.

OVERSPEED

VMO/MMO 350/.82
(235/.60 in case of dispatch with landing gear down).
VLE 280/.67
VFE . . . . see below

CONF	VFE
FULL	177
3	185
2	200
1 + F	215
1	230

NAV ADR FAULT

Note : In case of simultaneous failure of ADR and IR (same ADIRU), apply ADR FAULT procedure before IR FAULT procedure.

■ ADR 1 FAULT :

– AIR DATA SWTG .... CAPT

R *Select ADR 3 (if available) to captain side.*
The GPWS TERR amber FAULT light comes on as the enhanced functions of the EGPWS are inhibited. As such, the GPWS TERR pushbutton should be switched OFF.

– ADR 1 .... OFF

Depending on ADR failure, ADR should be switched off.

STATUS

CAT 3 SINGLE ONLY

INOP SYS
ADR 1
CAT 3 DUAL
GPWS

■ ADR 2 FAULT :

– AIR DATA SWTG .... F/O

Select ADR 3 (if available) to first officer side.

– ADR 2 .... OFF

– BARO REF .... CHECK

If ADR 2 fails, both baro reference channels are driven by the same FCU channel. Consequently the baro reference displays must be checked.

STATUS

CAT 3 SINGLE ONLY

INOP SYS
ADR 2
CAT 3 DUAL

■ ADR 3 FAULT :

– AIR DATA SWTG (if ADR 3 in use) .... NORM

– ADR 3 .... OFF

STATUS

CAT 3 SINGLE ONLY

INOP SYS
ADR 3
CAT 3 DUAL

NAV ADR FAULT (CONT'D)

■ Two ADR FAULT :

R *Flight control normal laws are lost. Pitch alternate law preserves the neutral static*
R *stability. All protections, except maneuver protections, are lost.*

● ADR 1 + 2 FAULT :

– AIR DATA SWTG . . . . CAPT

Set ADR 3 (if available) to the captain's side.

– ADR (affected) . . . . OFF

The GPWS TERR amber FAULT light comes on, as the enhanced functions of the EGPWS are inhibited. As such, the GPWS TERR pushbutton should be switched OFF.

F/CTL ALTN LAW (PROT LOST)

MAX SPEED . . . . 320 KT

Speed is limited, due to the loss of high-speed protections.

● ADR 1 + 3 (or 2 + 3) FAULT :

Air data information is lost on one PFD.

Note : In case of an ADR 1 + 3 FAULT, the landing gear safety valve is controlled closed:
- *Landing gear retraction is inoperative.*
- *Landing gear extension must be performed by gravity.*

– AIR DATA SWTG . . . . NORM
– ATC (if ADR 1 failed) . . . . SYS 2
– ATC (if ADR 2 failed) . . . . SYS 1
– ADR (affected) . . . . OFF

R *In case of an ADR 1 + 3 FAULT, the GPWS TERR amber FAULT light comes on, as*
R *the enhanced functions of the EGPWS are inhibited. As such, the GPWS TERR*
R *pushbutton should be switched OFF.*

F/CTL ALTN LAW

(PROT LOST)

MAX SPEED . . . . 320 KT

Speed is limited, due to the loss of high-speed protections.

NAV ADR FAULT (CONT'D)

STATUS

MAX SPEED . . . . 320 KT

APPR PROC

R *Note : In case of an ADR 1 + 3 FAULT, the landing*
R *gear safety valve is closed. Landing gear*
R *extension must be performed by gravity.*
R *(Refer to 3.02.32).*

– FOR LDG . . . . USE FLAP 3

Do not select CONF FULL so as not to degrade handling qualities.

– GPWS LDG FLAP 3 . . . . ON

Will be displayed when CONF 3 is selected.

APPR SPD . . . . VREF + 10 KT

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.2.

ALTN LAW : PROT LOST

– WHEN L/G DN : DIRECT LAW

At landing gear extension, control reverts to direct law in pitch, as well as in roll (see DIRECT LAW procedure 3.02.27).

CAT 1 ONLY

● **ADR 1 + 3 (or 2 + 3) FAULT** :

BOTH PFD ON THE SAME FAC

In case of ADR 1 + 3 FAULT, the GPWS TERR amber FAULT light comes on as the enhanced functions of the EGPWS are inhibited. As such, the GPWS TERR pushbutton should be switched OFF.

INOP SYS

F/CTL PROT
ADR 1 + 2 or (2 + 3) or (1 + 3)
AP 1 + 2
A/THR
RUD TRV LIM 1(2)(a)
GPWS (if ADR1 fault)

(a) RUD TRV LIM 1, in case of ADR 1 + 3 FAULT
RUD TRV LIM 2, in case of ADR 2 + 3 FAULT

ADR 1 + 2 + 3 FAULT

This procedure is not displayed on the ECAM. Only dual ADR warnings are displayed, in case of a triple ADR failure.

– ADR (all) . . . . OFF

– STBY INST (ALT + ASI) . . . . USE

Note : Disregard ECAM actions for AIR DATA SWTG and ATC, since these have no effect in case of a total loss of ADRs.

ADR 1 + 2 + 3 FAULT (CONT'D)

F/CTL ALTN LAW

(PROT LOST)

Note : The STALL WARNING is lost.

MAX SPEED 320/.82

See the following table for the IAS/M relationship for .82

FL	390	370	350	330	310	290	280 and below
MAX SPD	252	265	278	290	305	315	320

– WHEN L/G DN : DIRECT LAW

At landing gear extension, control reverts to direct law in pitch, as well as in roll (see the DIRECT LAW procedure 3.02.27).

Note : Use manual control of cabin pressurization :
– MODE SEL . . . . . . MAN
– MAN V/S CTL . . . . . . AS RQRD
These lines are not displayed on the ECAM. (For details, refer to 3.02.21).

STATUS

MAX SPEED 320/.82

R RUD WITH CARE ABV 160 KT

R *The rudder travel limit value is frozen at the value it had at the*
R *moment when the failure occurred. Therefore, rudder inputs*
R *must be limited at speeds above 160 knots, so as not to*
R *damage structure. At slats' extension, full rudder travel*
R *authority is recovered.*

APPR PROC :

R *Note : As the landing gear safety valve is closed, landing gear extension must be performed by gravity (Refer to 3.02.32).*

WHEN L/G DN : DIRECT LAW

At landing gear extension, control reverts to direct law in pitch, as well as in roll.

– FOR LDG . . . . USE FLAP 3

Do not select CONF FULL, so as not to degrade handling qualities.

– GPWS LDG FLAP 3 . . . . ON

Displayed, when CONF 3 is selected.

APPR SPD . . . . VREF + 10 KT

CAT 1 ONLY

ADR 1 + 2 + 3 FAULT (CONT'D)

STATUS

● **DURING FINAL APPR**
– V/S CTL . . . . FULL UP
LDG DIST PROC . . . . APPLY
Multiply the landing distance by 1.2.
Note : In case of a go-around, respect the maximum speed of 215 knots in CONF 1+F, due to loss of flap auto retraction to CONF 1.

CAUTION
Check that ΔP is zero before opening the doors.

INOP SYS
See below

INOP SYS displayed on ECAM

F/CTL PROT
WINDSHEAR DET
GPWS

ADR 1+2+3
AP 1 + 2

A/THR
RUD TRV LIM 1+2

Other inoperative systems

CAB PR 1+2

ATC ALTI MODE

TCAS ◁*
L/G RETRACT

RAT automatic extension.

NAV IR FAULT

Note : In case of a simultaneous ADR and IR (same ADIRU) failure, apply the ADR FAULT procedure prior to the IR FAULT procedure.

■ IR 1 FAULT :

– ATT HDG SWTG . . . . CAPT

The GPWS TERR amber FAULT light comes on, as the enhanced functions of the EGPWS are inhibited. As such, the GPWS TERR pushbutton should be switched off.

STATUS

	INOP SYS
IR MAY BE AVAIL IN ATT *Refer to the IR ALIGNMENT IN ATT MODE procedure.* CAT 3 SINGLE ONLY	IR 1 CAT 3 DUAL TCAS (*)

R *Note : (*) In case of an IR 1 fault, the TCAS may be inoperative (depending on the TCAS*
R *manufacturer).*

■ IR 2 FAULT :

– ATT HDG SWTG . . . . F/O

STATUS

	INOP SYS
IR MAY BE AVAIL IN ATT *Refer to the IR ALIGNMENT IN ATT MODE procedure.* CAT 3 SINGLE ONLY	IR 2 CAT 3 DUAL

■ IR 3 FAULT :

– ATT HDG SWTG (if IR 3 in use) . . . . NORM

This line is not displayed on the ECAM.

STATUS

	INOP SYS
IR MAY BE AVAIL IN ATT *Refer to the IR ALIGNMENT IN ATT MODE procedure.* CAT 3 SINGLE ONLY	IR 3 CAT 3 DUAL

NAV IR FAULT (CONT'D)

■ **Two IR FAULT :**

● **If IR 1 + 2 FAULT :**

– ATT HDG SWTG .... CAPT

Set IR 3 (if available) to Captain.
Attitude information on F/O PFD is lost.
The GPWS TERR amber FAULT light comes on as the enhanced functions of the EGPWS are inhibited. As such, the GPWS TERR pushbutton should be switched OFF.

● **If IR 1 + 3 (or 2 + 3) FAULT :**

– ATT HDG SWTG .... NORM

Attitude information is lost on one side (captain or first officer).
R *The GPWS TERR amber FAULT light comes on as the enhanced functions of the EGPWS are inhibited. As such, the GPWS TERR pushbutton should be switched OFF.*

F/CTL ALTN LAW

(PROT LOST)

Flight control normal laws are lost. Pitch alternate law with static stability becomes active.
All protections, except maneuver protections, are lost.

MAX SPEED .... 320 KT

Speed is limited because of a loss of high-speed protection.

⇩

NAV IR FAULT (CONT'D)

STATUS

MAX SPEED . . . . 320 KT

APPR PROC

- FOR LDG . . . . USE FLAP 3

  Do not select CONF FULL, so as not to degrade handling qualities.

- GPWS LDG FLAP 3 . . . . ON

  Will be displayed, when CONF 3 is selected.

APPR SPD : VREF + 10 KT

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.2.

ALTN LAW : PROT LOST

WHEN L/G DN : DIRECT LAW

At landing gear extension, control reverts to direct law, in pitch, as well as in roll (see the DIRECT LAW procedure 3.02.27).

IR (affected) MAY BE AVAIL IN ATT

Refer to the IR ALIGNMENT IN ATT MODE procedure.

CAT 1 ONLY

INOP SYS

F/CTL PROT
IR 1 (2)(3)
IR 1 + 2 or 1 + 3 or 2 + 3
AP 1 + 2
A/THR
YAW DAMPER 1(2)(a)
TCAS (*)

(a) Yaw damper 1, in case of an IR 1 + 3 fault
Yaw damper 2, in case of an IR 2 + 3 fault

Note : *(*) In case of an IR 1 fault, the TCAS may be inoperative (depending on the TCAS manufacturer).*

IR ALIGNMENT IN ATT MODE

If IR alignment is lost, the navigation mode is inoperative (red ATT flag on PFD and red HDG flag on ND).

Aircraft attitude and heading may be recovered by applying the following procedure.

R *Aircraft must stay level with constant speed during 30 seconds.*

– MODE SELECTOR . . . . ATT

ALIGN light on during 30 seconds.

ATT MODE displayed on CDU.

– LEVEL A/C ATTITUDE . . . . HOLD

– CONSTANT A/C SPEED . . . . MAINTAIN

– DISPLAY SYS switch . . . . AFFECTED SYS

– DISPLAY DATA switch . . . . HDG

Depending on the CDU keyboard installed, an "H" may be written on the "5" key :

■ **If "H" is written on the "5" key :**

– H KEY . . . . PRESS

Degree marker, 0 decimal point, ENT and CLR lights come on.

– A/C HEADING . . . . ENTER

■ **If "H" is not written on the "5" key :**

– A/C HEADING . . . . ENTER

Enter aircraft magnetic heading on CDU keyboard. Then press ENT key to enter data.

Example : to enter heading 320°, dial 3, 2, 0, 0 then press ENT.

Heading will be displayed on the associated ND.

"HDG–ATT MODE" will be displayed on CDU.

Due to IR drift, magnetic heading has to be periodically crosschecked with standby compass and updated if required.

NAV PRED W/S DET FAULT

The predictive windshear function is lost.

Crew awareness

STATUS

INOP SYS

PRED W/S DET

F/CTL IR DISAGREE

Disagreement between two IRs, the third one having failed or been rejected by the ELACs. Pitch direct, roll direct, and yaw mechanical laws become active. All protections (pitch and roll) are lost.

– ATT . . . . X CHECK

Use the standby horizon to determine the faulty IR.

● **IF DISAGREE CONFIRMED :**

– FAULTY IR . . . . OFF

This will also switch off the associated ADR.

– ELAC 2 . . . . OFF THEN ON

– ELAC 1 . . . . OFF THEN ON

R *Note : When the ELAC 1 computer is reset on ground, the pitch trim returns to the*
R *ground setting position (0°).*

After corrective action (faulty IR switched off and ELACs reset), pitch alternate law with reduced protections is recovered.

F/CTL ALTN LAW

(PROT LOST)

– MAX SPEED . . . . 320 KT

STATUS

– MAX SPEED . . . . 320 KT

APPR PROC

– FOR LDG . . . . USE FLAP 3

Do not select CONF FULL, so as not to degrade handling qualities.

– GPWS LDG FLAP 3 . . . . ON

Will be displayed, when CONF 3 is selected.

APPR SPD . . . . VREF + 10

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.2.

ALTN LAW : PROT LOST

WHEN L/G DN : DIRECT LAW

At landing gear extension, control reverts to direct law in pitch, as well as in roll (see the DIRECT LAW procedure 3.02.27).

INOP SYS

F/CTL PROT

NAV RA 1(2) FAULT

Crew awareness.

STATUS

■ **One RA FAULT :**

CAT 2 ONLY

INOP SYS
RA 1(2)
CAT 3
GPWS (if RA 1 fault)

■ **Both RA FAULT :**

WHEN L/G DN : DIRECT LAW

At landing gear extension, flight controls revert to direct law in pitch, as well as in roll (see DIRECT LAW procedure 3.02.27).

CAT 1 ONLY

R *ILS APPR mode cannot be engaged ; LOC mode is*
R *available via the FCU LOC pushbutton.*

INOP SYS
RA 1 + 2
A/CALLOUT
AP 1 + 2 (when landing gear is down)
GPWS

NAV TCAS FAULT

Crew awareness.

STATUS

INOP SYS
TCAS

NAV GPS 1(2) FAULT

Crew awareness.

STATUS

INOP SYS
GPS 1(2)

NAV FM/GPS POS DISAGREE

This message is triggered, when either one of the FM positions differ from either of the GPS positions, by more than 0.5 latitude or longitude minutes.

– A/C POS . . . . CHECK

The following procedure is not displayed on the ECAM :

■ **If the message occurs at takeoff initiation, or in ILS/LOC approach (LOC green) :**

– DISREGARD it.

■ **If the message occurs in climb, cruise, or descent :**

– CHECK navigation accuracy, using raw data.

● If the check is positive : NAV mode and ND ARC/ROSE NAV may be used.

● If the check is negative : HDG/TRK mode and raw data must be used.

– When possible, compare the FM position versus the GPIRS position, on the POSITION MONITOR page.

● If one FM position agrees with the GPIRS position on the POSITION MONITOR page, use the associated FD/AP.

● If not, deselect GPS and revert to basic information.

■ **If the message occurs during a non precision approach :**

– Overlay approach : SELECT HDG, or TRK, and use raw data.
– GPS or RNAV approach : GO AROUND, or fly visual, if visual conditions are met.

NAV ILS 1(2) FAULT

Crew awareness.

STATUS

CAT 1 ONLY

INOP SYS
ILS 1(2)
CAT 2

NAV GPWS FAULT

– GPWS . . . . OFF

STATUS

INOP SYS
GPWS

R

EGPWS ALERTS

CAUTION
During night or IMC conditions, apply the procedure immediately. Do not delay reaction for diagnosis.
During daylight VMC conditions, with terrain and obstacles clearly in sight, the alert may be considered cautionary. Take positive corrective action until the alert ceases, or a safe trajectory is ensured.

■ **"PULL UP" - "TERRAIN TERRAIN PULL UP" - "TERRAIN AHEAD PULL UP"**

Simultaneously :
- AP . . . . OFF
- PITCH . . . . PULL UP
  Pull up to full backstick and maintain.
- THRUST LEVERS . . . . TOGA
- SPEEDBRAKE lever . . . . CHECK RETRACTED
- BANK . . . . WINGS LEVEL or adjust
  For "TERRAIN AHEAD PULL UP" only, in addition to climbing, and if the crew concludes that turning is the safest way of action, a turning maneuver can be initiated.

● **When the flight path is safe and GPWS warning ceases** :
Decrease pitch attitude and accelerate.

● **When speed is above VLS and vertical speed is positive** :
Clean up aircraft, as required.

■ **"TERRAIN TERRAIN" "TOO LOW TERRAIN"** :

Adjust the flight path, or initiate a go-around.

■ **"TERRAIN AHEAD"** :

Adjust the flight path. Stop descent. Climb and/or turn, as necessary, based on analysis of all available instruments and information.

■ **"SINK RATE" "DON'T SINK"** :

Adjust pitch attitude and thrust to silence the alert.

■ **"TOO LOW GEAR" - "TOO LOW FLAPS"** :

Correct the configuration, or perform a go-around.

■ **"GLIDE SLOPE"** :

Establish the airplane on the glideslope, or switch OFF the G/S mode pushbutton, if flight below the glideslope is intentional (non precision approach).

NAV GPWS TERR DET FAULT

The enhanced TCF and TAD modes of the EGPWS are inoperative.

- GPWS TERR . . . . OFF

  The basic GPWS mode 1 to mode 5 are still operative if the SYS pushbutton switch lights FAULT or OFF are not illuminated.

TCAS WARNINGS

■ **Traffic advisory : "TRAFFIC" messages**

Do not maneuver based on a TA alone.
Attempt to see the reported traffic.

■ **Preventive resolution advisory : "MONITOR VERTICAL SPEED" message.**

Maintain or adjust the vertical speed, as required, to avoid the red area of the vertical speed scale.
Attempt to see the reported traffic.
Notify ATC.
When "CLEAR OF CONFLICT" is announced :
Resume normal navigation in accordance with ATC clearance.

■ **Corrective resolution advisory : All "CLIMB" and "DESCEND", or "MAINTAIN VERTICAL SPEED MAINTAIN", or "ADJUST VERTICAL SPEED ADJUST" type messages.**

Respond promptly and smoothly to a RA.

– AP (if engaged) .... OFF

The TCAS orders may require an incremental load factor, which is greater than that achieved by the autopilot.

R – BOTH FDs .... OFF

R Adjust the vertical speed, as required, to that indicated on the
R green area of the vertical speed scale.

Note : Avoid excessive maneuvers, while keeping the vertical speed outside the red area of the VSI and within the green area. If necessary, use the full speed range between Vαmax and Vmax.

Respect stall, GPWS, or windshear warnings.
Attempt to see the reported traffic.
Notify ATC.
When "CLEAR OF CONFLICT" is announced :
– Resume normal navigation, in accordance with ATC clearance.
R AP/FD can be re-engaged, as required.

● **GO AROUND procedure must be performed when a RA "CLIMB" or "INCREASE CLIMB" is triggered on final approach.**

Note : Resolution Advisories (RA) are inhibited below 900 feet.

F/CTL ADR DISAGREE

If one ADR is faulty, or has been rejected by the ELAC, and if there is a speed or alpha disagreement between the 2 remaining ADRs, alternate law becomes active, and protections are lost.

– AIR SPD . . . . X CHECK

■ **IF SPD DISAGREE :**

Refer to the ADR CHECK PROC paper procedure to determine the faulty ADR.

– FAULTY ADR . . . . OFF

■ **IF NO SPD DISAGREE :**

– AOA DISCREPANCY

F/CTL ALTN LAW

(PROT LOST)

– MAX SPEED . . . . 320 KT

STATUS

– MAX SPEED . . . . 320 KT

APPR PROC

– FOR LDG . . . . USE FLAP 3

Do not select CONF FULL, so as not to degrade handling qualities.

– GPWS LDG FLAP 3 . . . . ON

Displayed, when CONF 3 is selected.

APPR SPD . . . . VREF + 10

LDG DIST PROC . . . . APPLY

Multiply the landing distance by 1.2.

ALTN LAW : PROT LOST

WHEN L/G DN : DIRECT LAW

At landing gear extension, control reverts to direct law in pitch, as well as in roll (see DIRECT LAW procedure 3.02.27).

● **IF NO SPD DISAGREE :**

RISK OF UNDUE STALL WARN

INOP SYS

F/CTL PROT

ADR CHECK PROC

Use this procedure :

– Following an ADR DISAGREE, if there is a speed disagree (16 knots minimum) between the remaining ADRs.
– In case of an erroneous speed/altitude, which can either be suspected by :
  · Speed discrepancies (between ADR 1, 2, 3, and standby instruments).
  · Fluctuating or unexpected increase/decrease/permanent indicated speed, or pressure altitude.
  · Abnormal correlation of the basic flight parameters (speed, pitch attitude, thrust, climb rate).
  · Abnormal AP/FD/ATHR behavior.
  · STALL warning, or OVERSPEED warnings, that contradicts with at least one of the indicated speeds.
    * Rely on the stall warning that could be triggered in alternate or direct law. It is not affected by unreliable speeds, because it is based on angle of attack.
    * Depending on the failure, the OVERSPEED warning may be false or justified. Buffet, associated with the OVERSPEED VFE warning, is a symptom of a real overspeed condition.
  · Inconsistency between radio altitude and pressure altitude.
  · Reduction in aerodynamic noise with increasing speed, or increase in aerodynamic noise with decreasing speed.
  · Impossibility of extending the landing gear by the normal landing gear control.

To determine the correct ADR, refer to the :

– UNRELIABLE SPEED INDICATION procedure to fly the target pitch and thrust setting (Refer to the FCOM 3.02.34), or
– SEVERE TURBULENCE procedure, if in cruise, to set a thrust and deduce the correct speed indication (Refer to the FCOM 3.04.91).
– FAULTY ADR . . . . OFF

UNRELIABLE SPEED INDICATION

Unreliable speed indication may be due to radome damage, or due to air probe failure or obstruction.
The indicated altitude may also be affected, if static probes are affected.
Unreliable speed cannot be detected by the ADIRU. The flight control and flight guidance computers normally reject erroneous speed/altitude source(s), provided a significant difference is detected.
However, they will not be able to reject two erroneous speeds or altitudes that synchronously and similarly drift away. In this remote case, the aircraft systems will consider the remaining correct source as being faulty and will reject it. Consequently, the flight control and flight guidance computers will use the remaining two wrong ADRs for their computation.
Therefore, in all cases of unreliable speed situation, the pilots must identify the faulty ADR(s) and then switch it (them) OFF. During this failure identification time, since the flight control laws may be affected, it is recommended to maneuver the aircraft with care until the ADR(s) is (are) switched OFF.
Unreliable speed indications may be suspected, either by :
- Speed discrepancies (between ADR 1, 2, 3, and standby instruments).
- Fluctuating or unexpected increase/decrease/permanent indicated speed, or pressure altitude.
- Abnormal correlation of the basic flight parameters (speed, pitch attitude, thrust, climb rate).
- Abnormal AP/FD/ATHR behavior.
- STALL warning, or OVERSPEED warnings, that contradicts with at least one of the indicated speeds.
  - Rely on the stall warning that could be triggered in alternate or direct law. It is not affected by unreliable speeds, because it is based on angle of attack.
  - Depending on the failure, the OVERSPEED warning may be false or justified. Buffet, associated with the OVERSPEED VFE warning, is a symptom of a real overspeed condition.
- Inconsistency between radio altitude and pressure altitude.
- Reduction in aerodynamic noise with increasing speed, or increase in aerodynamic noise with decreasing speed.
- Impossibility of extending the landing gear by the normal landing gear control.

UNRELIABLE SPEED INDICATION (CONT'D)

How to apply the procedure :

- If the wrong speed or altitude information does not affect the safe conduct of the flight, first apply the ADR CHECK procedure to identify the faulty ADR(s) and switch it (them) OFF. If necessary, enter the unreliable speed procedure, or severe turbulence table (if in cruise), to set the pitch and thrust corresponding to the current flight phase. Check the resulting speed indicated on the table with all the indicated speeds/altitudes (from ADR 1, 2, 3 and standby instruments) to positively identify the faulty ADR(s).
- If the safe conduct of the flight is affected (all the speed indications are unreliable, or the wrong speed indication cannot not be positively identified) :
  - Immediately apply the memory items : AP/FD/ATHR OFF, and fly the memory pitch – thrust settings.
  - Then, once stabilized, refer to the QRH in order to determine the pitch and thrust settings required by the current flight phase.
  - Determine the faulty ADR(s) once the aircraft is stabilized, by comparing all of the indicated speeds/altitudes (from ADR 1, 2, 3 and standby instruments) with the expected speed, as per the table ; use ground speed and GPS speed/altitude variations for reasonableness considerations.
  - In the extreme case where the faulty ADR(s) cannot be identified and all speed indications remain unreliable, apply the proper pitch-thrust settings for each flight phase until landing and refer to ground speed and GPS speed/altitude variations for assistance.

UNRELIABLE SPEED INDICATION (CONT'D)

CAUTION
If the failure is due to radome destruction, the drag will increase, and N1 must, therefore, be increased by 5 %. Fuel flow will increase by about 27 %.

IMMEDIATE ACTIONS

– AP/FD .... OFF
– A/THR .... OFF
– FLAPS .... MAINTAIN CURRENT CONFIG
– SPEEDBRAKES .... CHECK RETRACTED

Note : If failure is detected while in CONF FULL and go-around is initiated, select CONF 3.

– L/G .... UP WHEN AIRBORNE

IMMEDIATE PITCH ATTITUDE AND THRUST GUIDANCE

■ **With slats extended :**

– THRUST LEVER .... MCT
– PITCH ATTITUDE .... 12.5°

■ **In clean configuration :**

– THRUST LEVER .... CLB
– PITCH ATTITUDE below FL 100 .... 10°
– PITCH ATTITUDE above FL 100 .... 5°

Respect the stall warning, if in alternate law.
Ground speed variations can provide valuable short-term information at low altitude.
The FPV is unreliable, if altitude information is affected. In other cases, it is a valuable aid in establishing a safe flight path.

WHEN FLIGHT PATH IS STABILIZED

– PROBE WINDOW HEAT .... ON
– ATTITUDE/THRUST .... ADJUST

Adjust attitude and thrust according to the table below.

UNRELIABLE SPEED INDICATION (CONT'D)

FLIGHT PHASE		WEIGHT (1000 kg)	FLT LEVEL	PITCH ATT	N1
TAKEOFF					TO or FLX
ACCELERATION	F	below 45 45 to 55 55 to 65 above 65		21° 17° 15° 13°	CL
and CONF CHANGE	S	below 45 45 to 55 55 to 65 above 65		16° 13° 10° 9°	CL
CLIMB	250 kt	below 45 above 45	0 to 50	15° 12°	CL
	250 kt	below 45 above 45	50 to 100	13° 11°	
Climb profile : · 250 kt below FL 200 · 275 kt from FL 200 to FL 320 · M 0.76 above FL 320	250 kt	below 45 above 45	100 to 150	11° 9°	
	250 kt	below 45 above 45	150 to 200	9° 8°	
	275 kt		200 to 250 250 to 320	5.5° 4.5°	
	.76		above 320	4°	
CRUISE	250 kt	below 55 above 55	0 to 200	1.5° 3°	*
	275 kt	below 55 above 55	200 to 320	1° 2.5°	*
	. 76	below 50 from 50 to 65 above 65	above 320	1.5° 2.5° 3°	*

* In cruise, initially set the pitch attitude and adjust N1, to maintain approximate level flight with the pitch attitude held constant. When time permits, set an accurate N1 from FCOM 3.04.91 "SEVERE TURBULENCE", and adjust attitude to maintain level flight.

UNRELIABLE SPEED INDICATION (CONT'D)

FLIGHT PHASE		WEIGHT (1000 kg)	FLT LEVEL	PITCH ATT	N1
DESCENT	.76	below 45 from 45 to 55 above 55	above 350	– 2.5° – 1.5° – 0.5°	IDLE
	.76	below 45 from 45 to 55 above 55	350 to 320	– 4° – 3° – 2°	
Descent profile : M 0.76 above FL 320 · 275 kt from FL 320 to FL 200 · 250 kt below FL 200	275 kt	below 45 from 45 to 55 above 55	320 to 200	– 3.5° – 2° – 1°	
	250 kt	below 45 from 45 to 55 above 55	200 to 100	– 2° – 1° 0°	
	250 kt	below 45 from 45 to 55 above 55	below 100	– 3° – 1.5° – 0.5°	
APPROACH (STABILIZED) IN CLEAN TO SELECT FLAPS 1 (equivalent to green dot)		below 45 45 to 55 55 to 65 above 65	LEVEL OFF	5.5°	43 % 47 % 52 % 56 %
IN CONF 1 TO SELECT FLAPS 2 (equivalent to S speed)		below 45 45 to 55 55 to 65 above 65	LEVEL OFF	7.0°	44 % 49 % 53 % 58 %
IN CONF 2 TO SELECT FLAPS 3 (equivalent to VLS + 10)		below 45 45 to 55 55 to 65 above 65	LEVEL OFF	8.0°	45 % 51 % 55 % 60 %
IN CONF 3 TO SELECT FLAPS FULL (equivalent to VLS + 10)		below 45 45 to 55 55 to 65 above 65	LEVEL OFF	7.0°	51 % 56 % 61 % 65 %
IN CONF FULL (equivalent to VLS + 10)		below 45 45 to 55 55 to 65 above 65	LEVEL OFF	5.0°	54 % 60 % 65 % 70 %

Note : 1. *The N1 given for approach is that required for level flight in the given configuration, before the configuration change is initiated.*
2. *To decelerate between stabilized points, N1 should be reduced toward idle and the attitude adjusted to maintain level flight.*
3. *When the attitude required for level flight equals that given for the next stable point, set the N1 appropriate to that point.*

UNRELIABLE SPEED INDICATION (CONT'D)

FLIGHT PHASE	WEIGHT (1000 kg)	FLT LEVEL	PITCH ATT	N1
FINAL APPROACH				
IN CONF FULL (equivalent to VLS + 10)	below 45 45 to 55 55 to 65 above 65	DESCENT AT – 3° GRADIENT	2.0°	42 % 47 % 51 % 55 %
IN CONF 3 (equivalent to VLS + 10)	below 45 45 to 55 55 to 65 above 65	DESCENT AT – 3° GRADIENT	4.5°	36 % 41 % 44 % 48 %

AIR BLEED 1(2) OFF

One engine bleed is switched off with no fault.

Crew awareness.

AIR ENG BLEED NOT CLSD

Engine bleed valve fails to close :
– during engine start or when APU BLEED is selected on.
– at engine shutdown or when APU BLEED is selected OFF with engine not running.

– ENG BLEED . . . . OFF

Note : The warning may be triggered
– after engine shutdown, or
– after APU BLEED is selected OFF with engine not running
due to residual pressure between the HP or IP valves and the engine bleed valve.
Select the ENG BLEED pushbutton OFF then on. If the warning disappears, no maintenance action is due.

STATUS

ONE PACK ONLY IF WAI ON

INOP SYS
ENG 1(2) BLEED

AIR ENG 1(2) BLEED ABNORM PR

● **If wing anti-ice is on and both packs are on :**

– PACK (affected) . . . . OFF

One pack must be closed when the pilot is using wing anti-ice because of precooler performance.

– X BLEED . . . . OPEN

STATUS

ONE PACK ONLY IF WAI ON

INOP SYS
ENG 1(2) BLEED
PACK 1(2) (if closed)

AIR ENG 1(2) BLEED FAULT

– ENG BLEED affected (if not automatically closed) . . . . OFF
- *With the ENG BLEED pushbutton switch on, the FAULT light remains on.*
- *With the ENG BLEED pushbutton switch OFF, the FAULT light goes out when the failure*
R *(overheat or overpressure) disappears.*

● **If wing anti-ice is on and both packs are on :**
– PACK affected . . . . OFF
One pack must be closed when the pilot is using wing anti-ice because of precooler perfomance.

– X BLEED . . . . OPEN

STATUS

ONE PACK ONLY IF WAI ON

INOP SYS
ENG 1(2) BLEED
PACK 1(2)
(if closed)

AIR DUAL BLEED FAULT

R *Do not apply this procedure, if ENG BLEED 1 was lost due to a :*
. LEAK on side 1
. ENG 1 FIRE
. Start air valve 1 failed open.

MAX FL 200

Rapidly descend to FL200, to recover the APU bleed supply.

– APU . . . . START

Start the APU during the descent.

● **AT OR BELOW FL200** :

● **If ENG 2 BLEED loss due to** :

LEAK on side 2, or
ENG 2 FIRE, or
Start Air Valve 2 failed open.

– X BLEED . . . . SHUT

– PACK2 (if above FL150) . . . . OFF

Only if PACK 1 is available.

– WING A.ICE . . . . OFF

APU BLEED must not be used for wing anti-ice.

– APU BLEED . . . . ON

AVOID ICING CONDITIONS

AIR L (R) WING or ENG 1(2) BLEED LEAK

Note : Spurious ENG 1(2) BLEED LEAK or L(R) WING LEAK warnings may be triggered after electrical transients. Reset in these cases the affected ENG BLEED pushbutton switch for an ENG BLEED LEAK, or reset both ENG BLEED pushbutton switches for a WING LEAK.

– ENG BLEED affected (if not automatically closed) . . . . OFF
- *· With the ENG BLEED pushbutton switch on, the FAULT light remains on.*
- *· With the ENG BLEED pushbutton switch off, the FAULT light goes out when the overheat disappears.*

● **If left wing or bleed leak :**
  – APU BLEED (if not closed) . . . . OFF

– X BLEED (if not closed) . . . . SHUT
– WING ANTI-ICE . . . . OFF
– AVOID ICING CONDITIONS

STATUS

AVOID ICING CONDITIONS
R ● **IF A/C ICING SEVERE**
  – MIN SPD . . . . ALPHA PROT

INOP SYS
WING A.ICE
ENG 1(2) BLEED
PACK 1(2)

AIR X BLEED FAULT

– X BLEED .... MAN CTL
Select OPEN, when the APU BLEED pushbutton is ON, or for engine start, or when WING
R *ANTI-ICE is on with one bleed inoperative.*
Select SHUT in other cases.

● **If manual opening inoperative, and only one bleed available:**
– WING ANTI ICE .... OFF
AVOID ICING CONDITIONS

STATUS

● **If manual opening inoperative, and only one bleed available :**
AVOID ICING CONDITIONS
● **IF A/C ICING SEVERE** :
– MIN SPD .... ALPHA PROT
X BLEED MAN CTL

INOP SYS
WING A. ICE
X BLEED

AIR APU BLEED LEAK

Note : This warning may spuriously appear after electrical transients. In that case, an APU bleed reset may be attempted by switching the APU BLEED pushbutton OFF, than ON.

– APU BLEED (if not closed) .... OFF
· *With the APU BLEED pushbutton ON, the FAULT light remains on.*
· *With the APU BLEED pushbutton off, the FAULT light goes off, when the overheat disappears.*

STATUS

INOP SYS
APU BLEED

AIR APU BLEED FAULT

The valve position disagrees with the commanded position, when the APU is running.
Crew awareness.
Note : Switching the APU BLEED pushbutton once may allow APU bleed recovery.

STATUS

INOP SYS
APU BLEED
(if valve closed)

AIR ENG HP VALVE FAULT

Crew awareness.

STATUS

AIR PRESS LOW AT IDLE

AIR L (R) WNG LEAK DET FAULT

Crew awareness.

STATUS

INOP SYS
L(R) LEAK DET

BLEED MONITORING FAULT

Crew awareness.

STATUS

INOP SYS
BMC 1 + 2

AIR ENG 1(2) BLEED LO TEMP

In fligth, ENG BLEED temperature is too low for correct wing de-icing.

- A/THR . . . . OFF
- THR LEVER (affected engine) . . . . ADVANCE
  Thrust lever of affected engine must be advanced with A/THR OFF.
  This may increase bleed temperature.

● **IF UNSUCCESSFUL and opposite bleed available** :
- X BLEED . . . . OPEN
- ENG BLEED (affected) . . . . OFF
- associated PACK (if opposite pack ON) . . . . OFF
  One pack must be closed when the pilot is using wing anti-ice due to precooler performance.

STATUS

ONE PACK ONLY IF WAI ON

INOP SYS
ENG 1(2) BLEED
PACK 1(2)
(if selected OFF)

● **IF UNSUCCESSFUL and opposite bleed not available** :
- WING A. ICE . . . . OFF

AVOID ICING CONDITIONS

STATUS

AVOID ICING CONDITIONS
● **IF A/C ICING SEVERE** :
- MIN SPD . . . . ALPHA PROT

AIR ENG 1 + 2 BLEED LO TEMP

- A/THR . . . . OFF
- THR LEVERS . . . . ADVANCE
  Thrust levers must be advanced with A/THR OFF.
  This may increase the bleed temperature.

● **IF UNSUCCESSFUL** :
- WING A. ICE . . . . OFF

AVOID ICING CONDITIONS

STATUS

AVOID ICING CONDITIONS
● **IF A/C ICING SEVERE** :
- MIN SPD . . . . ALPHA PROT

APU AUTO (EMER) SHUT DOWN

APU EMER SHUT DOWN is triggered if :
- *an APU fire is detected on ground, or*
- *the ground crew shuts down the APU manually by pushing the APU SHUT OFF pushbutton on the nose gear interphone panel, or*
- *the flight crew presses the APU FIRE pushbutton in the cockpit.*

– MASTER SW . . . . OFF

STATUS

INOP SYS
APU

DOORS (L/R/FWD/AFT) AVIONICS

■ **On the ground**

Crew awareness.

■ **In flight**

No crew action required as long as cabin pressure is normal.

● **IF ABN CAB V/S :**

– MAX FL 100/MEA

Limit maximum flight level to FL100 or MEA or minimum obstacle clearance altitude.

Avionics doors are of plug type. Therefore full depressurization is not recommended.

STATUS

MAX FL 100/MEA

DOORS CABIN/EMER EXIT/CARGO

Crew may confirm a cabin door warning by checking the visual indicator on the door.

■ **On the ground**

Crew awareness.

Crew may confirm a cargo door warning by removing the detachable inspection panel on the base of cargo door.

■ **In flight**

No crew action required as long as cabin pressure is normal.

● **IF ABN CAB V/S :**

– MAX FL 100/MEA

Limit maximum flight level to FL100 or MEA or minimum obstacle clearance altitude.

If door warning is accompanied by abnormal increase of cabin altitude, flight crew must reduce cabin ΔP and altitude by descending.

STATUS

MAX FL 100/MEA

ENG 1(2) FUEL FILTER CLOG

Crew awareness.

Maintenance action is due.

ENG 1(2) REVERSER FAULT

R *Note : If this ECAM warning is triggered at engine shut down, it can be considered as*
R *spurious, and consequently does not need to be reported in the aircraft logbook.*

- **If reverser position fault with reverser pressurized :**

  ENG 1(2) AT IDLE

  Thrust of the affected engine is locked at idle.

  – THR LEVER 1(2) . . . . IDLE

  Set thrust lever of affected engine at idle.

STATUS

INOP SYS

REVERSER 1(2)

ENG 1(2) REV PRESSURIZED

Reverse thrust system is pressurized with reverser doors stowed and locked.

– THR LEVER 1(2) . . . . IDLE

If flight conditions permit, reduce the thrust of the affected engine to IDLE as a precautionary measure.

ENG 1(2) REV SWITCH FAULT

Crew awareness.

ENG 1(2) EIU FAULT

The data bus between the EIU and ECU fails. Therefore :

- *affected engine start is lost*
- *autothrust control is lost*
- *thrust reverser on the affected engine is lost*
- *when idle is selected, only approach idle is available*
- *bleed corrections on N1 limit are lost (See BLEED STATUS FAULT procedure).*

Crew awareness.

ENG 1(2) APPR IDLE ONLY

Minimum idle is lost.

STATUS

INOP SYS

A/THR

REVERSER 1(2)

ENG 1(2) START

ENG VIB SYS FAULT

Crew awareness.

ENG 1(2) OIL LO PR

● **IF OIL PR < 13 PSI :**

Check oil pressure indication on ECAM ENG page.

– THR LEVER (of affected engine) .... IDLE
– ENG MASTER (of affected engines) .... OFF

ENG 1(2) **SHUT DOWN**

Carry out after ENG SHUT DOWN procedure.

Note : If oil pressure is low (< 13 psi) is indicated only on ECAM ENG page (red indication) without the ENG OIL LO PR warning, it can be assumed, that the oil pressure transducer is faulty. Flight crew may continue engine operation while monitoring other engine parameters.

ENG 1(2) OIL HI TEMP

Oil temperature between 140° C and 155° C for more than 15 minutes or oil temperature above 155° C.

– THR LEVER (of affected engine) .... IDLE
– ENG MASTER (of affected engine) .... OFF

ENG 1(2) **SHUT DOWN**

Apply after ENG SHUT DOWN procedure.

ENG 1(2) OIL FILTER CLOG

Crew awareness.

R *Maintenance action is due, except if the caution is temporarily displayed during cold engine*
R *start with engine oil temperature lower than 40°C.*

ENG 1(2) N1/N2/EGT OVERLIMIT

■ **Max pointer indication :**

EGT between 950 and 990° C or
N1 between 104.0 % and 105.8 % or
N2 between 105.0 % and 105.8 %.

– THR LEVER (of affected engine) . . . . BELOW LIMIT

Normal operation may be resumed and maintained until next landing. Report in maintenance log.

■ **Max pointer indication :**

EGT above 990° C or
N1 above 105.8 % or
N2 above 105.8 %.

– THR LEVER (of affected engine) . . . . IDLE
– ENG MASTER (of affected engine) . . . . OFF

If conditions do not permit engine shut-down land ASAP using the minimum thrust required to sustain safe flight.

ENG 1(2) **SHUT DOWN**

Apply after ENG SHUT DOWN procedure.

ENG 1(2) REVERSE UNLOCKED

One or more reverser doors are not stowed. Auto-restow function is only activated on ground with N1 less than 70 %.

■ **On ground :**

R ENG 1(2) AT IDLE

R *Displayed only if FADEC automatically sets the engine at idle (i.e. when 4 reverser doors*
R *not stowed or 1, 2 or 3 reverser doors not stowed with reverser pressurized).*

– THR LEVER (affected engine) . . . . IDLE
– ENG MASTER (affected engine) . . . . OFF

R ■ **In flight :**

R ● **If FADEC sets automatically the engine at idle :**
R ENG 1(2) AT IDLE
R – THR LEVER (affected engine) . . . . IDLE
R ● **IF BUFFET :**
R *The warning alone without buffet or vibration may be a false warning.*
R MAX SPEED . . . . 240 KT
R – ENG MASTER (affected engine) . . . . OFF
R ● **If FADEC does not set automatically the engine at idle :**
R ● **IF BUFFET :**
R – THR LEVER (affected engine) . . . . IDLE
R MAX SPEED . . . . 240 KT
R – ENG MASTER (affected engine) . . . . OFF
R ● **If reverser is actually deployed :**
R – RUD TRIM . . . . FULL R (L)
R – CONTROL HDG WITH ROLL
R *Note : Do not follow beta and beta target, if displayed.*

R **ENG 1(2)** **SHUT DOWN**

R *Apply after ENG SHUT DOWN procedure.*

ENG 1(2) STALL

This warning is triggered for an N2 between 50 % and IDLE.

A stall may be indicated by varying degrees of abnormal engine noises, accompanied by flame from the engine exhaust (and possibly from the engine inlet in severe case), fluctuating performance parameters, sluggish or no thrust lever response, high EGT and/or a rapid EGT rise when thrust lever is advanced. Engine stalls must be reported for maintenance action.

– ENG MASTER (affected engine) . . . . OFF

ENG 1(2) **SHUT DOWN**

Apply after ENG SHUT DOWN procedure.
Engine restart at crew discretion.

If the N2 is above IDLE, this warning is not displayed on the ECAM. Consequently, if the crew detects a stall, it must apply the following procedure :

■ **On the ground** :
  – ENG MASTER (affected engine) . . . . OFF

■ **In flight** :
  – THR LEVER (affected engine) . . . . IDLE
  – ENG PARAMETERS (affected engine) . . . . CHECK

● **Abnormal** :
  – ENG MASTER (affected engine) . . . . OFF

ENG 1(2) **SHUT DOWN**

Apply after ENG SHUT DOWN procedure.
Engine restart at crew discretion.

● **Normal** :
  – ENG A. ICE (affected engine) . . . . ON
  – WING A. ICE . . . . ON
  Operation of engine and wing anti ice will increase the stall margin, but EGT will increase accordingly.
  – THR LEVER (affected engine) . . . . . . SLOWLY ADVANCE

● **If stall recurs** :
  – THR LEVER (affected engine) . . . . REDUCE
  Reduce thrust and operate below the stall threshold.

● **If stall does not recur** :
  Continue engine operation.

ENG 1(2) START VALVE FAULT

■ START VALVE NOT CLOSED :

Remove all bleed sources supplying the faulty start valve.

– APU BLEED (if ENG 1 affected) . . . . OFF
– X BLEED . . . . SHUT

● **In flight** :
– ENG BLEED (affected side) . . . . OFF

● **On the ground** :
– MAN START (if man start performed) . . . . OFF
– ENG MASTER (affected side) . . . . OFF

R *On the ground, consider application of "START VALVE MANUAL OPERATION"*
R *procedure.*

■ START VALVE NOT OPEN :

● **If opposite engine running** :
– X BLEED . . . . ON

● **If APU AVAIL below FL 200** :
– APU BLEED . . . . ON

● **If UNSUCCESSFUL** :
– MAN START (if man start performed) . . . . OFF
– ENG MASTER (affected) (if auto start performed) . . OFF

MAN START procedure is useless since in both cases, the start valve is controlled by FADEC.
On the ground, consider application of "START VALVE MANUAL OPERATION" procedure.

ENG 1(2) HP FUEL VALVE

■ Associated engine below idle :

HP FUEL VALVE NOT OPEN.
Failure of HP fuel valve.

● **On the ground** :
– MAN START (if man start performed) . . . . OFF
– ENG MASTER (affected) . . . . OFF

■ Associated engine at or above idle :

Failure of HP fuel valve position switch.
HP FUEL POS SWT FAULT.

ENG 1(2) START FAULT

■ ENG 1(2) IGNITION FAULT

(No light up within the 18 seconds following ignition start).

● **In flight :**

– ENG MASTER (affected) . . . . OFF

Wait 30 seconds before attempting a new start (to drain the engine).

● **On the ground (auto start) :**

R *In case of no light up, the FADEC can perform one additional start attempt. After each unsuccessful start attempt, a dry crank phase is automatically performed.*

R *The following message will be displayed on the ECAM :*

R – NEW START IN PROGRESS

● **When the final dry cranking process is finished :**

– ENG MASTER (affected) . . . . OFF

Following starter cooldown, the pilot must decide whether to attempt auto or manual start, or to report the nostart condition for appropriate maintenance action.

● **On the ground (manual start) :**

R – MAN START (affected) . . . . OFF

R – ENG MASTER (affected) . . . . OFF

– MODE SEL . . . . CRANK

R – MAN START (affected) . . . . ON

Note : *The last two lines are not displayed on the ECAM.*

Dry crank the engine for 30 seconds. The start valve automatically reopens when N2 is below 20 %.

The pilot must decide whether to attempt a new start, or to report the no start condition for appropriate maintenance action.

ENG 1(2) START FAULT (CONT'D)

■ ENG 1(2) STALL, ENG 1(2) EGT OVERLIMIT :

● **In flight** :

– ENG MASTER (affected) . . . . OFF

Wait 30 seconds before attempting a new start (to drain the engine).

● **On the ground (auto start)** :

If it detects a stall or a potential EGT overheat, the FADEC will reduce the fuel schedule in stages, if necessary, to achieve a normal condition. The following message will be displayed on the ECAM.

R – NEW START IN PROGRESS

If a normal condition cannot be achieved, the fuel valve is closed and the following ECAM message is displayed :

– ENG MASTER (affected) . . . . OFF

· *The fuel metering valve and starter air valve are automatically closed. Both igniters are turned off.*

· *Setting ENG MASTER to OFF confirms automatic start abort.*

· *In case of ENG STALL, consider making a XBLEED start, if pressure is low.*

● **On the ground (manual start)** :

R – MAN START (affected) . . . . OFF

R – ENG MASTER (affected) . . . . OFF

– MODE SEL . . . . CRANK

R – MAN START (affected) . . . . ON

Note : The last two lines are not displayed on the ECAM.
Dry crank the engine for 30 seconds. The start valve automatically reopens when N2 is below 20 %.
The pilot must decide whether to attempt a new start, or to report the no start condition for appropriate maintenance action.

■ STARTER TIME EXCEEDED :

– MAN START (if manual start is performed) . . . . OFF

– ENG MASTER (affected) . . . . OFF

■ LO START AIR PRESS :

– BLEED AIR SUPPLY . . . . CHECK

■ THR LEVER NOT AT IDLE :

– THR LEVER . . . . IDLE

ENG 1(2) LOW N1 (on ground)

No N1 rotation during start.

● **IF CONFIRMED** :

– ENG MASTER (affected) . . . . OFF

ENG 1(2) N1 or N2 or EGT or FF DISCREPANCY

There is discrepancy between the displayed value on ECAM and the real value. ECAM upper display shows a CHECK message below the affected indication.

Crew awareness.

Normal indication may be recovered by switching from DMC 1 to DMC 3.

If unsuccessful and if both thrust levers are at the same position, cross check with the opposite parameter.

ENG RELIGHT (in flight)

MAX ALTITUDE . . . . See below

- ENG MASTER (affected) . . . . OFF
- THR LEVER (affected) . . . . Check IDLE
- MAN START pushbutton . . . . OFF

  Auto start is recommended in flight. Be aware that, unlike the procedure for auto start on the ground, the crew must take appropriate action in case of abn start.
- ENG MODE SEL . . . . IGN
- X BLEED . . . . OPEN

  If outside windmilling start envelope, FADEC will open starter valve.
- WING A. ICE (for starter assist) . . . . OFF
- ENG MASTER . . . . ON

  Engine light up must be achieved within 30 after fuel flow increases. Monitor N2. If uncertain about successful relight, move the thrust lever forward and check engine response.
- ENG PARAMETERS (N2, EGT) . . . . CHECK

  If the START FAULT-ENG STALL warning is triggered although engine parameters are normal, disregard the warning.

■ **When idle reached :**

- ENG MODE SEL . . . . NORM
- TCAS MODE SEL ⊲* . . . . check TA/RA

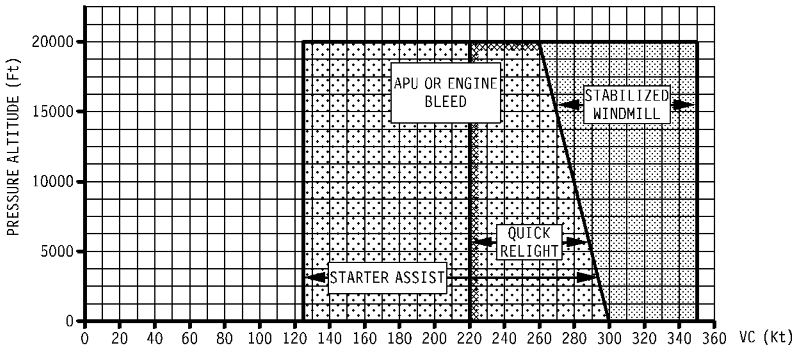
  Check that the selector is at TA/RA since if the ENG SHUT DOWN procedure has been applied, the TCAS mode selector may have been set at TA position.
- Affected SYS . . . . RESTORE

  Restore affected systems and set X BLEED selector at AUTO.

■ **if no relight :**

- ENG MASTER (affected) . . . . OFF

  Wait 30 seconds before attempting a new start (to drain the engine).



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ENG 1(2) FAIL

An engine flame-out may be recognized by a rapid decrease in EGT, N2, FF, followed by a decrease in N1.
Engine damage may be accompanied by :
– Loud noise,
– Significant increase in aircraft vibrations and/or buffeting,
– Repeated or uncontrollable engine stalls,
– Associated abnormal indications such as hydraulic fluid loss, or no N2 indication.

R LAND ASAP

■ **Before takeoff or after landing**

– THR LEVER (affected engine) . . . . IDLE
– ENG MASTER (affected engine) . . . . OFF
On ground, after 5 minutes, the FADEC is no longer supplied. So, the THR LEVER . . . IDLE line reappears, even if the thrust lever is at idle.

● **IF DAMAGE**

– ENG FIRE P/B (affected engine) . . . . PUSH
The FADEC is no longer supplied. So, the THR LEVER . . . IDLE line reappears, even if the thrust lever is at idle.
– AGENT 1 . . . . DISCH

● **IF NO DAMAGE**

If conditions permit, do not restart the engine. A new engine start would erase FADEC troubleshooting data.
– ENG (affected) RELIGHT . . . . INITIATE
If no damage, a new start sequence may be initiated.

ENG 1(2) $\boxed{\text{SHUT DOWN}}$

Apply ENG SHUT DOWN procedure, if damage or if engine relight is unsuccessful.

ENG 1(2) FAIL (CONT'D)

■ **In flight**

– ENG MODE SEL . . . . IGN

Selection of continuous ignition confirms the immediate relight attempt made by the FADEC.

– THR LEVER (affected engine) . . . . IDLE

Note : In case of GPWS (EGPWS ◁) alerts, reduce speed with care below VLS with flaps extended (at light weights VMC may be reached before αMax) when applying the GPWS (EGPWS ◁) procedure.

● **IF NO ENG RELIGHT**

– ENG MASTER (affected engine) . . . . OFF

● **IF DAMAGE**

– ENG FIRE P/B (affected engine) . . . . PUSH

FADEC is no longer supplied. As a consequence the line THR LEVER . . . IDLE reappears, even if the thrust lever is at idle.

– AGENT 1 (after 10 seconds in flight) . . . . DISCH

ENG 1(2) SHUT DOWN

Apply ENG SHUT DOWN procedure if damage or if engine relight unsuccessfull.
If high vibration occurs and continues after engine shutdown, reduce airspeed and descent to a safe altitude.
Attempt to determine and use a pratical airspeed and altitude for minimum vibrations.

● **IF NO DAMAGE**

– ENG (affected) RELIGHT . . . . INITIATE

Apply ENG RELIGHT (in flight) procedure.

ENG 1(2) REV ISOL FAULT

Crew awareness.

The thrust reverser shut off valve is detected failed open.

After ENG 1(2) SHUT DOWN

LAND ASAP

- **If wing Anti-ice ON :**
  - PACK (affected side) . . . . OFF
    One pack must be closed when wing anti-ice is in use due to precooler performance.
  - R X BLEED (if ENG FIRE pb not pushed) . . . . OPEN
    X BLEED must be opened to have symmetrical wing anti-icing.
- ENG MODE SEL . . . . IGN
  Continuous ignition is selected, in order to protect the remaining engine.
- FUEL X FEED . . . . ON
  Fuel X Feed valve is opened to avoid fuel imbalance.
  Note : Select "TA" on TCAS control panel (if installed).
- **If REV unlocked and if BUFFET :**
  MAX SPEED . . . . 240 KT
- **If ENG FIRE pushbutton pushed :**
  - XBLEED . . . . SHUT
  - WING ANTI ICE . . . . OFF

  AVOID ICING CONDITIONS

Affected systems
* HYD
* ELEC
* AIR BLEED

Note : In some conditions, with full asymmetric power, the aircraft may be control-limited before reaching the protection system limit. Therefore, in extreme conditions, where low speed may be advantageous (GPWS, WINDSHEAR, etc), reduce speed with care below VLS and respect the minimum control speed.

STATUS

- **If ENG 1(2) FIRE pushbutton pushed :**
  AVOID ICING CONDITIONS

After ENG 1(2) SHUT DOWN (CONT'D)

STATUS

- **IF A/C ICING SEVERE**
  MIN SPD . . . . ALPHA PROT
- **If REV unlocked :**
  APPR PROC
  - R R **4 doors not stowed (CFM) or reverser deployed (IAE) :**
    - **IF BUFFET :**
      - FOR LDG . . . . USE FLAP 1
      - APPR SPD . . . . . . VREF + 55 KT
      - RUD TRIM . . . . 5 DEG R(L)
        When committed to land, set 5° rudder trim towards live engine.
      - A/THR . . . . OFF
      - GPWS FLAP MODE . . . . OFF
    - **WHEN LDG ASSURED :**
      - LDG . . . . DOWN
    - **AT 800 FT AGL :**
      - TARGET SPD . . . VREF + 40 KT

      LGD DIST PROC . . . . APPLY
      Multiply the landing distance by 1.75, due to FLAP1 selection and increase of landing speed.
  - R R **1, 2, or 3 doors not stowed (CFM) or reverse detected unlocked (IAE) :**
    - R **IF BUFFET :**
      - R FOR LDG . . . . USE FLAP 3
      - R GPNS LDG FLAP 3 . . . . ON

      R APPR SPD : VREF + 10 kt
      - R LGD DISP PROC . . . . APPLY
        R *Multiply the landing distance by 1.2.*
- **If WING A/ICE off :**
  - **IF PERF PERMITS :**
    - X BLEED . . . . OPEN
      If no obstacle constraint exists, single engine gross ceiling (Refer to 3.06.20 p 1) must be decreased by 1200 feet.

After ENG 1(2) SHUT DOWN (CONT'D)

ONE PACK ONLY IF WAI ON

Note : – *If available, the APU may be started and the APU GEN used.*
– *If the ENG 1 FIRE pushbutton is pushed, APU bleed must not be used.*
If ENG 2 FIRE pushbutton is pushed, APU bleed may be used provided X BLEED selector is set at SHUT.
– *After landing, the Fuel Used value of the engine, shutdown in flight, becomes incorrect.*

STATUS

INOP SYS
ENG 1(2) BLEED
PACK 1(2)
MAIN GALLEY
GEN 1(2)
G ENG 1 PUMP or
Y ENG 2 PUMP
WING A. ICE
(if affected ENG FIRE pushbutton pushed)
AFT CRG HEAT

ENG 1(2) ONE TLA FAULT

Crew awareness.

ENG 1(2) IGN FAULT

■ **IGN A or B FAULT :**
Crew awareness.

STATUS

INOP SYS
ENG 1(2) IGN A (B)

■ **IGN A + B FAULT :**
– AVOID ADVERSE CONDITIONS

STATUS

INOP SYS
ENG 1(2) IGN

ENG FLEX TEMP NOT SET

At takeoff, the pilot sets the thrust levers at MCT/FLEX without having entered the flex TO temperature. The FADEC selects MCT thrust.

– THR LEVERS . . . . TO/GA

ENG 1(2) THR LEVER DISAGREE

Both Thrust Lever Angle (TLA) sensors not in agreement on one engine.
If the failure occurs during takeoff (with thrust lever in TOGA or FLX/MCT gate), FADEC maintains TO., FLX TO., or DRT TO ◁ thrust until thrust reduction, after which the maximum available thrust is MCT. In flight, if the failure occurs while the thrust lever is between idle and MCT, the FADEC selects the larger TLA limited at MCT. On ground, the FADEC selects idle thrust.

■ **On ground (if TLA not at TOGA or FLX/MCT) :**

- ENG (affected) IDLE POWER ONLY.
  FADEC automatically selects idle power.
- THR LEVER (affected) . . . . IDLE

■ **In flight :**

- AVAIL MAX POWER : MCT
  If TLA at, or below, MCT with slats retracted (or when MN > 0.47, if the onside EIU is failed).
- ENG (affected) AT IDLE (when slats are extended).
- THR LEVER (affected) (when slats are extended) . . . . . IDLE
- A/THR (if engaged) . . . . KEEP ON
- A/THR (if not engaged and if slats are not extended) . . ON
  With A/THR engaged, thrust is automatically managed between idle and higher TLA position.

STATUS

● **If TLA at, or below, MCT**

● **WHEN SLATS OUT**
(Displayed, if slats not extended), or

● **WHEN MN < 0.47**
(Displayed, if the onside EIU is failed)
ENG (affected) AT IDLE
For any case of thrust lever disagree (TO, FLEX, or between Idle and MCT), the FADEC will command idle thrust for the approach when slats are extended (or when the Mach number is less than 0.47, if associated EIU is failed). It is independent of the autothrust condition. The affected engine's thrust remains definitively at idle, even for go-around.

REV AVAIL ON GND
ENG (affected) AVAIL MAX PWR : MCT
ON GND ENG (affected) MAX PWR : IDLE.

INOP SYS
ENG 1(2) THR

ENG 1(2) THR LEVER FAULT

R *No validated thrust lever angle for one engine thrust lever.*

■ **On the ground :**

ENG (affected) IDLE POWER ONLY.

Idle power is automatically selected by FADEC.

If associated thrust reverser is already deployed, FADEC commands restow.

– THR LEVER (affected) . . . . IDLE

■ **In flight :**

If selected thrust lever position at the time of fault detection is :

TO or FLEX : FADEC freezes TO or flex TO thrust until slat retraction. At slat retraction it will select MCT thrust.

Between IDLE and MCT : in manual thrust setting mode, engine rating increases and freezes at MCT or IDLE with slats extended (or MN < 0.47 if the FADEC no longer receives the slats position due to EIU failure). It is possible to activate autothrust. If selected, autothrust mode will manage thrust between idle and MCT.

– ENG (affected) AT IDLE

R *For any case of thrust lever fault (TO, FLEX or between IDLE and MCT) the FADEC will*
R *command idle thrust for the approach when slats are extended (or when MN < 0.47*
R *if associated EIU is failed). It is independant of the autothrust condition. Thrust of*
R *affected engine remains definitively at idle even for go around.*

– THR LEVER (affected) . . . . IDLE

When slats are extended or MN < 0.47, if on side EIU is failed.

● **A/THR engaged :**

– A/THR . . . . KEEP ON

● **A/THR not engaged :**

ENG (affected) HI PWR IN MAN THR.

Inhibited when the FADEC commands the affected engine at IDLE.

● **BEFORE SLATS IN :**

– A/THR . . . . ON

HI POWER ONLY (if thrust lever angle failed in TO or flex position).

STATUS

● **WHEN SLATS OUT**

(Displayed if slats not extended) or,

● **WHEN MN < 0.47**

(Displayed if the onside EIU is failed).

ENG 1(2) AT IDLE

INOP SYS

REVERSER 1(2)
ENG 1(2) THR

ENG 1(2) COMPRESSOR VANE

Failure of VBV or VSV. Depending on the type of failure, one of the two following messages is displayed :

– AVOID RAPID THR CHANGES or

If A/THR engaged, adjust thrust lever (of affected engine) to align thrust lever command with actual N1 and disconnect A/THR.

ENG (affected) SLOW RESPONSE

STATUS

AVOID RAPID THR CHANGES or
ENG (affected) SLOW RESPONSE

ENG COMPRESSOR VANE

Engine 1 and 2 VBV or VSV motor fault detected (on stand) by ECU channel.

Crew awareness.

ENG 1(2) FUEL CTL FAULT

Failure of Fuel Metering Valve. Depending on the type of failure, one of the two following messages is displayed.

– AVOID RAPID THR CHANGES or
ENG (affected) SLOW RESPONSE

STATUS

AVOID RAPID THR CHANGES or
ENG (affected) SLOW RESPONSE

ENG 1(2) OVSPD PROT FAULT

Crew awareness.

Note : If the warning appears during engine start, shut down the engine. Restart the engine. If the warning still appears, maintenance action is due.

ENG 1(2) FADEC ALTERNATOR

Loss of electrical auto supply of either FADEC channel.

Crew awareness.

ENG 1(2) CTL VALVE FAULT

Failure of Burner staging valve or HP Turbine clearance system or RACC system.

MAX N2 .... 96 %

Retard associated thrust lever to limit N2 to 96 %.

STATUS

MAX ENG (affected) N2 .... 96 %

ENG 1(2) SENSOR FAULT

PS3, T25, T3, N1, N2 data not available on both ECU channels.

- **on the ground :**

  Crew awareness.
- **in flight :**

  AVOID RAPID THR CHANGES.

STATUS

AVOID RAPID THR CHANGES.

ENG 1(2) PROBES FAULT

P0, PT2, T12 data not available on both ECU channels.

Crew awareness.

ENG 1(2) FUEL RETURN VALVE

- **VALVE NOT OPEN**

  The valve is failed closed.

  Crew awareness.
- **VALVE NOT CLOSED**

  The valve is failed open.

  Crew awareness.

ENG DUAL FAILURE

LAND ASAP

– ENG MODE SEL . . . . IGN

An immediate relight attempt is made.

– THR LEVERS . . . . IDLE

OPTIMUM RELIGHT SPD . . . . 300 KT

The optimum airspeed to allow an effective windmilling start attempt is 300 kt.
In case of speed indications failure (volcanic ash) the pitch attitude for optimum relight speed
R *is – 4.5°. (For weights above 50 000 kg/110 000 lb add 1° for each 10 000 kg/22 000 lb.)*
R *At 300 kt, the aircraft can fly up to about :*
R *· 2 NM per 1000 ft at 50 000 kg/110 000 lb*
R *· 2.2 NM per 1000 ft at 60 000 kg/132 000 lb*
R *· 2.4 NM per 1000 ft at 70 000 kg/154 000 lb*

– EMER ELEC PWR (if EMER GEN not in line) . . . . MAN ON

Pressing EMER ELEC PWR MAN ON pushbutton allows extension of RAT and emer gen coupling.

– VHF1/HF1 (*) /ATC1 . . . . USE

· In Elec emer configuration only VHF1, HF1 (*) and ATC1 are supplied.
· Notify traffic control of the nature of the emergency and state intention.
If there is no contact with air traffic control, switch to code A7700 or transmit a distress message on one of the following frequencies, VHF frequency 121.5 MHz, HF 2182 KHz or 8364 KHz.

– FAC1 . . . . OFF THEN ON

Aircraft is out of trim due to right aileron up float.
Resetting FAC 1 permits to recover rudder trim even if no indication is available.

● **IF NO RELIGHT AFTER 30 S :**

– ENG MASTERS . . . . OFF 30 S/ON

Engine masters must be left OFF for 30 seconds to allow ventilation of combustion chamber.

ENG DUAL FAILURE (CONT'D)

- **If UNSUCCESSFUL :**
  - APU (IF AVAIL) . . . . START

    If the APU is available, APU may be started when below FL 250, and APU BLEED may be used for engine start below FL 200.

R *APU start is unavailable for 45 seconds after the loss of both engine generators.*
R *This 45–second delay prevents any interference with emergency generator*
R *coupling.*
  - APU BLEED . . . . ON
  - ENG MASTERS . . . . OFF 30 S/ON

    Start one engine at a time.

  OPTIMUM SPEED . . . . G DOT

  Green dot is displayed on the Captain's PFD. It represents the best lift-to-drag ratio.

- **EARLY IN APPR**

  (If ditching is foreseen, apply the DITCHING procedure, instead of the following) :
  - CAB SECURE . . . . ORDER
  - FOR LDG . . . . USE FLAP 3

    As only blue hydraulic power is available, only the slats will extend and operating times are noticeably increased.

- **AT 5000 FEET AGL :**
  - L/G . . . . GRVTY EXTN

    See the L/G GRVTY EXTN procedure (3.02.32).

  TARGET SPEED . . . . 150 KT

- **AT TOUCHDOWN :**
  - ENG MASTERS . . . . OFF

    LP and HP valves close.
  - APU MASTER SW . . . . OFF

    APU LP valve closes.
  - EVAC . . . . INITIATE
  - BAT 1 + 2 (if time permits before leaving aircraft) . . . . OFF

    Batteries are left ON, until the flight crew leaves the aircraft, to ensure cabin communications.

Note : Keep batteries on for at least 10 seconds after switching the ENG MASTERS to OFF, to allow complete closure of fuel LP valves.

ENG 1(2) BLEED STATUS FAULT

Status of bleed valves, pack valves, wing and engine anti ice valves, X bleed valve is not received by the FADEC active channel.

■ **on ground :**

– HI GND IDLE

FADEC increases minimum idle as if valves were opened.

● **If ENG ANTI ICE on :**

– ENG MODE SEL . . . . IGN

When eng anti ice is on, there is no automatic selection of continuous relight since FADEC does not know position of engine anti ice valves position.

● **BEFORE T.O. :**

– PACK (associated side) . . . . OFF

Associated pack must be closed to reduce risk of excessive EGT.

STATUS

ENG 1(2) HI GND IDLE

■ **In flight**

● **If ENG ANTI ICE on**

– ENG MODE SEL . . . . IGN

STATUS

ENG 1(2) HI GND IDLE

ENG 1(2) FADEC A(B) FAULT

Loss of one FADEC channel.

Crew awareness.

R *Note : Some cases of spurious FADEC fault have been experienced at engine start on*
R *ground.*
R *The warning can be considered as spurious, if it disappears after application of the*
R *following procedure :*
R *– Set the master lever to OFF, and wait until N2 speed goes below 5 %.*
R *– Pull and reset the C/B's of the affected ECU electrical supply (A04 or A05 on*
R *49 VU or R41 or Q40 on 120 VU).*
R *– Wait for the ECU power-up sequence, and restart the engine.*

ENG 1(2) FADEC FAULT

– CONFIRM ENG STATUS.

ON SYS PAGES :

Since engine indications are lost, other system pages such as HYD ELEC or BLEED must be used to confirm engine status.

● **IF ENG FAIL CONFIRMED** :

– ENG MASTER (affected) . . . . OFF

ENG 1(2) **SHUT DOWN**

Apply the after ENG SHUT DOWN procedure.

ENG 1(2) FADEC HI TEMP

■ **On the ground** :

– ENG MASTER (associated engine) . . . . OFF
– ENG MODE SEL . . . . NORM
– FADEC GND PWR . . . . Check OFF

■ **In flight** :

● **If the ECU temp is above the overheat threshold** :

FADEC OVHT

Reducing engine power should decrease temperature in the ECU area.
If overheating is severe enough, ECU failure could result in a significant loss of engine functions.

ENG TYPE DISAGREE

This caution is triggered when a rating discrepancy is detected between two engines.

Crew awareness

ENG THRUST LOCKED

The thrust is frozen on one or more engine after a failure or an involuntary autothrust disconnections.
This caution is automatically repeated every 5 seconds until thrust levers are moved.

– THR LEVERS . . . . MOVE

ENG TAILPIPE FIRE

Internal engine fire may be encountered during engine start or engine shutdown.
It may be seen by the ground crew or EGT may fail to decrease after MASTER switch is turned OFF.

CAUTION
External fire agents can cause severe corrosive damage and therefore should only be considered after having applied following procedure.

R – MAN START (if manual start performed) . . . . OFF
– ENG MASTER (affected) . . . . OFF

Note : Do not press engine fire pushbutton since this would cut off the FADEC power supply which would prevent motoring sequence.

– AIR BLEED PRESS . . . . ESTABLISH

· Select APU or opposite BLEED to motor the engine.
· If APU BLEED not available and opposite engine shutdown, connect an external pneumatic power (if readily available).

– ENG MODE SEL . . . . CRANK
– MAN START . . . . ON

The start valve reopens automatically when N2 is below 20 %.

● **When burning stopped**
  – MAN START . . . . OFF
  – ENG MODE SEL . . . . NORM
  – Maintenance action is due.

HIGH ENGINE VIBRATION

The VIB advisory on ECAM (N1 ≥ 6 units, N2 ≥ 4.3 units) is mainly a guideline to induce the crew to monitor engine parameters more closely.

VIB detection alone does not require engine shut down.

Note : 1. High engine vibrations may be accompanied by cockpit and cabin smoke and/or the smell of burning. This may be due only to compressor blade tip contact with associated abradable seals.
2. High N1 vibrations are generally accompanied by perceivable airframe vibrations. High N2 vibrations can occur without perceivable airframe vibrations.

■ **If no icing conditions :**

– ENG PARAMETERS . . . . CHECK

Check engine parameters and especially EGT ; crosscheck with other engine. Report in maintenance log.

● **If rapid increase above the advisory :**

– THRUST LEVER (affected engine) . . . . RETARD

Flight conditions permitting reduce N1 to maintain vibration level below advisory threshold.

Note : If the VIB indication does not decrease following thrust reduction, this may indicate other problems on the engine. Apply adequate procedure.

■ **If icing conditions :**

An increase of engine vibration in icing conditions with or without engine anti-ice may be due to fan blades and/or spinner icing.

– ATHR . . . . OFF

– ENGINE ANTI ICE . . . . CHECK

If ENG ANTI ICE is off, switch it ON at idle fan speed, one engine after the other with approximately 30 seconds interval.

– THRUST LEVER (one engine at a time) . INCREASE THRUST

Increase thrust to a setting compatible with the flight phase. VIB level will come back to normal after ice shed despite a slight increase during acceleration.
Resume normal operation.

Note : If possible, shut the engine down after landing for taxiing, when vibrations above the advisory level have been experienced during the flight.

ON GROUND EMER/EVACUATION

Carefully analyze the situation before deciding to evacuate passengers. However, do not waste valuable time.

- AIRCRAFT/PARKING BRK .... STOP/ON
- ATC (VHF) .... NOTIFY
  Notify ATC of the nature of the emergency, and state intentions.
  Only VHF 1 is available on batteries.
R - ΔP .... CHECK ZERO
R   *If ΔP is not at zero, select manual mode and V/S CTL-FULL UP in order to fully open the*
R   *outflow valve.*
- ENG MASTER 1 and 2 .... OFF
  Associated LP and HP valves close.
- CABIN CREW (PA) .... NOTIFY
  Notify the cabin crew of the nature of the emergency, and state intentions.
- FIRE pushbuttons (ENG and APU) .... PUSH
R - AGENTS (ENG and APU) .... AS RQRD
- EVACUATION .... INITIATE
  Using the passenger address system, announce an appropriate command such as "PASSENGER EVACUATION-EVACUATE THROUGH LH or RH DOORS", and press the EVAC COMMAND pushbutton, if installed.

DITCHING

PREPARATION

- CABIN CREW .... NOTIFY
  Notify the cabin crew of the nature of the emergency and state intentions.
  Specify the available time.
- ATC/TRANSPONDER .... NOTIFY/AS RQRD
  Notify ATC of the nature of emergency encountered and state intentions.
  If not in contact with ATC, select transponder code A7700 or transmit a distress message on : (VHF) 121.5 MHZ or (HF) 2182 KHZ or 8364 KHZ.
- GPWS-SYS .... OFF
  R *Pressing OFF the SYS pushbutton switch avoids nuisance warning.*
- SEAT BELTS/NO SMOKING .... ON
- CABIN and COCKPIT .... PREPARE
  · loose equipment secured
  · survival equipment prepared
  · belts and shoulder harnesses locked
- LDG ELEV .... SELECT 00
- V. BUGS .... SET
- BARO .... SET
  Omit normal approach and landing check list.

APPROACH

- L/G LEVER .... UP
- ● **If engines running** :
  - SLATS and FLAPS .... MAX AVAIL
- ● **if engines not running** :
  - FOR LDG .... USE FLAP 3
  - USE RUDDER WITH CARE
  - MIN RAT SPEED .... 140 KT
- ENG MODE SEL .... NORM
- CABIN REPORT .... OBTAIN

DITCHING (CONT'D)

BEFORE DITCHING

- CAB PRESS MODE SEL . . . . CHECK AUTO

  The outflow valve would remain open, if the MODE SEL were not at AUTO.
- R BLEED (ENGs and APU) . . . . OFF
- DITCHING pushbutton . . . . ON

  R *The outflow valve, emergency ram air inlet, avionics ventilation inlet and extract*
  R *valves, and pack flow control valves close.*
- BRACE FOR IMPACT . . . . ORDER

  The ditching direction mainly depends on the wind direction, and on the state of the sea. These factors may be considered as follows :

  1. Wind direction :
  This may be determined by observing of the waves, which move and break downwind. Spray from the wave tops is also a reliable indicator.

  2. Wind speed :
  The following guidelines can be used to evaluate wind speed :
  A few white crests . . . . 8-17 knots
  Many white crests . . . . 17-26 knots
  Streaks of foam along the water . . . . 23-35 knots
  Spray from the waves . . . . 35-43 knots

  3. Sea state :
  This is best determined from a height of 500 to 1000 feet.
  At a lower altitude, the swell direction may be less obvious than the wave direction, even though the waves are much smaller.

  4. When there is no swell, align into the wind. In the presence of swell, and provided that drift does not exceed 10 degrees, ditch parallel to the swell and as nearly into wind as possible. If drift exceeds 10 degrees, ditch into the wind. The presence of drift on touchdown is not dangerous, but every effort should be made to minimize roll.
  Touch down with approximately 11 degrees of pitch, and minimum aircraft vertical speed.

DITCHING (CONT'D)

JUST BEFORE DITCHING

– ENG MASTERS . . . . OFF

AFTER DITCHING

– ATC (VHF 1) . . . . NOTIFY
With engine and APU shut down, only VHF 1 is supplied.
– FIRE pushbutton (ENG's and APU) . . . . PUSH
– AGENTS (ENG's and APU) . . . . DISCH
– EVACUATION . . . . INITIATE
After impact the lowest point of the passenger exits (aft door) remains above the waterline for more than 7 minutes.

FORCED LANDING

PREPARATION

- CABIN CREW .... NOTIFY
  Notify the cabin crew of the nature of the emergency and state intentions.
  Specify the available time.
- ATC/TRANSPONDER .... NOTIFY/AS RQRD
  Notify ATC of the emergency encountered and state intentions.
  If not in contact with the ATC, select transponder code A7700, or transmit a distress message on (VHF) 121.5 MHZ, or (HF) 2182 khz, or 8364 khz.
- OXYGEN CREW SUPPLY (if not required) .... OFF
- GPWS-SYS .... OFF
  To avoid nuisance warnings.
- SEAT BELTS/NO SMOKING .... ON
- GALLEY/COMMERCIAL ⊲* .... OFF
- CABIN and COCKPIT .... PREPARE
  · Loose equipment secured and survival equipment prepared.
  · Belts and shoulder harnesses locked.
- LDG ELEV .... SET
  If not known, select an approximate value.
- V BUGS .... SET
- BARO .... SET
  Omit normal approach and landing checklist.

APPROACH

- RAM AIR .... ON
  Switch ON the RAM AIR to ensure complete cabin depressurization on ground.

■ **If engines running :**

R - L/G lever .... DOWN
- SLATS and FLAPS .... MAX AVAIL

■ **If engines not running :**

- FOR LDG .... USE FLAP 3
R - L/G GRVTY EXTN .... DOWN
R *See the L/G GRVTY EXTN procedure (3.02.32).*
- USE RUDDER WITH CARE
- MIN RAT SPEED .... 140 KT
- GND SPLR .... ARM
- ENG MODE SEL .... NORM
- CABIN REPORT .... OBTAINED

⇩

FORCED LANDING (CONT'D)

BEFORE LANDING

- BRACE FOR IMPACT .... ORDER

JUST BEFORE TOUCHDOWN

- ENG MASTERS .... OFF

AFTER TOUCHDOWN

● **When aircraft has stopped :**
  - PARKING BRK .... ON
  - ATC (VHF 1) .... USE
    With both engines and APU shut down, only VHF 1 is supplied.
  - FIRE pushbutton (ENG's and APU) .... PUSH
  - AGENTS (ENG's and APU) .... DISCH
R - EVACUATION .... INITIATE

EMER DESCENT

R **IMMEDIATE ACTIONS**

– CREW OXY MASKS . . . . ON

Descend with the autopilot engaged :
. Turn the ALT selector knob and pull.
. Turn the HDG selector knob and pull.
. Adjust the target SPD/MACH.
Use of the autopilot is also permitted in EXPEDITE mode (⊲).

– THR LEVERS (if A/THR not engaged) . . . . IDLE

– SPD BRK . . . . FULL

Extension of the speedbrakes will significantly increase Vls.
To avoid autopilot disconnection and automatic retraction of the speedbrakes, due to possible activation of the angle of attack protection, allow the speed to increase before starting to use the speedbrakes.

R **WHEN DESCENT ESTABLISHED**

– EMER DESCENT FL 100 or minimum allowable altitude.

– SPEED . . . . MAX/APPROPRIATE

CAUTION
Descend at the maximum appropriate speed. If structural damage is suspected, use the flight controls with care and reduce speed as appropriate.

Landing gear may be extended below 25000 feet. Speed must be reduced to VLO/VLE.

– SIGNS . . . . ON

– ENG MODE SEL . . . . IGN

– ATC . . . . NOTIFY

Notify ATC of the nature of the emergency, and state intentions.
If not in contact with ATC, select transponder code A 7700, or transmit a distress message on (VHF) 121.5 MHZ, or (HF) 2182 KHZ, or 8364 KHZ.
· To save oxygen, set the oxygen diluter selector to the N position.
· With the oxygen diluter selector left at 100 %, oxygen quantity may be insufficient to cover the entire emergency descent profile.
· Ensure crew communication is established with oxygen masks. Avoid continuous use of the interphone to minimize interference from the oxygen mask breathing noise.

● **IF CAB ALT > 14 000 feet** :

– PAX OXY MASKS . . . . MAN ON

Confirm passenger oxygen masks released.
Note : Notify the cabin crew, when a safe flight level has been reached and oxygen mask use can be terminated.

OVERWEIGHT LANDING

R *Automatic landing is certified up to MLW, but has been demonstrated in flight up to MTOW.*
R *In determining the best course of action, the flight crew may consider the option to perform*
R *an automatic landing provided the runway is approved for automatic landing.*

– LDG CONF . . . . DETERMINE

When an overweight landing has to be performed after an operational turnback, refer to
R *FCOM to find approach and landing configuration given as a function of the approach*
R *climb limiting weight.*

<u>Note</u> : *For weights greater than 68000 kg (or 150 000 lb) S speed is greater than VFE CONF 2 (200 knots). Consequently the crew must select on FCU a speed below 200 knots before setting FLAPS 2. When in FLAPS 2, the crew can use managed speed again.*

– LDG DIST . . . . CHECK

– PACK 1 and 2 . . . . OFF or supplied by APU

Selecting packs off (or supplied from APU) will increase the maximum thrust available from the engines in the event of a go-around.

● **In final stages of approach**

– TARGET SPEED . . . . VLS

Reduce speed to reach VLS at runway threshold.

Touch down as smooth as possible (Maximum V/S at touchdown 360 ft/min)

● **At main landing gear touchdown**

– REVERSE THRUST . . . . USE MAX AVAILABLE

● **After nose wheel touchdown**

– BRAKES . . . . APPLY AS NECESSARY

Maximum braking may be used after nose wheel touchdown, but if landing distance permits, delay or reduce braking to take full benefit of the available runway length.

● **Landing complete**

– BRAKE FANS (✱) . . . . ON

Be prepared for tire deflation if temperatures exceed 800° C.

CREW INCAPACITATION

If a cockpit crew member becomes incapacitated, the remaining crew member must call a cabin attendant as soon as practicable. The best way to request assistance from the cabin crew, is by means of the passenger address system :
"ATTENTION, PURSER TO COCKPIT PLEASE". The purser or any other cabin attendant must proceed to the cockpit immediately.
The cabin attendant must then :

- tighten and manually lock the shoulder harness of the incapacitated crew member ;
- push the seat completely aft ;
- recline the seat back.

It takes 2 people to remove the dead weight of an unconscious body from a seat without endangering any controls and switches.
If it is not possible to remove the body, one cabin attendant must remain in the cockpit to take care of and observe the incapacited crew member.
In coordination with the purser :

- request assistance from any medically qualified passenger.
- check if a type qualified company pilot is on board to replace the incapacitated crew member.

BOMB ON BOARD

IF POSSIBLE, LAND AND EVACUATE THE AIRCRAFT IMMEDIATELY.

R If it is not possible to land and evacuate the aircraft within 30 minutes, apply the following procedures :

COCKPIT PROCEDURES

Background

To avoid the activation of an altitude-sensitive bomb, the cabin altitude should not exceed the value at which the bomb has been discovered.

To reduce the effects of the explosion, the aircraft should fly as long as possible with approximately 1 PSI differential pressure, to help the blast go outwards. 1 PSI differential pressure corresponds to a 2500 feet difference between the aircraft and the cabin altitude.

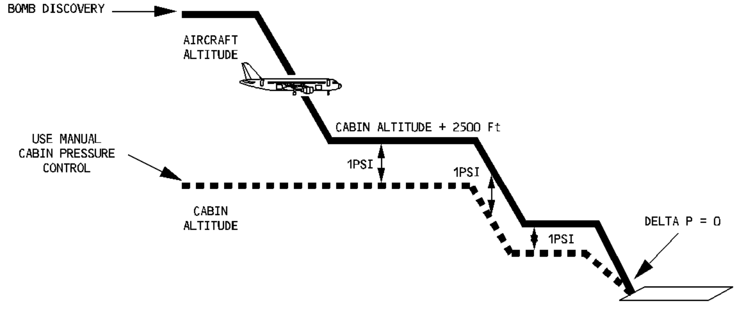
These conditions are achieved by using the manual pressure control.

Procedure

The following procedure assumes that it is initiated during climb or cruise :

- First, maintain the cabin altitude.
- While maintaining the cabin altitude, descend the aircraft to the cabin altitude + 2500 feet and maintain delta P at 1 PSI.
- During further steps of descent, maintain delta P at 1 PSI.
- For landing, reduce the differential pressure to zero, until the final approach.

If flight conditions are different, the crew should adapt the procedure, bearing in mind the above-mentioned principles (background paragraph).



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BOMB ON BOARD (CONT'D)

- AIRCRAFT (if climbing) . . . . LEVEL OFF
- CABIN PRESS MODE SEL . . . . MAN

  The purpose is to immediately prevent the cabin altitude from increasing, in order to avoid the activation of an altitude-sensitive bomb.
- CAB ALT . . . . MAINTAIN

  Use MAN V/S CTL to maintain the cabin altitude at the value it had when the bomb was discovered.
- CABIN CREW . . . . NOTIFY
- ATC/COMPANY OPERATIONS . . . . NOTIFY

  To obtain expert advice from explosive specialists.
- FUEL RESERVES . . . . DETERMINE

  Keep in mind that when flying at cabin altitude + 2500ft, fuel consumption in CONF 1, with landing gear down, will be about 2.1 times that consumed in clean configuration.
- NEXT SUITABLE AIRPORT . . . . DETERMINE
- FCU SPEED SELECTION KNOB . . . . PULL AND TURN

  Select the most appropriate speed, taking into account the time to destination, the fuel consumption and the fact that low speed could reduce the consequences of possible structural damage, if the bomb explodes.
- DESCENT TO CAB ALT + 2500 FT or MEA or minimum obstacle clearance altitude . . . . INITIATE

  Descending to 2500ft above the cabin altitude gives a cabin differential pressure of approximately 1 PSI, which helps to ensure that the blast goes outwards, if the bomb explodes.
- AVOID SHARP MANEUVERS

  which might result in the bomb moving.
- CAB ALT . . . . MAINTAIN

  Use MAN V/S CTL to maintain the cabin altitude. Initially brief UP input should be required; but, be careful not to increase the cabin altitude.

● **When at CAB ALT + 2500 FT** :
  - 1 PSI DELTA P . . . . MAINTAIN

    Use MAN V/S CTL to adjust delta P to 1 PSI. Brief DN input should be initially required to set 0 ft/min cabin vertical speed.
  - GALLEY/COMMERCIAL (*) . . . . OFF
  - FLAPS (fuel permitting) . . . . AT LEAST CONF 1

    For landing, use normal configuration.

BOMB ON BOARD (CONT'D)

– LANDING GEAR (fuel permitting, except for flight over water) .... DOWN

The detonation could damage the landing systems. Therefore, if fuel permits, configure the aircraft for landing as soon as possible. Reducing the speed will minimize stress on the aircraft structure.

● **For any other steps of descent :**

– 1 PSI DELTA P .... MAINTAIN

Use MAN V/S CTL to DN to adjust delta P to 1 PSI.

● **During approach :**

– CABIN PRESS MODE SEL .... AUTO

The purpose is to allow the CPC to automatically control the cabin altitude to 0 during final approach.

● **When the aircraft is on ground and stopped in a remote area (if possible) :**

R – EVACUATION .... INITIATE

Avoid exits and exiting on the same side as the bomb or near the bomb.

CABIN PROCEDURES

CAUTION

The least risk bomb location for the aircraft's structure and systems is the CENTER OF THE RH AFT CABIN DOOR.

– EOD PERSONNEL ON BOARD .... CHECK

Announce "Is there any EOD personnel on board ?". By using these initials, only those familiar with EOD (Explosive Ordnance Disposal) will be made aware of the problem.

– BOMB .... DO NOT OPEN, DO NOT CUT WIRES, SECURE AGAINST SLIPPING, AVOID SHOCKS

Secure in the attitude found, and do not lift before having checked for an anti-lift ignition device.

– PASSENGERS .... LEAD AWAY FROM BOMB

Move passengers at least 4 seat rows away from the bomb location. If the other seats are full, these passengers should sit on the floor in protected areas.

Passengers near the bomb should protect their heads with pillows, blankets, etc, and sit in the brace position.

All passengers must remain seated with seatbelts on and, if possible, head below the top of the head rest. Seat backs and tray tables should be in their full upright position.

BOMB ON BOARD (CONT'D)

– BOMB . . . . CHECK NO ANTI-LIFT DEVICE

To check for an anti-lift switch or lever, slide a string or stiff card, (such as the emergency information card) under the bomb, without disturbing the bomb.

R *If the string or card cannot be slipped under the bomb, it may indicate that an anti-lift switch or lever is present and that the bomb cannot be moved.*

If a card is used and can be slid under the bomb, leave it under the bomb and move together with the bomb. If it is indicated that an anti-lift device is present, it may be possible to move the bomb together with the surface on which the bomb is located, such as a shelf or seat cushion.

R R *If it is not possible to move the bomb, then it should be surrounded with a single thin sheet of plastic (e.g. trash bag), then with wetted materials, and other blast attenuation materials, such as seat cushions and soft carry-on baggage. Move personnel as far away from the bomb location as possible.*

● **If the bomb can be moved :**

PLACE THE BOMB AS CLOSE TO THE CENTER OF THE RH AFT CABIN DOOR AS POSSIBLE.

– PASSENGERS . . . . MOVE/ADVISE

Move passengers at least 4 seat rows away from the least risk bomb location (RH aft cabin door). If the other seats are full, these passengers should sit on the floor in protected areas towards the front of the aircraft.

Passengers near the bomb should protect their heads with pillows, blankets, etc, and sit in the brace position.

R *All passengers must remain seated with seatbelts on and, if possible, head below the top of the head rest. Seat backs and tray tables should be in their full upright position.*

R – RH AFT CABIN DOOR SLIDE . . . . DISARM

– LEAST RISK BOMB LOCATION (LRBL) . . . . PREPARE

Build up a platform of solid baggage against the door up to about 25cm (10 in) below the middle of the door.

On top of this, build up at least 25cm (10 in) of wetted material such as blankets and pillows.

R R *Place a single thin sheet of plastic (e.g. trash bag) on top of the wetted materials. This prevents any possible short circuit.*

BOMB ON BOARD (CONT'D)

– BOMB .... MOVE TO LRBL

Carefully carry in the attitude found, and place on top of the wetted materials in the same attitude and as close to the door structure as possible.

– LEAST RISK BOMB LOCATION .... COMPLETE

R *Place an additional single thin sheet of plastic over the bomb.*

Build up at least 25cm (10in) of wetted material around the sides and on top of the bomb.

DO NOT PLACE ANYTHING BETWEEN THE BOMB AND THE DOOR, AND MINIMIZE AIRSPACE AROUND THE BOMB.

The idea is to build up a protective surrounding of the bomb, so that the explosive force is only directed towards the only unprotected area into the door structure.

Fill the area around the bomb with seat cushions and other soft materials such as
R *hand luggage (saturated with water or any other nonflammable liquid) up to the cabin*
R *ceiling, compressing as much as possible. Secure the LRBL stock in place using belt,*
R *ties, or other appropriate materials. The more material stacked around the bomb, the less the damage will be.*

USE ONLY SOFT MATERIAL. AVOID USING MATERIALS CONTAINING ANY INFLAMMABLE LIQUID AND ANY METAL OBJECTS WHICH COULD BECOME DANGEROUS PROJECTILES.

– EVACUATION/DISEMBARKATION .... EXECUTE

Evacuate through normal and emergency exits on the opposite side of the bomb location.

Do not use the door just opposite the bomb.

Use all available airport facilities to disembark without delay.

VOLCANIC ASH ENCOUNTER

Accomplish the following while making a 180 degrees turn:

- ATC .... NOTIFY
- A/THR .... OFF

  This prevents the autothrust from generating thrust variations.
- THRUST (conditions permitting) .... DECREASE

  So as to reduce ash ingestion.

  R *If altitude permits, reduce thrust to idle. This maximizes engine surge margin and lowers*
  R *engine turbine temperature.*
- CREW OXYGEN MASKS .... ON/100 %
- CABIN CREW .... NOTIFY
- PASSENGER OXYGEN .... AS RQRD

  Depending on contamination.
- ENG ANTI ICE .... ON
- WING ANTI ICE .... ON
- PACK FLOW .... HI
- APU .... START

  If possible, start the APU and have it ready for an assisted engine relight in the event of an engine flame-out. Refer to APU limitations (refer to 3.01.49).
- ENGINE PARAMETERS .... MONITOR

  Monitor particularly EGT. If EGT exceeds limits, it may become necessary to consider a precautionary engine shutdown and engine restart in flight.
- AIRSPEED INDICATIONS .... MONITOR

  If airspeed is unreliable or lost, use the UNRELIABLE SPEED INDICATION procedure.

  Note : · *If both engines flame out and speed indications are lost, use the DUAL ENGINE FAILURE procedure to get the required pitch attitude for the optimum relight speed.*

  · *In case of engine failure, switch off the wing anti ice before engine restart.*

R

COCKPIT WINDSHIELD/WINDOW CRACKED

In case of a one ply failure, whichever the one may be, the windshield is still able to sustain the maximum differential pressure. Nevertheless, because the pilot is unable to accurately determine how many plies have failed, the differential pressure must be reduced to 5 PSI by applying the following procedure :

MAX FL 230

The maximum flight level is restricted to FL230 to obtain ΔP 5 PSI, without resulting in an excessive cabin altitude and corresponding EXCESS CAB ALT warning.
The following procedure, allows maintaining ΔP 5 PSI in manual cabin pressure mode.

– CAB PRESS MODE SEL . . . . MAN
– MAN V/S CTL . . . . AS RQRD

Set the cabin altitude, according to the table below :

ΔP = 5 PSI	FL	100	150	200	230
	CABIN ALTITUDE	0	3000	6000	8000

● **When starting the final descent**
– CAB PRESS MODE SEL . . . . AUTO

R

COCKPIT WINDSHIELD/WINDOW ARCING

– Affected WINDOW/WINSHIELD ANTI ICE C/B . . . . PULL

In case of electrical arcing, pull the circuit breaker of the affected window/windshield heating system :

. ANTI ICE L WHSLD (AF10) *. ANTI ICE/WINDOWS L C/B (X14)*
. ANTI ICE R WHSLD (AF03) *. ANTI ICE/WINDOWS R C/B (W14)*

R ## ECAM ADVISORY CONDITIONS

SYSTEM	CONDITIONS	RECOMMENDED ACTION
CAB PRESS	CAB VERTICAL SPEED V/S > 1800 ft/min	CPC changeover may be attempted : MODE SEL . . . . MAN Wait 10 seconds then : MODE SEL . . . . .AUTO
	CAB ALTITUDE altitude ≥ 8800 ft	MODE SEL . . . . MAN Manual pressure control
	CAB DIFF PRESS $\Delta P \geq 1.5$ psi in phase 7	LDG ELEV . . . . MAN ADJUST If unsuccessful : MODE SEL . . . . MAN Manual pressure control
ELEC	IDG OIL TEMP T ≥ 147°C	Reduce IDG load if possible (GALLEY or GEN OFF). If required, restore when temperature has dropped. Restrict use of generator to short time, if temperature rises again excessively.
FUEL	Difference between wing fuel quantities greater than 1500 kg (3307 lb)	FUEL MANAGEMENT. . . . . CHECK If a fuel leak is suspected, refer to FUEL LEAK procedure. For limitations, see 3.01.28.
	Fuel temp greater than 45°C in inner cell or 55° in outer cell	GALLEY . . . . OFF
	Fuel temp lower than – 40°C in inner or outer cell	Consider descending to a lower altitude and/or increasing Mach to increase TAT.
APU	FLAP OPEN Flap not fully closed when APU master switch is at off.	
	EGT > EGT MAX – 33°C (inhibited during APU start)	
	OIL QTY (message LOW OIL LEVEL pulsing)	If there is no oil leak, then the remaining oil quantity allows normal APU operation for about 10 hours.

R ## ECAM ADVISORY CONDITIONS

SYSTEM	CONDITIONS	RECOMMENDED ACTION
ENG	OIL PRESS P < 16 PSI	· If oil pressure is between 16 and 13 psi (advisory), continue normal operation. · If oil pressure is below 13 psi (red indication) without the ENG OIL LO PR ECAM warning, continue normal engine operation (it can be assumed that the oil pressure transducer is faulty). In both cases, monitor other engine parameters especially oil temperature and oil quantity.
	OIL PRESS P > 90 PSI	Monitor other engine parameters closely for symptoms of engine malfunction. If high oil pressure is not accompanied by other abnormal indications operate engine normally for remainder of flight. Record high oil pressure and corresponding N2 readings for maintenance action.
	OIL TEMP T > 140°C	A rise in oil temperature during normal steady-state operation indicates a system malfunction and should be closely monitored for other symptoms of engine malfunction. *Note : If OIL TEMP rise follows thrust reduction, increasing thrust may reduce oil temperature.* In addition, a rise in oil temperature could be related to the IDG oil cooling system. To reduce oil temperature rise before limits are reached, the following are recommended : 1. Low Speed - Increase engine speed to increase fuel flow and thereby cool IDG oil. 2. High Speed - Reduce generator load or turn off generator. If oil temperature continues to rise, mechanically disconnect IDG.
	OIL QTY < 3 qt	If oil quantity low at high power setting, expect level increase after power reduction
	NAC TEMP ≥ 240°C	Monitor engine parameters and cross check with other engine
	VIBRATION N1 ≥ 6 units N2 ≥ 4,3 units	Refer to HIGH ENGINE VIBRATION procedure. *Note : The advisory threshold may be decreased by a MCDU procedure at the level of vibration reached during the last flight.* *If this function has been activated, the N1 and N2 VIB indication will respectively pulse below 6 and 4.3.*

LDG CONF - APPR SPD - LDG DIST CORRECTIONS FOR FAILURES			FLAPS LEVER POSITION FOR LDG	APPR SPD : INCREMENT TO VREF (△ VREF)	MULTIPLY LDG DIST CONF FULL BY
ELEC	EMER ELEC CONFIG		3	10	1.9
	DC EMER CONFIG		NORM (1)	–	1.6
	DC BUS 1 + 2		NORM (1)	–	1.6
	DC BUS 2		NORM (1)	–	1.1
	DC ESS BUS/AC BUS 1		NORM (1)	–	Negl.
FTL CTL	ALTN LAW/DIRECT LAW ELAC 1 + 2 STAB JAM/L + R ELEV FAULT		3	10	1.2 *
	L(R) ELEV FAULT		3	15	1.2*
	ONE SPLR FAULT (except n°5)		NORM (1)	–	1.1
	TWO OR THREE SPLR FAULT		NORM (1)	–	1.1
	MORE THAN THREE SPLR FAULT		NORM (1)	–	1.2
	SEC 1 or 3 FAULT		NORM (1)	–	1.1
	SEC 2 FAULT		NORM (1)	–	Negl.
	SEC 1 + 3 FAULT		NORM (1)	–	1.2
	SEC 1 + 2 or 2 + 3 FAULT		NORM (1)	–	1.1
	SEC 1 + 2 + 3 FAULT		3	10	1.4
FLAPS/ SLATS	FLAPS and SLATS at zero		1	60 (APPR) 50 (THRESHOLD)	1.7 *
	0 < FLAPS < 1 :	Slats < 1	3	45	1.6 *
		Slats ≥ 1	3	25	1.35 *
	1 ≤ FLAPS < 2 :	Slats < 1	3	30	1.4 *
		Slats ≥ 1	3	15	1.2 *
	2 ≤ FLAPS < 3 :	Slats < 1	3	25	1.35 *
		Slats ≥ 1	3	10	1.15 *
	FLAPS = 3 :	Slats < 1	3	25	1.35 *
		1 ≤ Slats ≤ 3	3	10	1.15 *
		Slats > 3	3	5	1.1 *
	FLAPS > 3 :	Slats < 1	NOT ALLOWED		
		1 ≤ Slats ≤ 3	FULL	10	1.15 *
		Slats > 3	FULL	5	1.1 *

(1) If CONF 3 is used when “NORM” is indicated in the table, multiply the resulting landing distance by an additional factor of 1.1.

R

LDG CONF - APPR SPD - LDG DIST CORRECTIONS FOR FAILURES		FLAPS LEVER POSITION FOR LDG	APPR SPD : INCREMENT TO VREF (△ VREF)	MULTIPLY LDG DIST CONF FULL BY
HYD	BLUE or YELLOW or GREEN	NORM (1)	–	1.1
	GREEN + BLUE	3	25	1.5
	GREEN + YELLOW	3	25	2.3
	YELLOW + BLUE	NORM (1)	–	1.1
BRK	ANTI SKID	NORM (1)	–	1.4
	AUTO BRK FAULT	NORM (1)	–	1.2
NAV	IR 1 + 2 + 3 FAULT	3	10	2.1
	DUAL IR FAULT DUAL ADR FAULT ADR 1 + 2 + 3 FAULT	3	10	1.2 *
ENG	REV UNLOCK with buffet	1 **	55 (APPR) 40 (THRESHOLD)	1.75 *
	REV UNLOCK with buffet	3 **	10	1.2 *

(1) If CONF 3 is used when “NORM” is indicated in the table, multiply the resulting landing distance by an additional factor of 1.1.
* See below for multiple failures.
R ** The applicable landing configuration (CONF 1 or CONF 3) is
R displayed on the ECAM STATUS page.

USE OF THE TABLE

– *△ VREF accounts for corrections due to failure, and to the required landing configuration. The LDG DIST factor must be applied to the actual landing distance of CONF FULL.*
– *For a single failure :*
  · *Determine the required LDG CONF to be selected ;*
  · *Determine the △ VREF ;*
  · *VAPP = VREF + △ VREF + WIND CORRECTION ;*
  · *Determine the LDG DIST factor.*
– *For multiple failures :*
  · *Use the lowest LDG CONF ;*
  · *Use the highest △ VREF to compute VAPP ;*
  · *Multiply the landing distance factors together, except when all failures are indicated by an asterisk (*). In this case, the highest factor has to be taken.*
  · *Examples : Dual failure*

FLAPS FAULT (F < 3, S ≥ 1)	LDG CONF 3	△ VREF = 10 KT	LDG DIST × 1.15*
BRK ANTI SKID	NORM CONF	△ VREF = 0	LDG DIST × 1.4
TOTAL	LDG CONF 3	△ VREF = 10 KT	LDG DIST × 1.61

ALTN LAW	LDG CONF 3	△ VREF = 10 KT	LDG DIST × 1.2*
FLAPS FAULT (F < 1, S ≥ 1)	LDG CONF 3	△ VREF = 25 KT	LDG DIST × 1.35*
TOTAL	LDG CONF 3	△ VREF = 25 KT	LDG DIST × 1.35

WINDSHEAR

A red flag "WINDSHEAR" is displayed on each PFD associated with an aural synthetic voice "WINDSHEAR" repeated three times.

If windshear is detected either by the system or by pilot observation, apply the following recovery technique:

■ At takeoff

- **If before V1**

  The takeoff should be rejected only if significant airspeed variations occur below indicated V1 and the pilot decides that there is sufficient runway remaining to stop the airplane.

- **If after V1**
  - THR LEVERS . . . . TOGA
  - REACHING VR . . . . ROTATE
  - SRS ORDERS . . . . FOLLOW

■ Airborne, initial climb or landing

- THR LEVERS AT TOGA . . . . SET OR CONFIRM
- AP (if engaged) . . . . KEEP
- SRS ORDERS . . . . FOLLOW

  This includes the use of full back stick, if demanded.

  Note : 1. If engaged, the autopilot disengages when α is greater than α prot.

  2. If the FD is not available, use an initial pitch attitude up to 17.5°. If necessary to minimize the loss of height, increase this pitch attitude.
- DO NOT CHANGE CONFIGURATION (SLATS/FLAPS, GEAR) UNTIL OUT OF SHEAR.
- CLOSELY MONITOR FLIGHT PATH AND SPEED.
- RECOVER SMOOTHLY TO NORMAL CLIMB OUT OF SHEAR.

WINDSHEAR AHEAD

The "W/S AHEAD" message is displayed on each PFD. The color of the message depends on the severity and location of the windshear.

W/S AHEAD red

■ Takeoff

Associated with an aural synthetic voice "WINDSHEAR AHEAD, WINDSHEAR AHEAD".

● **Before takeoff**

- Delay takeoff, or select the most favorable runway.

● **During the takeoff run**

- Reject takeoff.

  Note : Predictive windshear alerts are inhibited above 100 knots until 50 feet.

● **When airborne**

- THR LEVERS . . . . TOGA

  As usual, the slat/flap configuration can be changed, provided the windshear is not entered.

- SRS ORDERS . . . . FOLLOW

  Note : If engaged, the autopilot disengages when α is greater than α prot.

■ Landing

Associated with an aural synthetic voice "GO AROUND, WINDSHEAR AHEAD".

Note : If a positive verification is made that no hazard exists, the warning may be considered cautionary.

- THR LEVERS . . . . TOGA
- ANNOUNCE . . . . "GO AROUND-FLAPS"
- FLAPS . . . . RETRACT ONE STEP
- L/G UP . . . . SELECT

This includes the use of full backstick, if demanded.

Note : 1. If engaged, the autopilot disengages when α is greater than α prot.
2. If the FD is not available, use a pitch initial attitude up to 17.5°. If necessary to minimize the loss of height, increase this pitch attitude.

W/S AHEAD amber

Apply precautionary measures, as indicated in the SUPPLEMENTARY TECHNIQUES 3.04.91.

GENERAL

A successful outcome for an emergency situation depends, first of all, upon each crew member's perfect knowledge and execution of the duties assigned to him.
The captain should check frequently that all crew members know exactly their assigned positions and their specific duties, as well as the duties of the other crew members, in case of an abnormal or an emergency condition.
Since it is not possible to cover all the situations that may occur, the captain will be responsible for adapting the following instructions to obtain the best coordination of the emergency operation. Should it be physically impossible for the captain to carry out his duties, another crew member will substitute for him according to the chain of command.
The procedures in this manual are AIRBUS INDUSTRIE procedures and should be considered to be a reference.

COCKPIT ASSIGNED AREAS FOR EVACUATION

– If it is NOT POSSIBLE to reach the passenger cabin :
  The crew shall evacuate the aircraft through the cockpit clearview windows, by means of the escape ropes.
  On the ground, each crew member shall assist the passengers and direct them away from the aircraft.
– If it is POSSIBLE to reach the passenger cabin :

CAPT	– He is the last person to leave the cockpit, proceeds to the cabin and assists with passenger evacuation, as situations dictate. – He is the last person to leave the aircraft and checks that all persons have been evacuated. – He evacuates the aircraft through the rear door or any other suitable exit, if he cannot reach the rear door. – On the ground, he takes command of operations until the arrival of the rescue units.
F/O	– He proceeds to the cabin. – He evacuates the aircraft through any suitable exit. – He assists passengers on the ground and directs them away from the aircraft.

CABIN CREW ASSIGNED AREAS FOR EVACUATION

R

C/A DESIGNATION	ASSIGNED JUMP SEAT	ASSIGNED DOOR	ASSIGNED AREA
1ST ATTENDANT	FWD OUTBOARD	FWD CABIN LH	FWD/MID ZONE
2ND ATTENDANT	AFT LH	AFT CABIN LH	MID/AFT ZONE LH
3RD ATTENDANT	AFT RH	AFT CABIN RH	MID/AFT ZONE RH

If the cockpit crew does not participate in the cabin evacuation, the first attendant is responsible for checking the entire cabin before leaving the aircraft.

Note : These procedures are established for the minimum required number of cabin crew.

COMMUNICATIONS

1. EMERGENCY ALERT			
FROM	TO	COMMUNICATION METHOD	REMARKS
COCKPIT	CABIN	Passenger Address (P.A.) System : "ATTENTION CREW ! AT STATIONS ! "	Short and precise announcement to warn that an emergency evacuation may be required very soon. Cabin attendants must proceed to their emergency stations and fasten their seat belts.

R

2. INITIATE EVACUATION - (RESTRICTED EXITS)			
FROM	TO	COMMUNICATION METHOD	REMARKS
COCKPIT	CABIN	P.A. System : "PASSENGER EVACUATION !" and activate EVAC signals ⊲*.	Order to immediately evacuate through all usable exits.
CABIN	COCKPIT AND CABIN	EVAC SIGNAL SYSTEM ⊲* at FWD ATTND station, P.A. System or megaphone.	Used if there is no signal or order from the cockpit, and it is unmistakably clear that an evacuation must be executed.

3. EVACUATION NOT REQUIRED			
FROM	TO	COMMUNICATION METHOD	REMARKS
COCKPIT	CABIN	P.A. System : "CABIN CREW and PASSENGERS REMAIN SEATED !"	Immediate announcement made when the Captain decides that an evacuation is not required.

LAND EVACUATION

ATTENDANTS RESPONSIBLE FOR FORWARD/AFT PAX DOOR

- Wait until aircraft stops.
- Check outside conditions.
- Open door in ARMED configuration.
- Protect the exit and watch slide deployment.
- Stand by the assist space and command passenger evacuation.
- Evacuate the cabin after checking area of responsibility.
- Assist passengers on the ground.

COCKPIT EVACUATION THROUGH WINDOW

- Open the side window.
- Pull cover of escape rope stowage.
- Remove rope from stowage and throw out of the window (yellow flap appears at the attachment end, to indicate that entire rope is unfolded).
- Hold on the window assist handle and sit on the window frame.
- Grasp rope with both hands, tip over and lower to the ground.

EVACUATION ON WATER

CABIN ATTENDANT RESPONSIBLE FOR THE DOORS

R – Deploy the slide in the same manner, as is done for land deployment.
– Pull the manual inflation handle.
Do not wait for automatic inflation.

· **If the water level is close to the door sill :**
The slide is inflated on the water.
R – Leave the slide attached to the cabin floor.
– Evacuate passengers into the water, using the slide as a flotation device.
– Last crewmember should separate the slide from the door sill.
– Cut the mooring line.

· **If the water level is too far from the door sill :**
R – Disconnect the slide from the door sill.
The slide remains tied to the aircraft by a 20 feet mooring line.
– Hold the mooring line to keep the slide close to the exit.
– Evacuate passengers into the water, using the slide as a flotation device.
– Crewmembers should board the slide last.
– Cut the mooring line.

R *Note : Evacuation priority should be attributed to those doors equipped with slides, since*
R *they can be used as flotation devices.*

FOREWORD

R The procedures contained in this Chapter are recommended by Airbus, and are consistent with the other Chapters of this manual.
The Authorities do not certificate Standard Operating Procedures. The manufacturer presents them herein as the best way to proceed, from a technical and operational standpoint. They are continually updated and the revisions take into account Operator input, as well as manufacturer experience.
In addition, Operators may amend them, as needed. However, the manufacturer recommends that Operators using the FCOM as onboard operational manual submit suggested changes to expedite publication, and maintain consistency of the manual.
The Operator should note that they may rewrite this Chapter, at their own responsibility ; this could, however, make it difficult to update the manual and keep it consistent with the other Chapters.

PRELIMINARY

The following sections contain expanded information on normal procedures.
Standard Operating Procedures consist of inspections, preparations, and normal procedures. All items of a given procedure are listed in a sequence that follows a standardized scan of the cockpit panels, unless that sequence goes against the action priority logic, to ensure that all actions are performed in the most efficient way.
Standard Operating Procedures are divided into flight phases, and are performed by memory.
These procedures assume that all systems are operating normally, and that all automatic functions are used normally.
Some normal procedures, that are non-routine will be found in the SUPPLEMENTARY TECHNIQUES Chapter (3.04), and in the SPECIAL OPERATIONS Chapter (2.04).

NORMAL CHECKLIST

After completing a given procedure, the flight crew uses the related normal checklist to ascertain that they have checked the safety points.
The crewmember that reads the checklist should announce completion of the checklist (Example : "LANDING CHECKLIST COMPLETED").
R The normal checklist, developed by Airbus, takes advantage of the ECAM system and only includes the items that may directly impact safety and efficiency if done incorrectly.
All normal checklists are requested by the PF, and read by the PNF. They are of the challenge/response type. The responding crewmember only responds to the challenge after having checked the configuration. If the configuration does not agree with the checklist response, he must take corrective action before answering.

If corrective action is not possible, the pilot modifies the response to reflect the actual situation (specific answer). Whenever necessary, the other crewmember crosschecks the validity of the response. The challenger waits for the response, before proceeding any further.
For the checklist items identified "AS RQRD", the response states the actual condition or configuration of the system (for example "ANTI ICE"............."ON").

Note : *Normal checklists are not "TO DO" lists. The flight crew should have performed the actions, or checks, prior to going through the checklist.*
Obviously, the flight crew must take corrective action on any item that is not in the proper condition, when it reads the list.

COMMUNICATION

R · Cross-cockpit communications :
Cross-cockpit communication is VITAL for any two-pilot crew. Whenever a crewmember makes any adjustments or changes to any information or equipment on the flight deck, he must advise the other crewmember and obtain an acknowledgement. This includes such items as : FMGS alterations, changes in speed or Mach, the tuning of navigation aids, flight plan modifications, and the selection of such systems as anti-ice and pack low flow.
The flight crew must use headsets from engine startup to top of climb, and from top of descent until the aircraft is parked.
R · Sterile cockpit rule :
R Below 10 000 feet, any non-essential conversation within the cockpit and between the
R cabin and cockpit crews should be avoided. Adherence to this policy facilitates effective
R crew communication, as well as communication of emergency or safety-related
R information by cabin crew.

USE OF THE FLIGHT MANAGEMENT AND GUIDANCE SYSTEM

The FMGC has 3 functions :
– The two FG (Flight Guidance) functions :
  · Autopilot (AP) and Flight Director (FD)
  · Autothrust (A/THR)
– The FM (Flight Management) function.

AUTOPILOT AND FLIGHT DIRECTOR

The design objective of the AP and FD is to provide assistance to the crew throughout the flight :
– By freeing up the Pilot Flying from routine handling tasks, and thus providing time and resources to assess the overall operational situation.
– By providing the Pilot Flying with adequate attitude or flight path orders, with the flight director symbol on the Primary Flight Display, so as to facilitate accurate handling of the aircraft.

The AP/FD guides the aircraft along the intended flight path, or at the intended speed, according to the guidance modes engaged by the pilot on the Flight Control Unit (FCU). (Example : NAV-HDG-V/S...).

The FCU is the short-term interface between the pilot and the FMGC, used to select guidance targets and arm/engage guidance modes.

There are 2 types of modes and associated targets :

- Managed modes and targets : The aircraft is guided along the FMS lateral and vertical flight plan and speed profile. These modes and targets are armed or engaged by pressing the FCU knobs.
- Selected modes and targets : The aircraft is guided by selected targets according to the modes selected on the FCU. These modes and targets are armed or engaged by the pilot by turning and pulling the FCU knobs.

The PF's task is to set the desired modes and targets to fly the aircraft where he wants to go.

- If the autopilot is used, the PF may select the modes on the FCU.
R – If the autopilot is not used, the PF asks the PNF to select the intended modes and targets on the FCU.

The armed and engaged modes are indicated on the Flight Mode Annunciator (FMA) on top of the PFD ; the targets (SPD, ALT, HDG...) are indicated on the associated scales on the PFD.

- The crew must check the FCU-selected targets on the PFD.
- The crew must monitor the engaged/armed modes on the FMA.

If the autopilot and/or flight director do not guide the aircraft where the crew is expecting:

- The PF should disengage the autopilot using the instinctive disconnect pushbutton on the sidestick, or both pilots should delete the flight director symbols from the PFDs with the flight director pushbuttons located on the EFIS control panel, and fly the aircraft manually.
- The PF should not disengage the autopilot by sidestick override, except if instinctive reaction.

The autopilot may be used from after takeoff down to a late stage of the approach (including autoland when permitted).

The autopilot may be used in most failure cases, when available :

- In case of engine failure, without any restriction including autoland on CATII/CATIII ILS.
- In case of abnormal configuration, down to 500 feet AGL in all modes.

When the autopilot is engaged, there is no backdriven feedback system to the sidestick, since this is no longer necessary with fly-by-wire controls.

When the PF handflies the aircraft using the flight director, he must obey the flight director orders ; in other words, the crossbars must be centered, or the flight path vector must be on the flight path director symbol so as to fly according to the selected modes and targets.

- If the PF does not wish to fly the flight director orders,both pilots must delete the flight director symbols from the PFDs.
- When flying a visual approach, the flight directors should be deselected.

AUTOTHRUST (A/THR)

The A/THR's design objective is to provide assistance to the crew for thrust management throughout the flight.
The A/THR may be engaged in one of the following modes, which automatically depend on the AP/FD vertical modes :
– THRUST mode : The A/THR maintains a fixed thrust level (e.g. THR CLB or THR IDLE), when the AP/FD guides the aircraft in climb or descent at a constant speed (e.g. CLB or DES modes)
– SPEED/MACH mode : The A/THR varies the thrust, so as to maintain a target speed, when the AP/FD guides the aircraft on a given trajectory (e.g. V/S, ALT, G/S modes).
When the A/THR is active, the thrust levers are set to detents (e.g. MCT, CLB) ; they remain in this fixed position, while the A/THR varies or sets the thrust according to the active mode.
When the A/THR is active, the thrust lever position defines the maximum thrust available for the A/THR.
The crew must monitor the A/THR to ensure correct operation :
– On the PFD, by checking the active mode on the FMA, the current speed versus the target speed and, most importantly, the speed trend vector on the speed scale.
– On the ECAM, by checking the thrust command symbols on the engine thrust indication (N1 or EPR).
In case the PF is not satisfied with the A/THR's operation, he must disengage it using one of the instinctive disconnect pushbuttons located on the thrust levers.
He can then command the thrust manually, which is totally conventional.
R The A/THR may be used from thrust reduction, after takeoff, down to flare, at landing.
The A/THR may be used in most failure cases, when available, in case of :
– One engine failure, without any restrictions ;
– Abnormal configuration, with selected target speed for the approach.

FLIGHT MANAGEMENT SYSTEM (FMS)

The FMS is designed to provide assistance to the crew for :
– Navigation
– Flight planning
– Aircraft performance (optimum speeds/altitudes)
– Predictions
The FMS is an important long-term planning and management tool, linked to the AP/FD.
When the AP/FD is engaged in Managed modes, the aircraft is guided along the FMS flight plan, using the FMS target speeds.
The Multipurpose Control and Display Unit (MCDU) is used to insert and retrieve data to/from the FMS.
The FMS MCDU is a major interface between the pilots and the FMS. However, the various FMS entries required at successive flight phases should not distract the crew from the general flight conduct and duties.

The prime concern for the flight crew should be :
— is the aircraft flying as expected NOW ?
— what is the aircraft expected to fly NEXT ?
If any doubt is raised about the aircraft current trajectory, or proposed target speed..., the PF must immediately select the appropriate modes and targets on the FCU (which automatically disengages the managed modes).
Subsequently and if time permits, the PNF will analyze and correct whatever might have gone wrong on the MCDU.

GENERAL RULES FOR GOOD USE OF THE FMGS

— Monitor the AP/FD/ATHR modes and engagement status on the FMA
— Any FMA modification must be announced.
— Monitor the result of any target selection performed on the FCU, on the related scales of the PFD (e.g. SPD target, on SPD scale)
— Monitor the AP/FD/ATHR resulting guidance, on the basic flight instrument scales of the PFD (HDG, SPD, ALT, attitude...)
— If the PF is not satisfied with the guidance he must :
 · REVERT TO BASICS
 · FLY THE AIRCRAFT where he wants to go.

The FMGS description and procedures are provided in the FCOM VOL 4 called FMGS PILOT'S GUIDE.

TAKING OVER THE FLIGHT CONTROLS

Because of the nature of "fly by wire" and "side stick" systems, the PNF should not make control inputs to correct the PF's handling of the aircraft.
If a take-over becomes necessary during flight, the PNF must call clearly "I have control", and press the sidestick priority pushbutton, keeping it pressed until the transfer of control is clearly established.

TECHNICAL CONDITION OF THE AIRCRAFT

— The crew will verify the technical state of the aircraft (deferred defect list), with regard to airworthiness, acceptability of malfunctions (MEL), and influence on the flight plan.

WEATHER BRIEFING

— The crew will get a weather briefing.
— The briefing should include :
  · Actual and expected weather conditions, including runway conditions for takeoff and climb-out.
  · Significant weather enroute, including winds and temperatures.
  · Terminal forecasts for destination and alternate airports.
  · Actual weather for destination and alternates, for short range flights and recent past weather, if available.
  · Survey of the meteorological conditions at airports along the planned route.

Weather can affect the choice of routing (for example, influence which route is quickest) and the choice of flight level. The flight crew must also consider the possibility of runways being contaminated at the departure and destination airfields. The flight crew must also verify ISA deviations and enroute icing conditions, and must consider the possibility of holding due to weather at the destination.

NOTAMS

— The flight crew must examine NOTAMs for changes to routings, unserviceable navaids, availability of runways and approach aids etc, all of which may affect the final fuel requirement.
— In order to prevent the risks of projection of debris towards the trimmable horizontal stabilizer and the elevators, it is not recommended to takeoff from runways in bad condition (loose surface, under repair, covered with debris...).

FLIGHT PLAN AND OPERATIONAL REQUIREMENTS

— The crew will check the company flight plan for routing, altitudes, and flight time.
— The Captain will check the ATC flight plan and ensure that it :
R · Is filled in and filed, in accordance with the prescribed procedures,
  · It agrees with the fuel flight plan routing.
— The crew will check the estimated load figures, and will calculate the maximum allowable takeoff and landing weights.

OPTIMUM FLIGHT LEVEL

The flight crew should choose a flight level that is as close to the optimum as possible. To obtain the optimum flight level, use the chart in the QRH or in the FCOM (Refer to FCOM
R 2.05.20).
As a general rule, an altitude that is 4000 feet below the optimum produces a significant penalty (approximately 5 % of fuel). Flight 8000 feet below the optimum altitude produces a penalty of more than 10 % against trip fuel. (The usual contingency allowance is 5 %).

FUEL REQUIREMENTS

COMPUTERIZED FLIGHT PLAN CHECK

In most cases the flight crew uses a computer-derived flight plan to obtain the correct fuel requirements. Although these computerized requirements are normally accurate, the flight crew must check them for gross errors.
The easiest way to do this is to use the "Quick Determination of F-PLN" tables in FCOM
R 2.05.40. Although the aircraft will fly at ECON MACH that is based on the cost index, the 0.78 Mach table is accurate enough to permit the crew to check for gross error.
Ensure that both the captain and the first officer have verified that the fuel calculations and required fuel on board are correct and that the figure complies with the applicable regulations.

FUEL TRANSPORTATION

The flight crew must check the policy covering the "tankering" of fuel on sectors where there is a favourable fuel price differential or operational requirement.
Remember that carrying unnecessary extra fuel increases the fuel consumption for that sector and therefore reduces the economy of the operation (lower flex temperature, more tire and brake wear, more time in climb phase, lower optimum flight level etc).

SAFETY EXTERIOR INSPECTION

Items marked by (*) are the only steps to be completed during a transit stop.
This inspection ensures that the aircraft and its surroundings are safe for operations.
On arriving at the aircraft, check for obstructions in the vicinity, engineering activity, refueling, etc.

*– **WHEEL CHOCKS . . . . CHECK IN PLACE**

*– **LANDING GEAR DOORS . . . . CHECK POSITION**

> WARNING
> Do not pressurize the green hydraulic system without clearance from ground personnel, if any gear door is open. Remember that the green hydraulic system is pressurized if the yellow system is pressurized and the PTU is on auto.

*– **APU AREA . . . . CHECK**
Observe that the APU inlet and outlet are clear.

PRELIMINARY COCKPIT PREPARATION

Items marked by asterisks (*) are the only steps to be completed during a transit stop.
The following procedure, performed by the PNF ensures that all required checks are performed before the application of electrical power to avoid inadvertent operation of systems and danger to the aircraft and personnel.
Included is APU starting and the establishment of electrical and pneumatic power.

ENG

– **MASTER 1 and 2 . . . . OFF**

– **MODE selector . . . . NORM**

L/G

– **L/G lever . . . . Check DOWN position**

WIPERS

– **WIPERS . . . . OFF**

ELEC

■ **If the aircraft has not been electrically supplied for 6 hours or more, perform the following check :**

– **BAT 1 and 2 . . . . CHECK OFF**

– **BAT 1 and 2 VOLTAGE . . . . CHECK ABOVE 25.5 V**
Battery voltage above 25.5 V ensures a charge above 50 %.

● **If battery voltage is below 25.5 V :**
a charging cycle of about 20 minutes is required.

– **BAT 1 and 2 . . . . AUTO**

– **EXT PWR . . . . ON**
Check on ECAM ELEC page, battery contactor closed and batteries charging.

● **after 20 minutes :**

– **BAT 1 + 2 . . . . OFF**

– **BAT 1 and 2 VOLTAGE . . . . CHECK ABOVE 25.5 V**

● **If battery voltage is above 25.5 V :**

– **BAT 1 and 2 . . . . AUTO**
If the APU is started on batteries only, it should be started within 30 minutes after the selection of batteries to AUTO (35 minutes after battery selection to AUTO, the battery charge is less than 25 % of maximum capacity).

■ **<u>If the aircraft has been electrically supplied during the last 6 hours :</u>**

– **BAT 1 and 2 . . . . AUTO**

– **EXT PWR (when AVAIL light is on) . . . . ON**
AVAIL light goes out.

<u>HYD</u>

WARNING

R Do not pressurize hydraulic systems without clearance from ground crew.

<u>APU FIRE</u>

– **APU FIRE pushbutton . . . . IN and GUARDED**

– **AGENT light . . . . OUT**
If the APU is already running, ensure that the following check has already been completed. If not, perform it.

– **APU FIRE TEST pushbutton . . . . PRESS**
Check :
· APU FIRE warning on ECAM + CRC + MASTER WARN light (if AC Power available).
· APU FIRE pushbutton lighted red.
· SQUIB and DISCH lights on

APU START

■ **If EXT PWR ON light is on :**

– **APU MASTER switch . . . . ON**
ON light comes on.
APU page appears on ECAM.

R – **APU START . . . . ON**
FLAP OPEN indication appears on ECAM APU page.
On ECAM APU page, N and EGT rise.
When N = 95 % :
. On ECAM APU page, AVAIL indication appears.
. On APU panel : START ON light goes out.
AVAIL light comes on.
10 seconds later :
. ECAM DOOR page replaces ECAM APU page.

– **EXT PWR . . . . AS RQRD**

■ **if EXT PWR ON light is out:**

– **APU MASTER switch . . . . ON**
ON light comes on.

– **APU START . . . . ON**
At 95% RPM :
· START ON light goes out.
· AVAIL light comes on.
· APU GEN comes on line.
· ECAM APU page appears after 10 seconds.
If required, adjust brightness on ECAM control panel.
10 seconds later :
· ECAM DOOR page replaces ECAM APU page.

COCKPIT LIGHTS

*– **COCKPIT LIGHTS . . . . AS RQRD**
· Set OVHD INTEG LT, STBY COMPASS, DOME, ANN LT switches as required.
· Set FLOOD LT, and INTEG LT as required.
DOME light should be on because it is the only lighting source in the EMER ELEC configuration. The DIM position is recommended for takeoff.

* PARKING BRAKE

*– **PARKING BRAKE . . . . ON**

*– **ACCU PRESS & BRAKES PRESS indicators . . . . CHECK**
– Check for normal indications.
– The ACCU PRESS indication must be in the green band. If required use the electric pump on yellow hydraulic system to recharge the brake accumulator.

WARNING

Yellow and green hydraulic systems are pressurized from yellow electric pump. Get ground crew clearance before using the electric pump.

ALTERNATE BRAKING SYSTEM

Note : *The purpose of this check is to verify, before the first flight of the day, the efficiency of the alternate braking system (absence of "spongy pedals").*

– **Y ELEC PUMP . . . . CHECK OFF**

– **CHOCKS . . . . CHECK IN PLACE**

– **PARKING BRAKE . . . . OFF**

– **BRAKE PEDALS . . . . PRESS**
Apply maximum pressure on both pedals.

– **BRAKE PRESSURE (on BRAKE press indicator) . . . . CHECK**
Pressure must build up without delay symmetrically on left and right sides for the same application simultaneously applied on left and right pedals. With full pedal deflection, the
R pressure must be between 2000 and 2700 psi.

– **BRAKE PEDALS . . . . RELEASE**

– **PARKING BRAKE . . . . ON**
The parking brake must be on during the exterior inspection to allow the flight crew to check brake wear indicators.

F/CTL

– **FLAPS . . . . CHECK POSITION**
Check the upper ECAM display to confirm that the FLAPS position agrees with the handle position.

R *– **SPEEDBRAKE lever . . . . CHECK RETRACTED and DISARMED**

> WARNING
> If flight control surface positions do not agree with the control handle positions, check with the maintenance crew before applying hydraulic power.

PROBE/WINDOW HEAT

– **PROBE/WINDOW HEAT . . . . CHECK AUTO**

AIR COND

– **APU BLEED . . . . ON**
R Do not use APU BLEED, if ground personnel confirms that ground air unit is connected.
R Pilots should also check the ECAM BLEED page to determine whether an HP ground air
R unit is connected (pressure in the bleed system).

– **ALL WHITE LIGHTS . . . . OFF**

– **X BLEED . . . . AUTO**

– **Zone temperature selectors . . . . AS RQRD**
Full range temperature 24 ± 6° C (75 ± 11° F).

CARGO HEAT ⊲*

– **SELECTORS . . . . AS RQRD**
Set temperature selectors, as required.

ELEC

– **Scan and check that there are no amber lights, except GEN FAULT lights.**

VENT

– **Check all lights off.**

LEFT INTENTIONALLY BLANK

* ECAM

*– **RECALL . . . . PRESS**
· Press the RECALL pushbutton for at least 3 seconds to recall all warnings that have been cleared or cancelled.
· If applicable, check warnings compatible with MEL, then CLEAR or CANCEL them. If any action is required, call maintenance personnel as soon as possible.

*– **DOOR . . . . PRESS**
If oxygen pressure is below 1500 psi (boxed in amber) check “MIN FLT CREW OXY CHART” to ascertain if it is sufficient for the scheduled flight (Refer to 3.01.35).

*– **HYD . . . . PRESS**
Check that the quantity indexes are in the normal filling range.

*– **ENG . . . . PRESS**
R Check that the oil quantity is at or above 9.5 qts + estimated consumption (maximum
R average estimated consumption ~ 0.5 qt/h).

EMERGENCY EQUIPMENT

– **Check the following equipment :**
- Life jackets stowed
- Axe stowed
- Smoke hoods ◁* or portable oxygen equipment and full face masks ◁* stowed and serviceable
- Portable fire extinguisher lockwired and pressure in the green area
- Smoke goggles stowed (smoke hoods if installed)
- Oxygen masks stowed
- Flashlights stowed
- Escape ropes stowed

RAIN REPELLENT

– **Pressure and quantity indicators** . . . . **CHECK**

CAUTION
Never use rain repellent to wash the windshield and never use it on a dry windshield.

REAR and OVERHEAD CIRCUIT BREAKERS panels

– **REAR and OVERHEAD CIRCUIT BREAKERS panels** . . . . **CHECK**
Check that all circuit breakers are set. Reset as necessary.

GENERAL

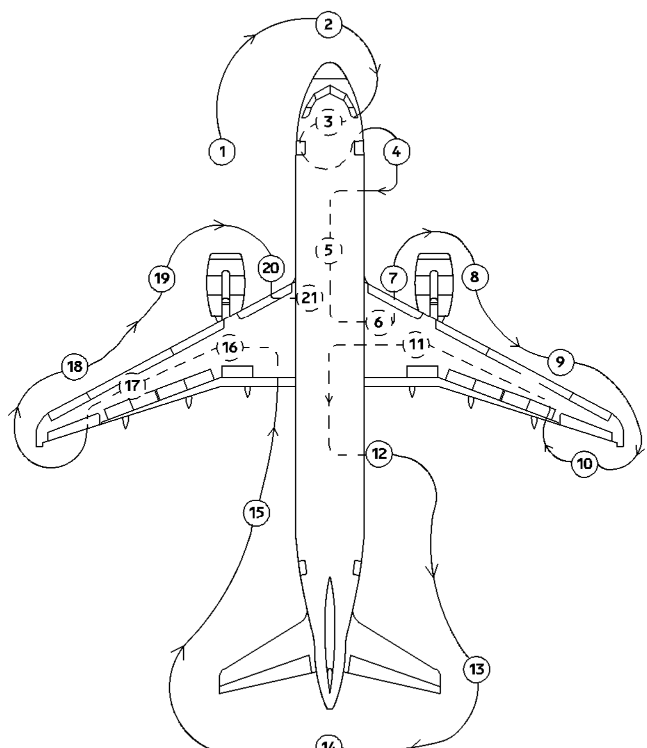
The exterior inspection ensures that the overall condition of the aircraft and its visible components and equipment are safe for the flight.
Complete inspection is normally performed by maintenance personnel or in the absence of maintenance personnel by a flight crew member before each originating flight.
Items marked by asteriks (*) must be performed again by a flight crew member before each flight.
The parking brake must be on during the exterior inspection to allow the flight crew to check brake wear indicators.

- Check structure for impact damage
- R Check that there is no evident fuel, oil or hydraulic leaks.

WARNING

If a landing gear door is open, contact the maintenance crew before applying hydraulic power.

EXTERIOR WALK-AROUND



(1) LH FWD FUSELAGE

*– AOA probes . . . . CONDITION
– F/O and CAPT static ports . . . . CLEAR
– Avionics equipment vent air inlet valve . . . . CONDITION
– Oxygen bay . . . . CLOSED
– Oxygen overboard discharge indicator . . . . GREEN
*– Toilet servicing door (if installed) . . . . CLOSED

(2) NOSE SECTION

*– Pitot probes . . . . CONDITION
– STBY static ports . . . . CLEAR
*– TAT probes . . . . CONDITION
*– Radome and latches . . . . CONDITION/LATCHED
– Forward avionics compartment door . . . . CLOSED
– Ground electrical power door (if not required.) . . . . CLOSED

(3) NOSE L/G

*– Nose wheel chocks . . . . IN PLACE
*– Wheels and tires . . . . CONDITION
– Nose gear structure . . . . CONDITION
– Taxi, TO, turn-off lights . . . . CONDITION
– Hydraulic lines and electrical wires . . . . CONDITION
– Wheel well . . . . CHECK
– Safety pin . . . . REMOVED

(4) RH FWD FUSELAGE

– RH + AFT avionic compartment doors . . . . CLOSED
– Avionic equipment vent air outlet valve . . . . CONDITION
– F/O-CAPT static ports . . . . CLEAR
*– AOA probe . . . . CONDITION
– Forward cargo door and selector panel . . . . CHECK

(5) LOWER CENTER FUSELAGE

– Potable water drain panel (if installed) . . . . CLOSED
– Antennas . . . . CONDITION
– Drain mast . . . . CONDITION
– RAM air inlet flap . . . . CONDITION
– LP and HP ground connection doors . . . . CLOSED
– Anticollision light . . . . CHECK
– CTR TK magnetic fuel level . . . . FLUSH
– Pack air intakes and outlets . . . . CLEAR

(6) RH CENTER WING

– Yellow hydraulic bay door . . . . CLOSED
– Fuel panel . . . . CLOSED
– Inner tank magnetic fuel . . . . FLUSH
– Fuel water drain valve inner tank . . . . NO LEAK
– Landing light . . . . CONDITION
*– Slat 1 . . . . CONDITION

(7) ENG 2 LH SIDE

– Oil fill access door . . . . CLOSED
– Master magnetic chip detector access door (IAE only) . . . . CLOSED
*– Fan cowl doors . . . . CLOSED/LATCHED
*– Drain mast . . . . CONDITION/NO LEAK
*– Engine inlet and fan blades . . . . CHECK

(8) ENG 2 RH SIDE

– Vent inlet (CFM only) . . . . CLEAR
– Pressure-relief/Start valve handle access door . . . . CLOSED
– Turbine exhaust (CFM only) . . . . CLEAR
– Pylon/access panel . . . . CONDITION/CLOSED

(9) RH WING LEADING EDGE

*– Slats 2, 3, 4, 5 . . . . CONDITION
– Inner and outer cells magnetic fuel level . . . . FLUSH
– Fuel water drain valves (outer cell, surge tank) . . . . NO LEAK
– Refuel coupling . . . . CLOSED
– Surge tank air inlet . . . . CLEAR
*– Fuel ventilation overpressure disc . . . . INTACT
– Navigation light . . . . CONDITION
*– Wing tip . . . . CONDITION

(10) RH WING TRAILING EDGE

- Static dischargers . . . . CHECK
*– Control surfaces . . . . CONDITION
*– Flaps and fairings . . . . CONDITION

(11) RH L/G AND FUSELAGE

*– Chocks . . . . REMOVED
*– Wheels and tires . . . . CONDITION
- Brakes and brake wear ind. . . . . CONDITION
- Torque link damper ⊲✱ . . . . CONDITION
- Hydraulic lines . . . . CHECK
- Landing gear structure . . . . CHECK
- Downlock springs . . . . CHECK
- Safety pin . . . . REMOVED
- Ground hydraulic connection yellow . . . . CLOSED
- Water drain mast ⊲✱ . . . . CONDITION
- Shroud fuel drain . . . . CONDITION/NO LEAK

(12) RH AFT FUSELAGE

- Cargo door and selector panel . . . . CHECK
- Bulk door ⊲✱ . . . . CHECK
*– Toilet service access door . . . . CLOSED
- Outflow valve . . . . CONDITION
- Drain mast . . . . CONDITION
- Flight recorder access door . . . . CLOSED

(13) TAIL

*– Stabilizer, elevator, fin, and rudder . . . . CONDITION
- Static dischargers . . . . CHECK
*– Lower fuselage structure (tail impact on runway) . . . . CONDITION

(14) APU

- Access doors . . . . CLOSED
- Air intake . . . . CONDITION
- Drain . . . . CONDITION/NO LEAK
- Oil cooler air outlet . . . . CLEAR
- Exhaust . . . . CLEAR
- Navigation light . . . . CONDITION
- Fire extinguisher overpressure indication (red disc) . . . . IN PLACE

⑮ LH AFT FUSELAGE

*– Stabilizer, elevator, fin, and rudder . . . . CONDITION
*– Potable water service door . . . . CLOSED
– Ground hydraulic connection blue and green doors . . . . CLOSED
– Hydraulic reservoir filling door . . . . CLOSED

⑯ LH LANDING GEAR

*– Chocks . . . . REMOVED
*– Wheels and tires . . . . CONDITION
– Brakes and brake wear indicator . . . . CONDITION
– Torque link damper ⊲* . . . . CONDITION
– Hydraulic lines . . . . CHECK
– Landing gear structure . . . . CHECK
– Downlock springs . . . . CHECK
– Safety pin . . . . REMOVED

⑰ LH WING TRAILING EDGE

*– Flaps and fairing . . . . CONDITION
*– Control surfaces . . . . CONDITION
– Static dischargers . . . . CHECK

⑱ LH WING LEADING EDGE

*– Wing tip . . . . CONDITION
– Navigation light . . . . CONDITION
– Surge tank air inlet . . . . CLEAR
R *– Fuel ventilation overpressure disc . . . . INTACT
– Fuel water drain valve . . . . NO LEAK
– Inner and outer cell magnetic fuel level . . . . FLUSH
*– Slats 2, 3, 4, 5 . . . . CONDITION

⑲ ENG 1 LH SIDE

– Oil fill access door . . . . CLOSED
– Master magnetic chip detector access door (IAE only) . . . . CLOSED
*– Fan cowl doors . . . . CLOSED/LATCHED
*– Drain mast . . . . CONDITION/NO LEAK
*– Engine inlet and fan blades . . . . CHECK

(20) ENG 1 RH SIDE

– Vent inlet (CFM only) . . . . CLEAR
– Pressure relief/Start valve handle access door . . . . CLOSED
– Turbine exhaust (CFM only) . . . . CLEAR
– Pylon/access panel . . . . CONDITION/CLOSED

(21) LH CENTER WING

*– Slat 1 . . . . CONDITION
– Wing leading edge ventilation intake ⊲*| . . . . CLEAR
– Fuel water drain valves . . . . NO LEAK
R – Inner tank magnetic fuel . . . . FLUSH
– Landing lights . . . . CONDITION
– Hydraulic reservoir pressurization door . . . . CLOSED
– RAT doors . . . . CLOSED

INTRODUCTION

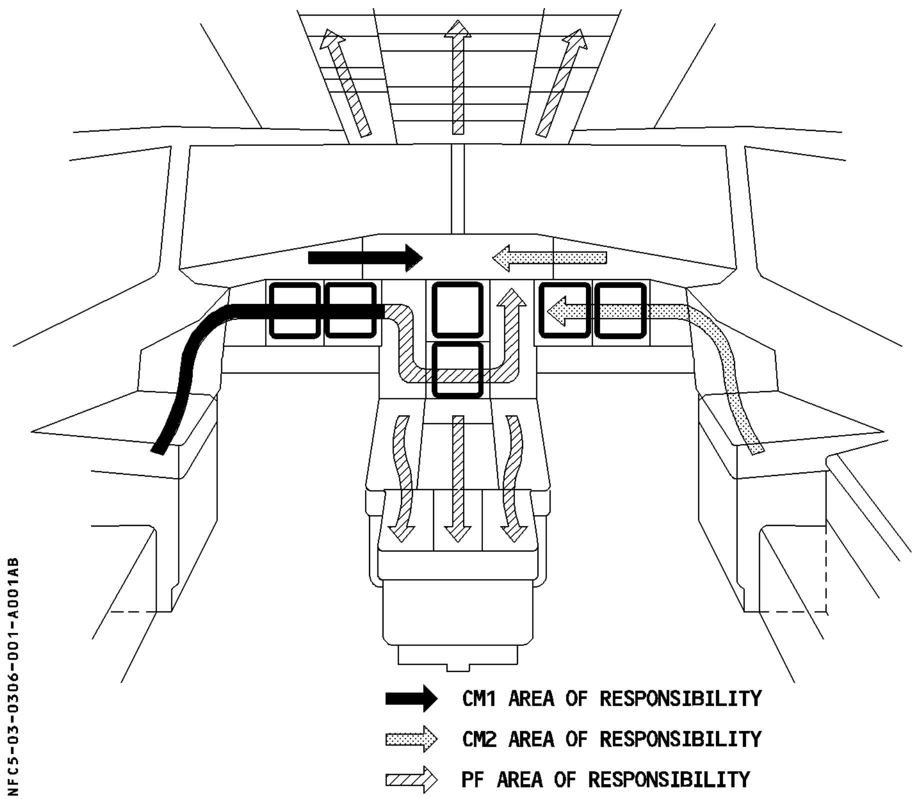
Items marked by (*) are the only steps to be completed during a transit stop.
The PF and PNF should perform the cockpit preparation according to the panel scan sequence, defined below, and the task sharing defined in the Quick Reference Handbook (QRH).

DOCUMENTATION AND MAINTENANCE

On entering the aircraft, obtain the technical (maintenance) log and verify that the certificate of maintenance and daily inspection (or similar) are up to date and signed. Check the deferred or carried-forward defects. If refueling has already been completed, check the uplift.

PANEL SCAN SEQUENCE

R



*– **GEAR PINS and COVERS . . . . CHECK**
Check that three are on board and stowed.

OVERHEAD PANEL

IT IS A GENERAL RULE TO TURN OFF ALL WHITE LIGHTS FOR ALL THE SYSTEMS DURING THE SCAN SEQUENCE. THESE ACTIONS ARE, THEREFORE, NOT LISTED HERE.

RCDR

*– **RCDR GND CTL . . . . ON**

– **CVR TEST . . . . PRESS AND RELEASE**
Check low frequency signal through the loudspeakers.

Note : Parking brake must be ON to perform the CVR test.

EVAC

– **CAPT and PURS/CAPT switch . . . . AS RQRD**
The usual position is CAPT.

*** ADIRS**

*– **Mode rotary selectors (3) . . . . NAV**
- The ADIRS outputs are used by many of the aircraft's systems, so it is essential to set the selectors to NAV as early as possible to provide data to the related systems.
- For the first flight of the day, set mode selectors to NAV. Alignment lasts approximately 10 minutes, depending on the latitude.
  Check that the ALIGN lights of the three ADIRS are on.
  Enter the present position, just after switching the three mode selectors to NAV, to avoid excessive ADIRS drift.
- For normal transit stops, it is normally not necessary to realign the IRSs. However, the flight crew should monitor their performance by checking the residual ground speed on the CDU with the aircraft stationary. If one IRS has a residual ground speed greater than 5 knots, complete a fast alignment on all 3 IRSs :
  . Set all 3 ADIRS CDU selectors to OFF.
  . Set all 3 ADIRS CDU selectors back to NAV within 5 seconds.
  . Press ALIGN IRS, and check coordinates received by ADIRS.

Note : For flights with long segments on which there are no FMGC position updates with radio navigation, perform a complete alignment. For other flights, a fast
R *alignment is sufficient. ADIRS performance may be degraded, if complete*
R *alignments are systematically performed.*

EXT LT

– **EXTERIOR LIGHTS . . . . AS RQRD**
Set the STROBE switch to AUTO, the BEACON switch to OFF, and remaining switches as required.

*** SIGNS**

*– **SEAT BELTS . . . . ON/AUTO**

*– **NO SMOKING . . . . AUTO**

*– **EMER EXIT LT . . . . ARM**

Note : Leaving the NO SMOKING selector ON prevents the emergency batteries from charging.
If the CIDS has been programmed (option) for a non-smoking flight, NO SMOKING signs are permanently on, with the NO SMOKING switch at AUTO (with permanent charge of emergency batteries).

CABIN PRESS

– **LDG ELEV . . . . AUTO**

*** AIR COND**

*– **PACK FLOW . . . . AS RQRD**
Select :
LO : If the number of passengers is below 115.
HI : For abnormally hot and humid conditions.
NORM : For all other normal operating cases.
If the APU is supplying, pack controllers select HI flow automatically, independent of the selector position.

ELEC

– **ECAM ELEC PAGE . . . . CALL**

– **BAT 1 + 2 . . . . OFF then ON**
R 10 seconds after selecting ON, check on the ECAM ELEC page that both battery charge currents are below 60 A and decreasing.

*** FUEL**

Apply the following procedure, if your airline is affected by FUEL CTR TK PUMP LO PR warnings in flight when the center tank is empty :

● **If the center tank is empty for the flight :**

– **FUEL MODE SEL . . . . MAN**

– **CTR TK PUMP 1 and 2 . . . . OFF**

ENG 1 – ENG 2 FIRE

– **ENG 1 and 2 FIRE pushbuttons . . . . CHECK IN and GUARDED**

– **AGENT 1 and AGENT 2 lights . . . . CHECK OUT**

– **ENG 1 (2) TEST pushbutton . . . . PRESS**
Check :
· ENG 1 (2) FIRE warning on ECAM + CRC + MASTER WARN light.
· ENG FIRE pushbutton lighted red.
· SQUIB and DISCH lights on.
· FIRE light (on ENG panel) on.

AUDIO SWITCHING panel

– **AUDIO SWITCHING panel . . . . NORM**

THIRD OCCUPANT AUDIO CONTROL PANEL

– **PA reception knob . . . . Select reception**
· This allows cabin attendant announcements to be recorded on the CVR.
· For proper recording, set volume at or above medium range.

MAINTENANCE PANEL

– **Check all lights out. If not out, select associated pushbutton switch to off.**

RMP

– **RMP . . . . ON**

– **Green NAV light . . . . CHECK OFF**

– **SEL light . . . . CHECK OFF**

– **COM FREQUENCIES . . . . TUNE**
Use VHF 1 for ATC (only VHF1 is available in emergency electrical configuration), VHF2 for ATIS and company frequencies. VHF3 is normally devoted to ACARS.

* AIRFIELD DATA

Obtain data needed for initializing the system and preparing the cockpit. This should include, RUNWAY IN USE, ALTIMETER SETTING, and WEATHER DATA.

* ATC CLEARANCE

Obtain ATC clearance or use the probable clearance.

* ACARS

R Initialize ACARS at that point or after FMGS INITIALIZATION, as per company policy.

*FMGS INITIALIZATION

At electrical power-up, the FMGSs and FCU run through various internal tests. Allow enough time (3 minutes) for tests' completion, and do not start to press pushbuttons until the tests are over. If the "PLEASE WAIT" message appears, do not press any MCDU key until the message clears.

*– **ENGINE & AIRCRAFT TYPE** . . . . **CHECK**

*– **FM database validity** . . . . **CHECK**
· Press the DATA key, and display the STATUS page (if not displayed).
· Check DATA BASE validity and stored WPT/NAVAIDS/RWY/ROUTES, if any.
If applicable, review the stored data for deletion decision.

*– **NAVAID DESELECTION** . . . . **AS RQRD**
If NOTAMs warn of any unreliable DME or VOR/DME, display DATA, then POSITION MONITOR. Access the SEL NAVAID page, and deselect the related navaid.

*– **FLIGHT PLAN INITIALIZATION** . . . . **COMPLETE**
· Press the INIT key.
· Insert CO RTE or city pair, and check FROM/TO.
· Check/modify ALTN/CO RTE.
· Enter flight number.

Note : *For ATC needs, the crew should enter exactly the entire flight number, as shown on the ICAO flight plan, without inserting any space, on the MCDU INIT page.*

· Enter (and/or check) cost index.
· Enter intended initial CRZ FL, or check if it was already supplied by the database. Modify it, if necessary, taking into account ATC constraints or expected gross weight.
· Check and modify CRZ FL TEMP and tropopause level to agree with forecast.
· Check latitude/longitude.

*– **ALIGN IRS prompt** . . . . **PRESS**
· Enter the present position, just after switching the three mode selectors to NAV.
· Do not move the aircraft, as long as alignment is not completed.
· The IRSs are usually aligned to the departure airport reference point coordinates. It is recommended to use these coordinates, as stored in the navigation database, for transit flights, or for any flight with GPS. When published, use of the gate coordinates (insert/slew in the INIT A page) should be reserved for aircraft without GPS, and when flying long segments without radio updates.
· When IRS alignment is completed, the RESET IRS TO NAV message on the MCDU may indicate a discrepancy between FM and IRS positions.

*– **F-PLN A page . . . . COMPLETE AND CHECK**
If CO RTE has been inserted, the F-PLN should automatically include the preferential or probable takeoff runway approach and landing runway, associated SIDs, STARs, transition and en route waypoints. However some data bases will only include departure and arrival airport idents and en route waypoints.
The crew must check, modify, or insert (as applicable) the F-PLN in the following order, according to the data given by ATIS, ATC, or MET :
· Lateral revision at departure airport. Select RWY, then SID, then TRANS using scroll keys.
· Lateral revision at WPT for ROUTE modification if needed. (Refer to 4.04.10).
R · Vertical revision. Check or enter climb speed limit, constraints according to ATC
R clearance. Enter step altitude as appropriate.

*– **WINDS . . . . AS APPROPRIATE**
Choose between using TRIP WIND or forecast wind for CLB or CRZ phases.
(Refer to 4.04.20).

*– **F-PLN . . . . CHECK**
· Check the F-PLN using F-PLN page and ND PLAN mode versus the computer (paper) flight plan or navigation chart.
· Check DIST TO DEST along the F-PLN. Compare it with the total distance computed for the flight with the computer (paper) flight plan.

*– **SECONDARY FLIGHT PLAN . . . . AS APPROPRIATE**
This is routinely a copy of the active flight plan. However, consideration may be given to the following :
a) Copy the active F-PLN, but modify it at a suitable WPT for an immediate return to the departure airfield in the event of, for example, engine failure.
b) If weather is below landing minimums at the departure airfield, the secondary flight plan should be that required for a diversion immediately after takeoff.
c) If there is a chance of a change in runway or SID during taxi, prepare for it by copying the active flight plan and making the necessary modifications.

*– **RADIO NAV . . . . CHECK**
· Check the VOR, ILS and ADF tuned by the FMGC.
· Modify them if required, and check that the correct identifier is displayed on the ND and PFD (ILS). If unsatisfactory, go through the audio check.

* FMGS DATA INSERTION

GROSS WEIGHT INSERTION (INIT B page) :

*– **ZFCG/ZFW** . . . . **INSERT**

*– **BLOCK FUEL** . . . . **INSERT**

CAUTION

The characteristic speeds displayed on the MCDU (green dot, F, S, VLS) are computed from the ZFW and ZFCG entered by the crew on the MCDU. Therefore, this data must be carefully checked (Captain's responsibility).

The flight crew should insert the weights after completing all other insertions. This is to avoid cycles of prediction computations at each change in flight plan, constraints, etc.

· If ZFCG and ZFW are unavailable, it is acceptable to enter the expected values in order to obtain predictions. Similarly, the flight crew may enter the expected fuel on board, if refueling has not been completed at that time.

· If ZFCG, ZFW, and BLOCK FUEL are inserted, the FM will provide all predictions, as well as the EXTRA fuel, if any.

TAKEOFF DATA INSERTION (PERF TAKEOFF page) :

*– **V1, VR, V2** . . . . **INSERT**

*– **FLX TO TEMP** . . . . **INSERT**

*– **THR RED/ACC altitude** . . . . **SET or CHECK**

For noise abatement procedure "A", the crew must set the acceleration altitude at, or above, 3000 feet.

*– **ENG OUT ACC altitude** . . . . **SET or CHECK**

*– **FLAPS/THS reminder** . . . . **INSERT**

*– **TO SHIFT** . . . . **AS RQRD**

Enter the takeoff SHIFT distance, if takeoff is to be from an intersection. This is
R essential for position updating at takeoff and, consequently, for navigation accuracy.

CLIMB, CRUISE, DESCENT, SPEED PRESELECTION

*– **PRESET SPEEDS . . . . AS RQRD**

If the flight is cleared for a close-in turn or close-in altitude constraint, the flight crew may preselect green dot speed on the PERF CLB page. Once the CLB phase is active, the preselected speed will be displayed in the FCU speed window and on the PFD (blue symbol). Once the turn is completed or the altitude cleared, the pilot will resume the managed speed profile by pressing the SPD selector on the FCU.

Similarly the pilot may select a CRZ MACH number on the PERF CRZ page (constant CRZ Mach segment, for example). When the CRZ phase is active, the preselected CRZ MACH number will be displayed in the FCU speed window and on the PFD. When ECON MACH number may be resumed, the crew presses the FCU SPD selector.

In either of the above cases, the pilot may cancel the CLB or CRZ preselected SPD/MACH prior to activating the related phase, by selecting ECON on the PERF CLB or CRZ pages.

SPD LIM is defaulted to 250 knots below 10000 feet in the managed speed profile. This may be either cleared or modified on the VERT REV page at the origin (or a climb waypoint).

GLARESHIELD

– **Glareshield integral light and flood light . . . . AS RQRD**

*– **BARO REF . . . . SET**
· Set QNH on EFIS control panel and on standby altimeter
· Check barometer settings and altitude indications on PFD and standby altimeter. (Tolerance limits are given in 3.04.34).

*– **FD . . . . CHECK ON**

*– **ILS . . . . AS RQRD**

R *Note : Do not engage the autothrust on ground as it may generate the AUTO FLT*
R *A/THR OFF warning at engine start.*

* EFIS CONTROL PANEL

*– **ND mode and range . . . . AS RQRD**
MODE : Display the ARC mode on the ND if the takeoff direction is approximately the departure direction, or the ROSE NAV mode if the direction change is to be more than 70° after takeoff (to allow the ND to display the area behind the aircraft).
RANGE : Set the minimum range to display the first waypoint after departure, or as required for weather radar.

*– **VOR/ADF selector . . . . AS RQRD**
Display VOR and ADF needles as needed.

* FCU

*– **SPD MACH window . . . . DASHED**

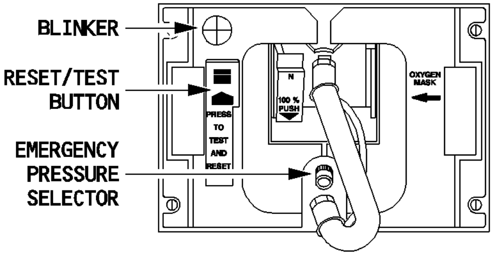
*– **HDG V/S-TRK FPA . . . . HDG V/S**

*– **ALT window . . . . INITIAL EXPECTED CLEARANCE ALT**

LATERAL CONSOLES

OXYGEN MASK TEST

NFC5-03-0306-011-A001AA



On the OXYGEN panel :

– **CREW SUPPLY . . . . CHECK ON**

On the glareshield :

– **LOUDSPEAKERS . . . . ON**

On the audio control panel :

– **INT reception knob . . . . PRESS OUT-ADJUST**

– **INT/RAD switch . . . . INT**

On the mask stowage box :

· Press and hold the reset/test button in the direction of the arrow.
  – Check that the blinker turns yellow for a short time, and then goes black.
· Hold the reset/test button down, and press the emergency pressure selector.
  – Check that the blinker turns yellow and remains yellow, as long as the emergency pressure selector is pressed.
  – Listen for oxygen flow through the loudspeakers. Warn any engineer, whose headset may be connected to the nose intercom, that a loud noise may be heard when performing this check.
· Check that the reset/test button returns to the up position and the N 100 % selector is in the 100 % position.

R · Press the emergency pressure selector again, and check that the blinker does not turn
R yellow. This ensures that the mask is not supplied.

On the ECAM DOOR/OXY page :

– **REGUL LO PR message . . . . CHECK OFF**
· The crew must perform this check after having checked all masks. It ensures that the LP valve is open, (due to residual pressure between the LP valve and the oxygen masks, an LP valve failed in the closed position may not be detected during the oxygen mask test).

CM 1/2 INSTRUMENT PANELS

– **PFD and ND brightness knob . . . . AS RQRD**
Check the ND outer ring to maximum range (radar display)

– **LOUDSPEAKER . . . . SET**
One o'clock position.

R *– **PFD . . . . CHECK**
– Check PFD/ND not transferred.
– Check for correct display when ATT and HDG are available.
– Check IAS, FMA, initial target ALT, altimeter readings, VSI, altimeter settings, heading and attitude display.

R *– **ND . . . . CHECK**
– Check for correct display.
– Crosscheck compass indication on the ND and DDRMI.
– Check ground speed less than 5 knots, heading, initial waypoint, VOR ADF indications.

CTR INSTRUMENT PANEL

R *– **STBY ASI . . . . CHECK**

R *– **STBY ALTI (and STBY ALTI in meter ⊲*|) . . . . CHECK**

R *– **STBY HORIZON . . . . CHECK**
Check no flag – Erect if necessary.

R **<u>* CLOCK</u>**

– **Check time, adjust if necessary ; elapsed time at zero, chrono at zero.**

<u>NOSEWHEEL STEERING</u>

R *– **A/SKID & N/W STRG . . . . ON**

PEDESTAL

ACP

– **INT knob . . . . PRESS OUT / VOLUME CHECK**
Make sure that INT volume is turned up to permit contact with the ground crew.

– **VHF . . . . CHECK**
Check transmission and reception.

– **HF (if required for flight) . . . . CHECK**
· Check transmission and reception.
· Do not transmit on HF during refueling.

* WEATHER RADAR

*– **Power supply switch . . . . CHECK OFF**

*– **WINDSHEAR switch (<*|) . . . . CHECK OFF**

*– **GAIN . . . . AUTO**

*– **MODE . . . . AS RQRD**

SWITCHING panel

– **SWITCHING panel . . . . CHECK**
Check all selectors at NORM.

* ECAM control panel

*– **STS . . . . PRESS**
Check that INOP SYS display is compatible with MEL.
If a message is displayed in MAINTENANCE STATUS, see PARKING procedure (Refer to 3.03.25).

*– **PRESS . . . . PRESS**
Check that the CAB PRESS page displays LDG ELEV AUTO to confirm correct position of the LDG ELEV selector.

Note : *The landing field elevation of the destination airport may not be correctly displayed on the ECAM CAB PRESS page. It is automatically corrected after first engine start.*

***THRUST LEVERS**

*– **THRUST LEVERS . . . . CHECK IDLE**

*** ENG**

*– **ENG MASTER switch . . . . CHECK OFF**

*– **ENG MODE selector . . . . CHECK NORM**

R *** PARKING BRK**

R *– **PARKING BRAKE . . . . ON THEN OFF**
· Check pressure on BRAKE PRESS indicator.
R · If chocks are in place, release the parking brake to increase brake cooling.

GRAVITY GEAR EXTN

– **GRAVITY GEAR EXTN . . . . CHECK STOWED**

ATC

– **ATC . . . . SET FOR OPERATION**

– **ALT RPTG . . . . ON**

– **SYS 1 . . . . SELECT**
Only system 1 is available in the emergency electrical configuration.

* FMGS DATA CONFIRMATION

*– **AIRFIELD DATA . . . . CONFIRM**

*– **ATC CLEARANCE . . . . OBTAIN**

*– **IRS ALIGN . . . . CHECK**
Confirm coordinates.

*– **GROSS WEIGHT INSERTION . . . . CHECK**
The PNF checks FMGS data.

*– **TO DATA . . . . CALCULATE/CHECK**
The PNF calculates and check takeoff data.

*– **F-PLN A and B pages . . . . CHECK**
· Select the EFIS CSTR pushbutton switch on.
· The PNF ensures that the inserted F-PLN agrees with planned routes. (Refer to 4.05.10)
· If company policy requires it, use the scroll key to check the whole F-PLN thoroughly. Tracks and distances between waypoints are displayed on the second line from the top of the MCDU. Compare them with the navigation charts, if necessary.
Check correct stringing, using ND in PLAN mode.
SID and EOSID tracks and distances must be checked from the appropriate navigation charts.

* ATC

*– **ATC CODE . . . . SET**

* FUEL

*– **FUEL QTY . . . . CHECK**
· Check that ECAM fuel on board corresponds to the F-PLN.
R · Check that fuel imbalance is within limits.

*TAKEOFF BRIEFING

*– **TAKEOFF BRIEFING . . . . PERFORM**

The purpose of the takeoff briefing is for the PF to inform the PNF of the planned course of action for both normal and abnormal situations during takeoff.

Whenever practical, it is recommended that as much of the takeoff briefing as possible be completed at the gate.

Prior to the first flight of a trip series the PF should conduct a complete departure briefing. It should include, but not necessarily be limited to, a review of the following areas:

- Adverse weather and runway conditions.
- Crew coordination in the event of a rejected takeoff.
- A discussion of any unusual, non-standard, or abnormal conditions which might affect the safety of the flight.
- SID with 1 engine out, making extensive use of FMGS.
- For airlines having different models of the A319/A320/A321 family, mention if the aircraft is an A319 or A320 or A321. Awareness of the aircraft model may prevent tailstrike.

The PF will brief for all subsequent flights, however, the briefing may be substantially reduced when continuing with the same crew.

However, any change or items peculiar to the specific departure should be thoroughly covered.

R ## *PC DEDICATED TO MAINTENANCE

R Check that the Personal Computer (PC) dedicated to maintenance use and located in front
R of lower stowage at RH rear corner is stowed.
R Check that the light of its manual switch is off. If not, switch it off.
R Check that its associated printer located in front of RH rear panel of the cockpit is stowed.

BEFORE PUSHBACK or START

– **LOADSHEET . . . . CHECK**
The Captain should thoroughly check the load and trim sheet, particularly for gross errors. Make sure that the loadsheet data is correct : Correct flight, correct aircraft, dry operating index, configuration, fuel on board, etc.
Compare ZFW/ZFCG with the previously-entered data, and adjust if necessary.

– **TAKEOFF DATA . . . . PREPARE and CHECK/REVISE**
Once the loadsheet is checked :
  – The PNF checks or recomputes the takeoff speeds and flexible temperature, using the RTOW charts.
  – The PF independently calculates the takeoff speeds and flexible temperature, as a crosscheck.
    Take particular care in determining the takeoff configuration. (Refer to 2.02.20).
R   Confirm any takeoff weight limitation.
  – The PF checks (or revises) the takeoff data in the INIT B and PERF pages of the MCDU.

– **SEATS, SEAT BELTS, HARNESSES, RUDDER PEDALS, ARMRESTS . . . . ADJUST**
The seat is correctly adjusted when the pilot's eyes are in line with the red and white balls.

– **MCDU . . . . IN TAKEOFF CONFIGURATION**
It is recommended that the crew displays F-PLN on the PNF side and PERF TAKEOFF on the PF side.

– **EXT PWR . . . . CHECK OFF**
Request that external power be removed.

– **BEFORE START CHECKLIST down to the line . . . . COMPLETE**

– **PUSHBACK/START UP CLEARANCE . . . . OBTAIN**
Obtain ATC pushback/startup clearance.
Obtain ground crew clearance.

– **NW STRG DISC . . . . CHECK AS RQRD**
In case of pushback (conventional or towbarless), the nosewheel steering selector bypass pin must be in the tow position. The ECAM's NW STRG DISC, or N WHEEL STEERG DISC memos indicate this to the flight crew.

CAUTION

If NW STRG DISC is not displayed on the ECAM, but the ground crew confirms that the steering selector bypass pin is in the towing position, then the pushback must not be performed. This is to avoid possible nose landing gear damage upon green hydraulic pressurization.
To dispatch the aircraft in such a case, refer to the MMEL.

In case of a powerpush by the main landing gear, the nosewheel steering selector should remain in the normal position to steer the aircraft (Refer to 3.04.80).

– **WINDOWS and DOORS . . . . CHECK CLOSED**
R – Check that the cockpit windows are closed and locked.
– Check, on the ECAM lower display, that all the aircraft doors are closed.

– **BEACON . . . . ON**

– **THR LEVERS . . . . IDLE**

CAUTION

Engines will start, regardless of the thrust lever position ; thrust will rapidly increase to the corresponding thrust lever position, causing a hazardous situation, if thrust levers are not at IDLE.

R – **PARKING BRAKE ACCU PRESS . . . . CHECK**
R The ACCU PRESS indication must be in the green band.

– **PARKING BRAKE . . . . AS RQRD**
– If no pushback is required, check that the PARKING BRK handle is ON, and check the BRAKES PRESS indication.

CAUTION

If, during engine start with parking brake on, the aircraft starts to move due to a parking brake failure, immediately release the PARKING BRK handle to restore braking by pedals.

– If pushback is required, set the PARKING BRK to OFF.

CAUTION

Do not use brakes during pushback, unless required due to an emergency.

After pushback is completed, set the PARKING BRAKE to ON and inform the ground crew to allow towbar to be disconnected.

– **BEFORE START CHECKLIST below the line . . . . COMPLETE**

AUTOMATIC ENGINE START

Use the automatic engine start procedure in most circumstances. However, if the start aborts due to insufficient starter inlet air pressure (e.g. on high airfields or in case of low pressure from an external pneumatic power group), it is recommended to proceed with the manual start procedure, rather than use the automatic one.
If, during the engine start the ground crew reports a fuel leak from engine drain mast, run the engine at idle for 5 minutes. If the leak disappears during the 5 minutes, the aircraft can be dispatched without maintenance action. If the leak is still present after 5 minutes,
R maintenance action may be required before next flight.

– **ENG MODE selector . . . . IGN/START**
The lower ECAM display shows the ENG page.

– **ANNOUNCE . . . . "STARTING ENGINE 2"**
Engine 2 is usually started first. It powers the yellow hydraulic system, which pressurizes the parking brake.

– **MASTER switch 2 . . . . ON**
Do not turn the MASTER switch ON before all amber crosses and messages have disappeared on the engine parameters (upper ECAM display).

ON ECAM UPPER DISPLAY	ON ECAM LOWER DISPLAY
N2 increases	Corresponding start valve in line. Bleed pressure indication green. Oil pressure increases.
At 16 % N2	Indication of the active igniter (A or B).
At 22 % N2 – FF increases 15 seconds (maximum) after fuel is on – EGT increases – N1 increases	
At 50 % N2	Start valve cross line. Igniter indication off.

- Parameter callouts are not mandatory.
- In case the electrical power supply is interrupted during the start sequence (indicated by the loss of ECAM DUs), abort the start by switching OFF the MASTER switch. Then, perform a 30-second dry crank.

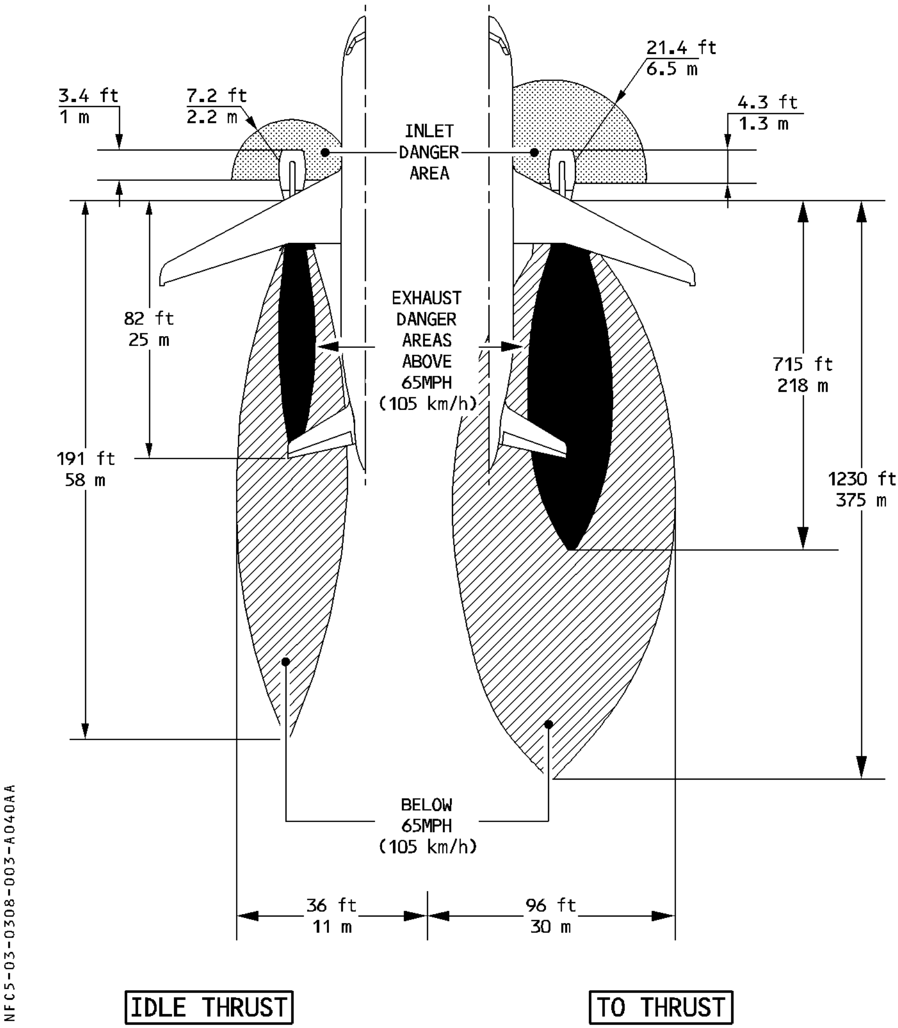
- **MAIN AND SECONDARY ENG. IDLE PARAMETERS . . . . CHECK NORMAL**
  At ISA sea level : N1 about 19.5 %
  N2 about 58.5 %
  EGT about 390° C
  FF about 275 kg/h (600 lb/h)
  Grey background on N2 indication disappears.

- **ANNOUNCE . . . . "STARTING ENGINE 1"**

- **MASTER switch 1 . . . . ON**
  Same procedure as for engine 2.
  Both pack valves reopen with 30 second delay after the second engine N2 is above 50 %.

  Note : *A PTU FAULT is triggered, if the second engine is started within 40 seconds following the end of the cargo doors operation.*

GROUND RUN UP – DANGER AREAS



AFTER START

– **ENG MODE selector** . . . . **NORM**
- Turning the ENG MODE selector to NORM indicates the end of the start sequence. AFTER START actions may be performed.
- On ECAM lower display the WHEEL page replaces the ENG page.
- Leaving the ENG MODE selector at the START/IGN position would prevent continuous relight selection on the ground (would be supplied at lift off). In addition, the ENG page would remain displayed. The selector must be cycled to recover normal control of ignition and to display WHEEL page.
- After start, to avoid thermal shock, the pilot should operate the engine at idle or near idle for at least 2 minutes before advancing the thrust lever to high power. Taxi time
R at idle may be included in the warm-up period.

– **APU BLEED** . . . . **OFF**
- Turn APU BLEED off just after engine start to avoid ingesting engine exhaust gases.
- APU BLEED valve closes, ENG BLEED valves open.

– **GROUND SPOILERS** . . . . **ARM**

– **RUD TRIM** . . . . **ZERO**
If RUD TRIM position indication is not at zero, press the RESET pushbutton.

– **FLAPS lever** . . . . **SET**
- Set flaps for takeoff.
- Check their position on the ECAM upper display.
- If taxiing in slush, keep the flaps retracted until reaching the holding point before takeoff.

– **PITCH TRIM** . . . . **SET**
Set takeoff CG on pitch trim wheel.

– **ECAM STATUS** . . . . **CHECK**
- Check that there is no status reminder (STS) on the ECAM upper display.
- If the status reminder is displayed, press the STS pushbutton.

– **ENG ANTI ICE . . . . AS RQRD**

· If icing conditions last longer than 30 minutes, or if significant engine vibration occurs,
R the engine should be accelerated to approximately 70 % N1 for 30 seconds before
R operating at higher thrust. (See also parking brake limitation 3.01.32). If airport surface
R conditions and congestion do not permit to accelerate the engine to 70 % N1, then
R power setting and dwell time should be as high as practical. This run up should also
R be performed just prior takeoff with particular attention to engine parameters to ensure
R normal engine operation.

· If switched on, IGNITION memo appears on ECAM as continuous ignition is automatically selected.

Note : Icing conditions may be expected when the OAT (on the ground and for take-off), or when TAT (in flight) is 10° C or below with visible moisture in the air or standing water, slush, ice or snow is present on the taxiways or runways.

– **WING ANTI ICE . . . . AS RQRD**

When wing ANTI ICE is switched on on the ground, the anti ice valves open for about 30 seconds (test sequence) then close as long as the aircraft is on ground.

– **APU MASTER switch (if APU not required) . . . . OFF**

· AVAIL light goes out after APU cooling period.

– **ECAM DOOR page . . . . SELECT**

· Check that all slides are armed

· Deselect the DOOR page after verifying the slides.

– **ANNOUNCE . . . . "CLEAR TO DISCONNECT"**

Request : Chocks removed
Nose wheel steering bypass pin removed (NW STRG DISC memo not displayed)
Interphone disconnect
Hand signal on the left/right side.

– **AFTER START CHECK LIST . . . . COMPLETE**

TAXI

– **TAXI clearance . . . . OBTAIN**

R – **NOSE light . . . . TAXI**
Turn on the nosewheel light to TAXI day and night.
R RWY TURN OFF lights may be switched ON, as required.

– **PARKING BRAKE . . . . OFF**
Check that brake pressure is zero (triple indicator). Slight residual pressure may be indicated for a short period of time.

– **ELAPSED TIME . . . . AS RQRD**
If ACARS is not installed, start ELAPSED TIME to record block time.

– **THRUST LEVERS . . . . AS RQRD**
- Little, if any, power above idle thrust will be needed to get the aircraft moving (40 % N1 maximum). Thrust should normally be used symmetrically. Once the aircraft starts to move, little thrust is required.
- Use of the engine anti-ice increases ground idle thrust, so the pilot must use care on slippery surfaces.
- The engines are close to the ground. Avoid positioning them over unconsolidated, or unprepared ground (beyond the edge of the taxiways, for example).
  Avoid high thrust settings at low ground speeds, which increase the risk of ingestion (FOD), and the risk of projection of debris towards the trimmable horizontal stabilizer and towards the elevators.

– **BRAKES . . . . CHECK**
– Once the aircraft starts moving :
· Check the brake efficiency of the normal braking system : The aircraft must slow down when pressing the brake pedals.

CAUTION

R If the aircraft has been parked in wet conditions for a long period, the efficiency of
R the first brake application at low speed will be reduced.

· Check also that green pressure has taken over yellow pressure : The yellow pressure on the brake pressure triple indicator must be at 0 when pressing the brake pedals. Although green hydraulic power supplies braking system, if pedals are quickly pressed a brief brake pressure indication appears on BRAKE PRESS indicator.
– Thereafter, the normal maximum taxi speed should be 30 knots in a straight line, 10 knots for a sharp turn. As the ground speed is difficult to assess, monitor ground speed on ND. Do not "ride" the brakes. As 30 knots is exceeded with idle thrust, apply brakes smoothly and decelerate to 10 knots, release the brakes and allow the aircraft to accelerate again.
– If a "spongy" pedal is felt during taxi, this indicates a degraded performance of the alternate braking system.
– If an arc is displayed on the ECAM WHEEL page above the brake temperature, select the brake fans on (if installed).

– **FLIGHT CONTROLS . . . . CHECK**

R 1. At a convenient stage prior to or during taxi and before arming the autobrake : PF applies full lateral and longitudinal sidestick deflection. This check will be called by the PF as it is carried out : "Full up, full down, neutral, full left, full right, neutral". PNF checks on F/CTL page full travel and correct sense of elevators and ailerons, and correct spoilers movement and retraction. PNF calls "checked" as each "neutral" is called.

Note : Full sidestick must be held for sufficient time for full travel to be reached.

2. PF presses PEDAL DISC pushbutton on nosewheel tiller and applies full left rudder, full right rudder and neutral. PNF monitors travel on F/CTL page as the check is called by PF: "Full left, full right, neutral". PNF calls "checked" at the neutral call.
3. The PNF applies full lateral and longitudinal sidestick deflection and silently checks on the F/CTL page : Full travel and correct sense of elevators and ailerons, and correct spoiler movement and retraction.

Note : The FLT CTL page is automatically shown for 20 seconds.

LEFT INTENTIONALLY BLANK

– **AUTO BRK . . . . MAX**
· ON light comes on.
· Autobrake may be armed with the parking brake on.
· The selection of MAX mode prior to takeoff improves safety, in the event of an aborted takeoff.
If the takeoff must be aborted, the autobrake system applies maximum braking as soon as the thrust levers are set to idle, if ground speed is above 72 knots.

– **ATC clearance . . . . CONFIRM**

TAKEOFF DATA/CONDITIONS

If takeoff data has changed, or in case of runway change, prepare updated takeoff data as appropriate :

– **F-PLN (Runway) . . . . REVISE**

– **FLAPS LEVER . . . . AS APPROPRIATE**
R Select takeoff position.

– **V1, VR, V2 . . . . REINSERT**

– **FLX TO temperature . . . . REINSERT**

FMGS

– **F-PLN (SID,TRANS) . . . . REVISE or CHECK**
Take particular care to confirm that the ATC clearance agrees with the FMGS, if NAV mode is to be used.

– **INITIAL CLIMB SPEED AND SPEED LIMIT . . . . MODIFY or CHECK**
Use VERT REV at departure, or at a CLB waypoint.

– **CLEARED ALTITUDE ON FCU . . . . SET**

– **HDG ON FCU . . . . IF REQUIRED, PRESET**
· If a heading is required by the ATC after takeoff, preset the heading on the FCU. NAV mode will be disarmed.
· RWY TRK mode will keep the aircraft on the runway track.

– **FD . . . . CHECK SELECTED ON**

– **FMA . . . . CHECK**

– **FLIGHT INSTRUMENTS . . . . CHECK**

– **RADAR (if required) . . . . ON**
If radar is required for the flight, use the following test procedure :
Adjust the tilt downward until ground returns appear and then slowly adjust it in 1 to 2 degree steps up to 15° UP for weather returns. Select tilt at 4° UP for takeoff.

R – **PREDICTIVE WINDSHEAR SYSTEM ⊲ . . . . AUTO**

– **ATC code . . . . CONFIRM/SET**

– **TAKEOFF BRIEFING . . . . CONFIRM**
This briefing should normally be only a brief confirmation of the thorough takeoff briefing made at the gate. Any changes in the clearance are to be addressed at this time.
Make extensive use as is possible of the displays. For example
"Takeoff from RWY 07 (Perf page), weight 68 000 kg (lower ECAM), configuration 2, 10 000 kg of fuel, FLEX 50° , 93 % N1 (upper ECAM), LMG 2D departure (FPLN page), V1 140, V2 145 (PFD), initial clearance 12000 feet blue (FMA)".

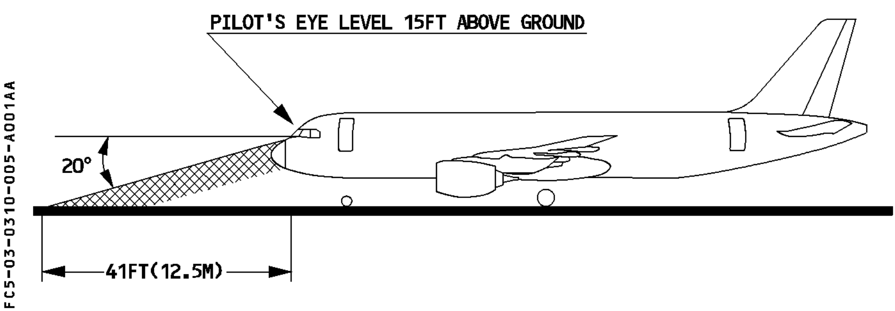
– **CABIN REPORT . . . . RECEIVE**
Obtain cabin report from the purser, as a minimum : "CABIN SECURED FOR TAKEOFF"

– **TO CONFIG pushbutton . . . . PRESS**
Check that ECAM upper display shows "TO CONFIG NORMAL".

– **TO MEMO . . . . CHECK NO BLUE LINE**

– **BEFORE TAKEOFF CHECKLIST down to the line . . . . COMPLETE**

VISUAL GROUND GEOMETRY



180° TURN ON RUNWAY

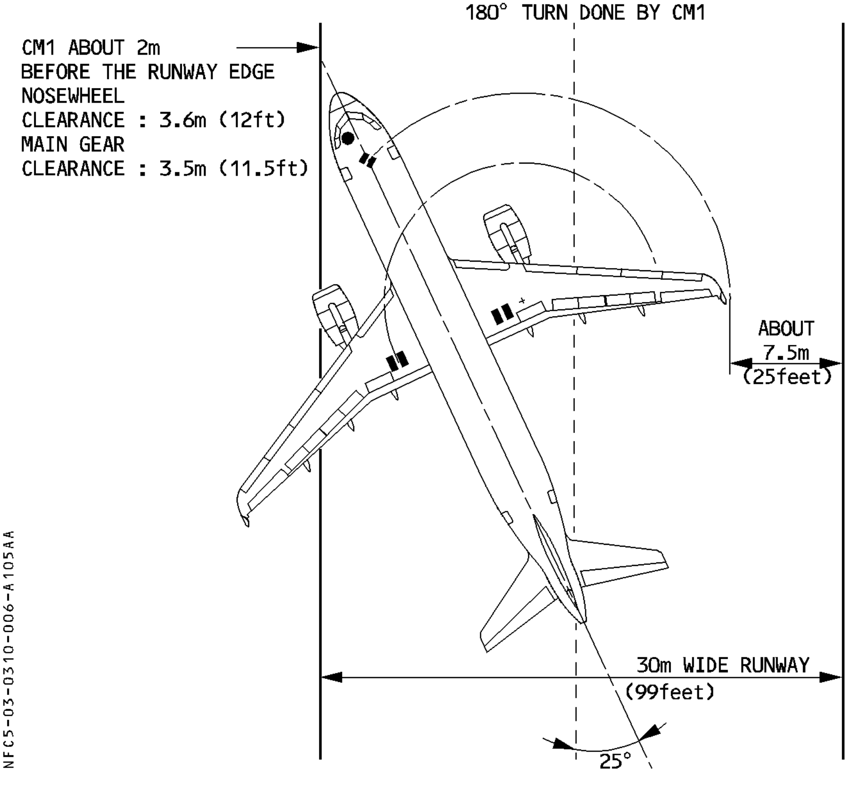
A standard runway is 45 meters wide. However, this aircraft only needs a pavement of 30 meters (99 feet) wide for a 180° turn.
The following procedure is recommended for making such a turn in the most efficient way.

- **FOR THE CM1**
  - Taxi on the right-hand side of the runway and turn left, maintaining 25° divergence from the runway axis. Maximum ground speed is 10 knots.

R
  - When the CM1 is at about 2 meters before the runway edge, he turns the nosewheel full right and sets 40 % to 43 % N1 for CFM engines, or 1.05 EPR for IAE engines.
- **FOR THE CM2**

  The procedure is symmetrical. (Taxi on the left-hand side of the runway).

R



Note : To avoid skidding the nosewheel on a wet runway, perform the turn at very low speed, using asymmetric thrust and differential braking as necessary.

BEFORE TAKEOFF

● **If the brake fans are running ⊲* :**

– **BRAKE TEMP . . . . CHECK**
· If brake temperature is above 150° C, delay takeoff.
· If brake temperature is below 150° C, select brake fans off.

– **TAKEOFF OR LINE UP CLEARANCE . . . . OBTAIN**

– **APPROACH PATH CLEAR OF TRAFFIC . . . . CHECK**

– **CABIN CREW . . . . ADVISE**

– **ENG MODE selector . . . . AS RQRD**
Select IGN, if :
· The runway has standing water.
· Heavy rain is falling.
· Heavy rain or severe turbulence is expected after takeoff.

Note : Continuous ignition is automatically selected, if the ENG ANTI ICE pushbutton is ON.

– **TCAS (⊲*) Mode selector . . . . TA or TA/RA**
The FAA recommends selecting TA mode :
– In case of known nearby traffic, which is in visual contact.
– At particular airports and during particular procedures, identified by an Operator as having a significant potential for unwanted or inappropriate resolution advisories (closely-spaced parallel runways, converging runways...)

– **PACK 1 and 2 . . . . AS RQRD**
R Consider selecting packs OFF, or APU bleed ON.
R This will improve performance when using TOGA thrust.
R In case of a FLEX takeoff, selecting packs OFF or APU bleed ON will reduce takeoff EGT,
R and thus reduce maintenance costs.
The use of flex thrust may reduce maintenance costs. The effect is particularly
R significant with the first degrees of FLEX.
Use of APU bleed is not authorized, if wing anti-ice is to be used.

– **EXTERIOR LIGHTS . . . . SET**
Set the RWY TURN OFF, LAND, and NOSE switches to ON/TO, in order to minimize bird strike hazard during takeoff.
R Set the STROBE lights to ON, before entering the runway.

– **SLIDING TABLE ◁* . . . . STOW**

– **ATC . . . . When cleared for takeoff : ON (or XPDR or XPNDR ◁*)**
This is not applicable to ATC panels equipped with :
· An AUTO position, if AUTO is selected.
· A common selector for ATC transponder and TCAS.

– **BEFORE TAKEOFF CHECKLIST below the line . . . . COMPLETE**
Read the checklist below the line, when line up or takeoff clearance is received.

TAKEOFF

– **ANNOUNCE . . . . « TAKEOFF »**

– **BRAKES . . . . RELEASE**
Rolling takeoff is recommended when possible.

● **If the crosswind is at or below 20 knots and there is no tailwind :**

– **THRUST LEVERS . . . . FLX or TOGA**
· To counter the nose-up effect of setting engine takeoff thrust, apply half forward stick until the airspeed reaches 80 knots. Release the stick gradually to reach neutral at 100 knots.
· For crosswind takeoffs, routine use of into-wind aileron is not recommended. In strong crosswind conditions, small amounts of lateral control may be used to maintain wings level, but the pilot should avoid using excessive amounts. This causes excessive spoiler deployment, which increases the aircraft tendency to turn into wind.
· PF progressively adjusts engine thrust in two steps :
– from idle to about 50 % N1 (1.05 EPR).
– from both engines at similar N1 to takeoff thrust.
· Once the thrust is set, the captain keeps his hand on the thrust levers until the aircraft reaches V1.

● **In case of tailwind or if crosswind is greater than 20 knots :**

– **THRUST LEVERS . . . . FLX or TOGA**
· PF applies full forward stick.
· For crosswind takeoffs, routine use of into-wind aileron is not recommended. In strong crosswind conditions, small amounts of lateral control may be used to maintain wings level, but the pilot should avoid using excessive amounts. This causes excessive spoiler deployment, which increases the aircraft tendency to turn into wind.
· PF sets 50 % N1 (1.05 EPR) on both engines then rapidly increases thrust to about
R 70 % N1 (1.15 EPR) then progressively to reach takeoff thrust at 40 knots ground speed, while maintaining stick full forward up to 80 knots. Release stick gradually to reach neutral at 100 knots.
· Once the thrust is set, the captain keeps his hand on the thrust levers until the aircraft reaches V1.

Note : ENG page replaces WHEEL page on the ECAM lower display.

– **DIRECTIONAL CONTROL . . . . USE RUDDER**
At 130 knots (wheel speed) the connection between nosewheel steering and the rudder pedals is removed, hence in strong crosswinds more rudder input will be required at this point to prevent the aircraft from turning into the wind.

– **CHRONO . . . . START**

– **PFD/ND . . . . SCAN**
· Check the flight mode annunciator on the PFD :
MAN TOGA (MAN FLX xx), SRS, RWY (or blank), both FDs on.
· Check the FMGS position update (aircraft on runway centerline).

R ● **Reaching 80 knots :**

R – **TAKEOFF N1 . . . . CHECK**
R Check that the actual N1 of individual engines has reached the N1 rating limit before
R the aircraft reaches 80 knots. Check EGT.

Note : If there is a discrepancy of more than 1 % of N1 between the engines, it should be entered in the logbook after flight.

– **ANNOUNCE . . . . « POWER SET »**

– **PFD and ENG indications . . . . SCAN**
· Scan airspeed, N1, and EGT throughout the takeoff.
· Disregard the EGT index pulsing amber when using TOGA or FLX thrust.

– **ANNOUNCE . . . . « ONE HUNDRED KNOTS »**
· The PF crosschecks the speed indicated on the PFD and announces “checked”.
· Below 100 knots the captain may decide to abort the takeoff according to the circumstances.
· Above 100 knots, rejecting the takeoff is a more serious matter.

– **ANNOUNCE . . . . « V1 »**

– **ANNOUNCE . . . . « ROTATE »**

– **ROTATION . . . . PERFORM**
R · At VR, initiate the rotation to achieve a continuous rotation with a rate of about 3°/sec,
R towards a pitch attitude of 15° (12.5° if one engine is failed).
R · Minimize lateral inputs on ground and during the rotation, to avoid spoiler extension.
R · After lift-off, follow the SRS pitch command bar.

CAUTION

If a tailstrike occurs, avoid flying at an altitude requiring a pressurized cabin, and return to the originating airport for damage assessment.

– **ANNOUNCE . . . . "POSITIVE CLIMB"**

– **ORDER . . . . "GEAR UP"**

– **LDG GEAR . . . . SELECT UP**

– **GRND SPLRS . . . . DISARM**

– **EXTERIOR LIGHTS . . . . SET**
Set NOSE & RWY TURN OFF light switches to OFF.
LAND lights may be left ON, depending on the airline policy or regulatory recommendation.

– **AP . . . . AS RQRD**
Above 100 feet AGL, AP 1 or 2 may be engaged.

– **ANNOUNCE . . . . "FMA"**

– **ANNOUNCE . . . . "GEAR UP"**

- **At thrust reduction altitude (LVR CLB flashing on FMA)**

  – **THRUST LEVERS . . . . CL**
  Move the thrust levers promptly to the CL detent, when the flashing LVR CLB prompt appears on the FMA. A/THR is now active.
  In manual flight, the pilot must anticipate the change in pitch attitude in order to prevent the speed from decaying when thrust is reduced.

– **PACK 1 and 2 (if applicable) . . . . ON**
· Select PACK 1 ON after CLB thrust reduction.
· Select PACK 2 ON after flap retraction.

Note : 1. Selecting pack ON before reducing takeoff thrust would result in an EGT increase.
2. Selecting both packs ON simultaneously may affect passenger comfort.
3. If packs are not switched on after the takeoff phase, an ECAM caution will be triggered.
4. PACK 2 may be selected earlier.

- **At acceleration altitude :**

  – **ANNOUNCE FMA . . . . "THR CLB/OP CLB" or "THR CLB/CLB"**
  Check the target speed change from V2 + 10 to the first CLB speed (either preselected or managed).

  Note : 1. For most normal operations, thrust reduction and acceleration altitudes will be the same. So, the FMA will change from FLX/SRS/NAV to THR CLB/CLB/NAV.
  2. If FCU-selected altitude is equal to or close to the acceleration altitude, then the FMA will switch from SRS to ALT.*

- **Above acceleration altitude (or once in climb phase) :**
  The following procedure ensures that the aircraft is effectively accelerating toward climb speed.

  - **<u>At F speed</u>**

    – **ORDER . . . . "FLAPS 1"**

    – **FLAPS 1 . . . . SELECT**

R – **CONFIRM/ANNOUNCE . . . . "FLAPS 1"**

    <u>Note</u> : For takeoff in CONF 1 + F, "F" speed is not displayed.

  - **<u>At S speed</u>**

    – **ORDER . . . . "FLAPS ZERO"**

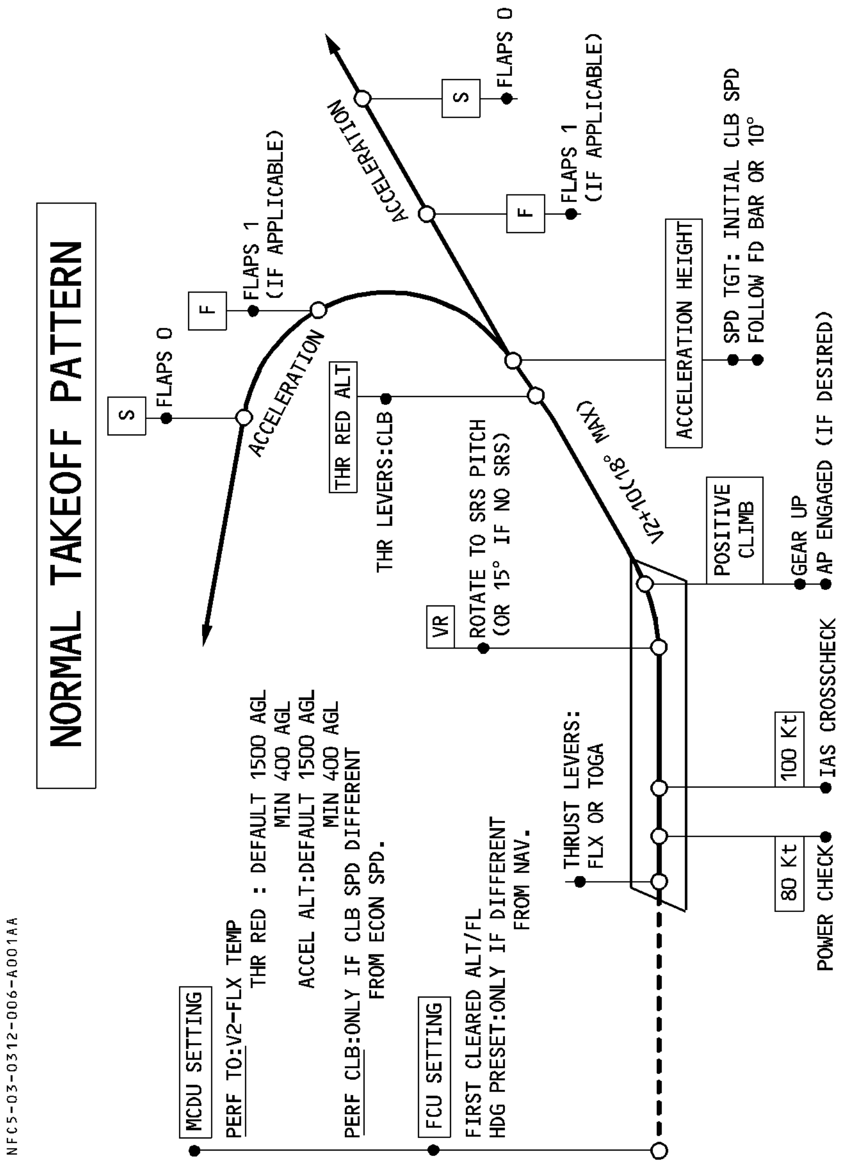
    – **FLAPS ZERO . . . . SELECT**

R – **CONFIRM/ANNOUNCE . . . . "FLAPS ZERO"**

    <u>Note</u> : CRUISE page replaces ECAM ENG page.

– **DERATED CLB OPS ⊲* . . . . REFER TO 3.04**

R



NOTE: IN CASE OF AN IMMEDIATE LANDING, IF THE PATTERN IS MADE BELOW 1500 FEET, SELECT ECAM RECALL DURING THE DOWNWIND LEG

AFTER TAKEOFF

– **APU BLEED . . . . AS RQRD**
If the APU has been used to supply air conditioning during takeoff, set the APU BLEED to OFF. For use of the APU BLEED, refer to the APU LIMITATION Chapter (3.01.49).

– **APU MASTER switch . . . . AS RQRD**

– **ENG MODE selector . . . . AS RQRD**
Select IGN, if severe turbulence or heavy rain is encountered.

– **TCAS (⊲) Mode selector . . . . TA/RA**
Select TA/RA, if the takeoff has been performed with TA only.

– **ANTI ICE PROTECTION . . . . AS RQRD**
R ENG ANTI ICE should be ON, when icing conditions are expected with a TAT at, or
R below, 10°C.

<u>Note</u> : *With ENG ANTI ICE ON, the FADEC automatically selects continuous ignition. The IGNITION memo appears on ECAM.*

– **AFTER TAKEOFF/CLIMB CHECKLIST down to the line . . . . COMPLETE**

CLIMB

– **Normal vertical mode is CLB or OP CLB with managed speed active.**

R – **PF MCDU . . . . PERF CLB**

· PF MCDU should be showing the PERF CLB page (allowing PF to monitor when the aircraft will reach the FCU selected altitude) but he may select other pages such as F-PLN page as may be tactically necessary.
With the AP engaged, the PF will make any required flight plan revisions.

· The MCDU PROG page displays OPT FL and MAX REC FL. It is worth noting that this OPT FL is a function of the cost index.

· The displayed MAX REC FL gives the aircraft at least a 0.3 g buffet margin. The pilot may enter a cruise flight level above this level into the MCDU and the FMGS will accept it, provided that it does not exceed the level at which the margin is reduced to 0.2 g.

– **PNF MCDU . . . . F-PLN**

PNF MCDU should be showing the F-PLN page (allowing him to enter any ATC long-term revisions to the lateral or vertical flight plan).

– **CLIMB SPEED MODIFICATIONS :**

● **If ATC, turbulence or operational considerations lead to a speed change :**

Select the new speed with FCU SPD selection knob and pull. Speed target is now "selected". To return to managed speed mode, push FCU SPD selection knob. The speed target is now "managed".

Note : The best speed (and rate of climb) for long-term situations lies between green dot speed and ECON speed. At high altitude, acceleration from green dot to ECON speed can take a long time.

– **EXPEDITE CLIMB ⊲**

● **If ATC requires a rapid climb through a particular level :**

Push the EXP pushbutton on the FCU. The target speed is now green dot speed.
FMA : THR CLB/EXP CLB/NAV

Note : Use EXP (⊲) only for short-term tactical situations. For the best overall economy fly at ECON IAS.
To return to ECON CLB speed :
Push ALT selector knob.
Check FMA : THR CLB/CLB/NAV

– **BARO REF** . . . . **SET**
- At transition altitude (baro setting flashing on PFD) set STD on the EFIS control panel and STBY ALT.
- Cross-check baro settings and altitude readings.

– **CRZ FL** . . . . **SET AS RQRD**
- If ATC clears the aircraft to its intended CRZ FL or above, there is no need to modify the CRZ FL entered in the INIT A page during cockpit preparation. The FCU will automatically take into account a higher CRZ FL selected with the FCU ALT knob.
- If ATC limits CRZ FL to a lower level than the one entered in the INIT A page (or present on the PROG page) the flight crew must insert this lower CRZ FL in the PROG page. Otherwise there is no transition into CRZ phase : the managed speed targets and Mach are not modified, and SOFT ALT mode is not available. In that case FMA will display: MACH/ALT/NAV instead of MACH/ALT CRZ/NAV.

– **AFTER TAKEOFF/CLIMB CHECKLIST below the line** . . . . **COMPLETE**

– **ENG ANTI ICE** . . . . **AS RQRD**
ENG ANTI ICE should be ON when the aircraft encounters icing conditions, unless the SAT is below – 40° C.

– **RADAR TILT** . . . . **ADJUST**
The tilt angle depends on aircraft altitude and on the selected range on the ND. The radar must have a slightly negative tilt in order to avoid overscanning and to show some ground return at the top edge of the ND.

● **At 10 000 ft :**

R – **LAND light** . . . . **OFF**

R – **SEAT BELTS** . . . . **AS RQRD**

R – **EFIS option** . . . . **ARPT**

R – **ECAM MEMO** . . . . **REVIEW**

– **RAD NAV page** . . . . **CHECK**
Clear manually tuned VORs from MCDU RAD NAV page.

– **SEC F-PLN page** . . . . **AS RQRD**
Recopy the active flight plan in the secondary if an immediate return flight plan has been constructed previously.

– **OPT/MAX ALT** . . . . **CHECK**

CRUISE

– **ECAM MEMO . . . . REVIEW**

– **ECAM SYS PAGES . . . . REVIEW**
Periodically review system display pages and, in particular :
ENG : Oil pressure and temperature
BLEED : BLEED parameters
ELEC : Parameters, GEN loads
HYD : A slight decrease in quantity is normal.
Fluid contraction during cold soak can be expected.
Green system is lower than on ground, following landing gear retraction.
FUEL : Fuel distribution.
COND : Duct temperature, compared with zone temperature.
Avoid large differences for passenger comfort.
FLT CTL : Note any unusual control surface position.

– **FLIGHT PROGRESS . . . . CHECK**
Monitor flight progress in the conventional way.
When overflying a waypoint :
· Check track and distance to the next waypoint.
R When overflying the waypoint, or every 30 minutes :
· Check FUEL : Check FOB (ECAM), and fuel prediction (FMGC), and compare with the computer flight plan or the in-cruise quick-check table (Refer to 3.05.20).
Check that the sum of the fuel on board and the fuel used is consistent with the fuel on board at departure. If the sum is unusually greater than the fuel on board at departure, suspect a frozen fuel quantity indication. Maintenance action is due before
R the next flight. If the sum is unusually smaller than the fuel on board at departure, or
R if it decreases, suspect a fuel leak.

CAUTION
This check must also be performed each time a FUEL IMBALANCE procedure is necessary. Perform the check before applying the FUEL IMBALANCE procedure. If a fuel leak is confirmed, apply the FUEL LEAK procedure.

– **STEP FLIGHT LEVEL . . . . AS APPROPRIATE**
(Refer to 3.05.15).

– **NAVIGATION ACCURACY . . . . CHECK**

On aircraft equipped with GPS primary, no navigation accuracy check is required, as long as GPS PRIMARY is available.

Otherwise, navigation accuracy must be monitored, at all times but especially when any of the following occurs :

· IRS only navigation
· The PROG page displays LOW accuracy.
· "NAV ACCUR DOWNGRAD" appears on the MCDU.

Methods for checking accuracy :

· Manually tune VOR (VOR/DME or ADF) to a station that is within range on the RAD NAV page, and select associated needles on the ND.
  Check that the needle (raw data) overlies the corresponding blue navaid symbol (FM computed) and that the DME distance is equal to the distance showing between the aircraft symbol and the navaid symbol on the ND.
· Or insert a VOR/DME ident in BRG/DIST TO field on the PROG page and compare the computed BRG (DIST) with the raw data on the ND. This method allows the FM error to be quantified.

If the check is positive (error ≤ 3NM) : FM position is reliable.
– Use ND (ARC or NAV) and managed lateral guidance.

If the check is negative (error > 3NM) : FM position is not reliable.
– Use raw data for navigation and monitor it.
– If there is a significant mismatch between the display and the real position : disengage MANAGED NAV mode and use raw data navigation (possibly switching to ROSE VOR, so as not to be misled by FM data).

– **RADAR TILT . . . . ADJUST**

Below 20000 feet	: Start with tilt near zero, then adjust. If using different ranges on the two NDs, set the tilt down for the shorter ND range (in order to monitor and detect weather activity) and near zero for the longer ND range (in order to monitor course changes).
Above 20000 feet	: A slight downward tilt is recommended.

– **CABIN TEMP . . . . MONITOR**

Pay regular attention to the ECAM CRUISE page, in order to monitor passenger cabin temperatures and adjust them, as necessary.

R ● **If the oxygen mask has been used :**

R

R – **OXYGEN MASK . . . . CHECK**

R Check that the oxygen mask has been properly stowed, as indicated in the FCOM

R 1.35.20.

DESCENT PREPARATION

Descent preparation and approach briefing can take approximately 10 minutes, so they should begin approximately 80 NM before top of descent.

- **LDG ELEV** . . . . **CHECK**
  Check on ECAM CRUISE page that LDG ELEV AUTO is displayed.

- **WEATHER AND LANDING INFORMATION** . . . . **OBTAIN**
  Check weather reports at ALTERNATE and DESTINATION airports. Airfield data should include runway in use for arrival.

FMGS

- **ARRIVAL page** . . . . **COMPLETE/CHECK**
  Insert TRANS, APPR, STAR, and APPR VIA if applicable. (Access by lateral revision at destination.)

- **F-PLN A page** . . . . **CHECK**
  Check speeds and altitude constraints.
  Add new speed or altitude constraints if required.

- **PERF CRUISE page** . . . . **CHECK**
  Enter winds for descent at cruise flight level.
  Modify the cabin descent rate if different pressure rate is required.

- **PERF DES page** . . . . **CHECK**
  Prior to descent, access PERF DES page and check ECON MACH/SPD. If a speed other than ECON is required, insert that MACH or SPD into the ECON field. This new MACH or SPD is now the one for the descent path and TOD computation, and it will be used for the managed speed descent profile (instead of ECON).
  A speed limit of 250 knots below 10000 feet is the defaulted speed, in the managed speed descent profile. The flight crew may delete or modify it if necessary on the VERT REV at DEST page.

– **PERF APPR page . . . . COMPLETE/CHECK**
  – Enter the QNH, temperature, and wind at destination.

  Note : *The entered wind should be the average wind given by the ATC or ATIS. Do not enter gust values. For example, if the wind is 150/20-25, insert the lower speed (150/20) (ground speed mini-function will cope with the gust).*

  – Insert the MDA (MDH if QFE used), or DH (whichever applies).

  CAUTION
  If QNH altimeter setting is used with an aircraft with QFE option, refer to 3.04.34.

  Note : *Changing the RWY or type of arrival (VOR, ILS) automatically erases the previous MDA/MDH or DH.*

  – Check or modify the landing configuration. Always select the landing configuration on the PERF APP page :
    · The pilot may choose FLAP 3 rather than FLAP FULL for landing, depending on the available runway length and go-around performance, or if windshear/severe turbulence is considered possible on the approach.
    · The ECAM may require landing in configuration 3, in case of a system failure :
      * First read the VLS CONF FULL value on the PERF APP page to determine the VAPP
R (or use QRH 2.31).
      * Then, select CONF 3 on the PERF APP page.

    As a general rule, managed speed can be used if the landing configuration and the configuration selected on the PERF APP page are the same. (If they are not the same, the managed speed will not drop down to the approach speed).
  – Check VAPP according to the FLAPS FULL or FLAPS 3 selection on the MCDU.
    The pilot can modify VAPP. The new value will be taken into account for ground speed mini-function.

  Note : *If some abnormality requires a speed increment for the approach, the increment must be added to VLS CONF FULL.*

– **GO-AROUND page . . . . CHECK/MODIFY**
  Check the THR RED ALT and ACC ALT, and modify if necessary.

– **RAD NAV page . . . . CHECK**
  Set navaids, as required, and check idents on the NDs (VOR-ADF) and PFDs (ILS). If a VOR/DME exists close to the airfield, select it and enter its ident in the BRG/DIST field of the PROG page, for NAV ACCY monitoring during descent.

– **SEC F-PLN page . . . . AS RQRD**
Before the top of descent, the SEC F-PLN should either be set to an alternate runway for destination, or to the landing runway in case of circling. In all cases, routing to the alternate should be available. If there is a last-minute runway change, then the flight crew only needs to activate the secondary F-PLN, without forgetting to set the new MDA or DH and navaids.

– **GPWS LDG FLAP 3 . . . . AS RQRD**
If the pilot plans on landing in FLAPS 3 configuration, the GPWS LDG FLAP 3 switch should be set to ON.

– **APPROACH BRIEFING . . . . PERFORM**
The flight crew should use FMGS pages as a descent and approach briefing guide.
· PERF page : Safe altitude is .. .. Transition altitude is .. ..
· RAD NAV page : ILS, VOR, ADF and associated crossing altitudes.
· F-PLN page : To check STAR, APPR, missed approach.
· FMA : MDA/DH (MDH/DH if QFE used).
R · Go-around (Standard call/task sharing, Diversion decision).
R · Terminal area topography to ensure a proper terrain awareness.
· Weather at destination.
· Fuel page : Fuel needed for diversion ; holding fuel possibility.
· Landing configuration (including ground spoilers, reverser application, and autobrake selection).
· Runway conditions, lighting, and dimensions.
· For airlines having different models of the A319/A320/A321 family, mention whether the aircraft is an A319, A320, or A321. Awareness of the aircraft model may prevent tailstrike.

– **DESCENT CLEARANCE . . . . OBTAIN**
When clearance is obtained, set the ATC-cleared altitude (FL) on the FCU (also considering what is the safe altitude).
If the lowest safe altitude is higher than the ATC-cleared altitude, check with the ATC that this constraint applies.
If it is confirmed, set the FCU altitude to the safe altitude, until it is safe to go to the ATC-cleared altitude.

– **ANTI ICE PROTECTION . . . . AS RQRD**
· During descent, ENG ANTI ICE must be ON when icing conditions are encountered. (Refer to 3.04.30 p. 1).
· With engine ANTI ICE ON, the FADEC automatically controls continuous ignition and selects a higher idle thrust which gives better protection against flame-out. The IGNITION memo appears on the ECAM.
· ANTI ICE ON reduces the descent path angle (when the engines are at idle). The pilot can compensate for this by increasing the descent speed, or by extending up to half speedbrakes.

DESCENT INITIATION

– **DESCENT . . . . INITIATE**
The normal method of initiating the descent is to select DES mode at the FMGS calculated top of descent (TOD).

■ **If ATC requires an early descent :**
Use DES mode which will guide the aircraft down at a lower vertical speed in order to converge on the required descent path. (The pilot may use a V/S of – 1000 ft/mn).

■ **If ATC delays the descent :**
Beyond TOD, a DECELERATE message comes up on the PFD and MCDU. This suggests to the crew that it starts reducing speed towards green dot speed (with ATC permission). When cleared to descend, select DES mode with managed speed active.

DESCENT MONITORING

– **PF MCDU . . . . PROG/PERF DES**
PF MCDU should be set to PROG or PERF DES page :
· PROG page in order to get VDEV or RQD DIST TO LAND/DIRECT DIST TO DEST information.
· PERF DES in order to get predictions down to any inserted altitude in DES/OP DES
R modes and EXP mode (◁*).

– **PNF MCDU . . . . F-PLN**
With the AP engaged, the PF usually makes any required F-PLN revisions.

Note : *The NDs show a level-off symbol ↳ along the flight path. Its position is based on the current active AP/FD and A/THR modes.*

– **DESCENT . . . . MONITOR**
(Refer to FCOM 4 05.60)
- When flying in NAV mode, use DES mode.
  The aircraft descends along the descent flight path : the PFD and PROG page display VDEV, and so it can be monitored. All constraints of the flight plan are taken into account for the guidance.
- When the aircraft is flying in HDG or TRK mode, and thus out of the lateral F-PLN, DES mode is not available.
  However the PFD still displays VDEV, and this is useful whenever cross track error is small (up to 5 NM) - PROG page displays DIST RQD TO LAND/ DIRECT DIST TO DEST: the comparison of this data helps the crew to monitor the descent.
  The flight crew can use the level ↘ symbols on the ND to monitor the descent.
  MCDU predictions assume a return to the lateral F-PLN and descent flight path.
  Note that whenever the lateral mode is changed from NAV to HDG/TRK the vertical mode reverts to V/S at the value pertaining at the time of the mode change.
- From time to time during stabilized descent, the flight crew may select FPA to check that the remaining distance to destination is approximately the altitude change required divided by the FPA in degrees.

  $\boxed{\text{FPA } (°) = \Delta \text{ FL/DIST (NM)}}$

DESCENT ADJUSTMENT

To increase the rate of descent :
- Increase descent speed (by use of selected speed) if comfort and ATC permit. It is economically better (Time/Fuel) than the following procedures.
- Maintain high speed as long as possible. (SPD LIM may be suspended, subject to ATC clearance).
- If the aircraft is high and at high speed, it is more efficient to keep the high speed to ALT* and decelerate, rather than to mix descent and deceleration.
- If the aircraft goes below the desired profile, use SPEED and the V/S mode to adjust the rate of descent.

Note : EXPEDITE DESCENT.
If a high rate of descent is required, push the EXPED pushbutton ⊲⊳ on the FCU. The target speed for the descent now becomes Mach 0.8 or 340 knots, whichever is lower. The FMA will display THR IDLE/EXP DES/NAV.*
To return to DES mode, push the FCU ALT knob.
To return to SPEED/V/S modes, pull the FCU V/S knob.
In all cases, monitor the FMA to ensure that the mode engages properly.

– **SPEEDBRAKES . . . . AS RQRD**
In OPEN DES : Use speedbrakes to increase the rate of descent. The pilot may use up to half speedbrakes to maintain the required rate of descent, when engine anti-ice is used.
In DES mode : If the aircraft is on, or below, the flight path and the ATC requires a higher rate of descent, do not use speedbrakes because the rate of descent is dictated by the planned flight path. Thus, the A/THR may increase thrust to compensate for the increase in drag. In this case, use OPEN DES with speedbrakes.

Note : 1. If speedbrakes are used above 315 knots/M.75 with the AP engaged, their rate of retraction is low (total time for retraction from full extension is approximately 25 seconds). The ECAM memo page displays SPD BRAKES in amber until retraction is complete.
2. In order to avoid overshooting the altitude, due to speedbrake retraction in ALT mode, retract the speedbrakes at least 2000 feet before the selected altitude.*

– **RADAR TILT . . . . ADJUST**
Every 10000 feet of the planned descent, and down to about 15000 feet, adjust the tilt upwards to eliminate ground clutter on the upper part of the ND.
Every 5000 feet below 15000 feet, adjust the tilt angle one degree upwards, in order to keep the ND relatively free of ground clutter.

– **BARO REF . . . . SET**
· Set QNH (or QFE ⊲*⊳) on the EFIS control panel and on the standby altimeter, when approaching the transition level and when cleared for an altitude.
· Crosscheck baro settings and altitude readings.

Note : When operating in low OAT, altitude corrections, as defined in 3.05.05 page 6, should be considered.

● **If EGPWS is available :**

R – **TERR ON ND . . . . ON**
R If use of radar is required, consider selecting the radar display on the PF side, and
R TERR ON ND on the PNF side only.

– **ECAM STATUS . . . . CHECK**
· Check that there is no status reminder on the upper ECAM display.
· If there is a status reminder, check the aircraft STATUS.
· Check the ECAM status page before completing the approach checks. Take particular note of any degradation in landing capability, or any other aspect affecting the approach and landing.

● **At 10 000 feet :**

R – **LAND LIGHTS . . . . ON**
LAND lights may be switched ON, according to the airline policy/regulatory recommendation.

– **SEAT BELTS . . . . AS RQRD**

– **EFIS option . . . . CSTR**

– **ILS pushbutton . . . . AS RQRD**
Select ILS, if an ILS or LOC approach is intended.
The PFD displays the LOC and glide scales and deviation symbol, if there is a valid ILS signal.

– **RAD NAVAIDS . . . . SELECTED/IDENTIFIED**
Ensure that appropriate radionavaids are tuned and identified.
For NDB approaches, manually select the reference navaid.

– **NAV ACCURACY . . . . CHECK**
On aircraft equipped with GPS primary, no navigation accuracy check is required, as long as GPS PRIMARY function is available.
Otherwise, crosscheck NAV ACCURACY using the PROG page (BRG/DIST computed data), and the ND (VOR/DME raw data).
The navigation accuracy check determines which autopilot mode the flight crew should use for the approach, and the type of displays to be shown on the ND.

Note : *In flight, at operation at or close to idle, each engine may use different fuel nozzle modes. This may lead to EGT differences up to 150°C between both engine. This is to be considered as normal operation.*

GENERAL

For more information about precision approaches and how to use the FMGS see FMGS pilot's guide (Refer to 4.05.70). The approach procedures described here assume that the flight crew uses managed speed guidance which is recommended.

Note : *If the forecasted tail wind at landing is greater than 10 knots, decelerated approach is not allowed, and the speed should be stabilized around VREF + 5 knots in final.*

INITIAL APPROACH

– **ENG MODE selector** . . . . **AS RQRD**
Select IGN if the runway is covered with standing water, or if heavy rain or severe turbulence is expected during approach or go-around.

R – **SEAT BELTS** . . . . **ON/AUTO**

– **APPROACH PHASE** . . . . **CHECK/ACTIVATE**
· If the aircraft overflies the DECEL pseudo waypoint in NAV mode, the APPR phase activates automatically.
· If the aircraft is in HDG/TRK mode, approximately 15 NM from touchdown activate and
R confirm APPROACH phase on the MCDU.

– **POSITIONING** . . . . **MONITOR**
· In NAV mode, use VDEV information on the PFD and PROG page.
· In HDG or TRK mode, use the energy circle on ND representing the required distance to land.

– **MANAGED SPEED** . . . . **CHECK**
If ATC requires a particular speed, then use selected speed. When the ATC speed constraint ("maintain 170 knots to the outer marker", for example) no longer applies, return to managed speed.

– **SPEEDBRAKES . . . . AS RQRD**
If the pilot uses speedbrakes to increase the rate of deceleration, or to increase the rate of descent, he should realize that VLS with speedbrakes fully extended, in the clean configuration, may be higher than green dot speed and possibly than VFE FLAP 1. The A/THR in speed mode, or the pitch demand in OPEN DES, will limit the speed to VLS. In this situation, the pilot should begin to retract speedbrakes upon reaching VLS + 5 knots and should select FLAP 1, as soon as speed is below VFE NEXT. He may then extend the speedbrakes, if necessary. The landing gear may always be extended out of sequence to aid deceleration.

– **NAV ACCURACY . . . . MONITOR**
When GPS PRIMARY is available, no NAV ACCURACY monitoring is required.
When GPS PRIMARY is lost, check the PROG page to verify that the required navigation accuracy is appropriate to the flight phase. Monitor NAV accuracy, and be prepared to change approach strategy. If NAV ACCURACY DOWNGRAD occurs, use raw data to check navigation accuracy.
Navigation accuracy determines which autopilot modes the flight crew should use, the type of displays to be shown on the ND, as well as the use of EGPWS.

R

<table>
<tr><th rowspan="2">NAVIGATION ACCURACY</th><th colspan="2">ND</th><th rowspan="2">AP/FD mode</th><th rowspan="2">TERR pushbutton</th></tr>
<tr><th>PF</th><th>PNF</th></tr>
<tr><td>GPS PRIMARY</td><td colspan="2" rowspan="3">ARC or ROSE NAV with navaid raw data</td><td rowspan="3">NAV</td><td rowspan="3">ON</td></tr>
<tr><td>NAV ACCUR HIGH</td></tr>
<tr><td>NAV ACCUR LOW and NAV ACCURACY check ≤ 1 NM</td></tr>
<tr><td>GPS PRIMARY LOST and NAV ACCUR LOW and NAV ACCURACY check > 1 NM</td><td rowspan="2">ROSE ILS</td><td rowspan="2">ARC or ROSE NAV or ROSE ILS with navaid raw data</td><td rowspan="2">HDG or TRK</td><td rowspan="2">OFF</td></tr>
<tr><td>GPS PRIMARY LOST and Aircraft flying within unreliable radio navaid area</td></tr>
</table>

– **RADAR TILT . . . . ADJUST**
Increase tilt, as required (+ 3° to + 4°).

– **APPROACH CHECKLIST . . . . COMPLETE**

INTERMEDIATE/FINAL APPROACH (ILS approach entered in the F-PLN)

The objective is to be stabilized on the final descent path at VAPP, thrust above idle, in the landing configuration, at 1000 feet, after continuous deceleration on the glideslope.

R To be stabilized, all of the following conditions must be achieved prior to, or upon, reaching
R this stabilization height :
R – The aircraft is on the correct lateral flight plan,
R – The aircraft is in the desired landing configuration,
R – The thrust is stabilized above idle, to maintain the target speed on the desired glide path,
R – No excessive flight parameter deviation.

The advantages are : lower fuel consumption, lower noise levels, time saved, flexibility and ability to vary speed to suit ATC.

If the aircraft is not stabilized on the approach path in landing configuration, at 1000 feet in instrument conditions, or at 500 feet in visual conditions, or as restricted by airline
R policy/regulations, a go-around must be initiated.

– **APPR pushbutton on FCU . . . . PRESS**
  · Press the APPR pushbutton, only when ATC cleares the aircraft for the approach. This arms the LOC and G/S modes.
  · LOC and/or G/S capture modes will engage no sooner than 3 seconds after being armed.

Note : ICAO defines the envelope where the quality of the G/S signal ensures a normal capture. This envelope is within 10 NM, +/–8 degrees of the centerline of the ILS glide path and up to 1.75 teta and down to 0.3 teta (teta being the nominal glide path angle).
When arming the approach well outside of the normal G/S capture envelope, a spurious G/S engagement may occur due to a wrong G/S deviation signal. This spurious G/S capture will order a pitch up, if the aircraft is below the glide beam, and a pitch down attitude, if the aircraft is above the glide beam.*
Whenever the pilot notices the pitch movement, or the spurious G/S, or the trajectory deviation, he will immediately disconnect the AP, if engaged, to re-establish a normal attitude and will disengage APPR mode. It is then recommended to arm/rearm APP (ILS) mode within the normal capture zone.*

– **Both APs . . . . ENGAGE**
  When APPR mode is selected, both autopilots should be engaged.

AT GREEN DOT SPEED

– **ORDER . . . . "FLAPS 1"**

– **FLAPS 1 . . . . SELECT**

R – **CONFIRM/ANNOUNCE . . . . "FLAPS 1"**
· FLAPS 1 should be selected not less than 3 NM from FAF (final approach fix).

Note : *The ECAM displays the STATUS page automatically if it is applicable and if the flight crew has not already selected a system page manually.*

· Check deceleration toward "S" speed.
· The aircraft must reach or be established on the glide slope with FLAPS 1 and S speed at or above 2000 feet AGL.
· If the aircraft speed is significantly higher than S on the glide slope, or if the aircraft does not decelerate on the glide slope, extend the landing gear to slow it down. The use of speedbrakes is not recommended because it causes an unwanted increase in VLS.

– **TCAS (⊲) . . . . TA or TA/RA**
FAA recommends to select TA only mode :
· In case of known nearby traffic which is in visual contact
· At particular airports and during particular procedures identified by an operator as having a significant potential for unwanted or inappropriate resolution advisories (closely spaced parallel runways, converging runway, low terrain along the final approach...).

– **FMA . . . . CHECK**

– **LOC CAPTURE . . . . MONITOR**

– **ANNOUNCE . . . . "LOC*"**

– **G/S CAPTURE . . . . MONITOR**

● **If above the glideslope :**

– **V/S mode . . . . SELECT**

– **FCU ALTITUDE . . . . SET ABOVE A/C ALTITUDE**

– **Do not reach VFE to avoid reversion to OP CLB.**

Note : *If the aircraft intercepts the ILS above radio altimeter validity range (no radio altitude indication available on the PFD), CAT 1 is displayed on FMA. Check that the FMA displays the correct capability for the intended approach when the aircraft is below 5000 feet.*

– **ANNOUNCE** . . . . **"G/S*"**

– **GO-AROUND ALT** . . . . **SET**
Set the go around altitude on the FCU.

AT 2000 FT AGL (minimum)

– **ORDER** . . . . **"FLAPS 2"**

– **FLAPS 2** . . . . **SELECT**

R – **CONFIRM/ANNOUNCE** . . . . **"FLAPS 2"**
· Check deceleration toward F speed.
· If the aircraft intercepts the ILS glideslope below 2000 feet AGL, select FLAPS 2 at one dot below the glideslope.
· If the aircraft speed is significantly higher than S on the glide slope, or the aircraft does not decelerate on the glide slope, extend the landing gear in order to slow down the aircraft. The use of speedbrakes is not recommended.
· When the speedbrakes are deployed, extending the flaps beyond FLAPS 1 may induce a slight roll movement, and in calm conditions a small lateral control asymmetry may remain until disturbed by a control input or by an atmospheric disturbance.

WHEN FLAPS ARE AT 2

– **ORDER . . . . "GEAR DOWN"**

– **L/G DOWN . . . . SELECT**

– **GROUND SPOILERS . . . . ARM**

– **AUTO BRK . . . . AS RQRD**
Use of autobrake is recommended.
Use of MAX mode is not recommended at landing.
On short or contaminated runways, use MED mode.
On long and dry runways, LO mode is recommended.

Note : If, on very long runways, the pilot anticipates that braking will not be needed, use of the autobrake is unnecessary.

Firmly press the appropriate pushbutton, according to the runway length and condition, and check that the related ON light comes on.

– **CONFIRM/ANNOUNCE . . . . "GEAR DOWN"**

WHEN LANDING GEAR IS DOWN

– **ORDER** . . . . **"FLAPS 3"**

– **FLAPS 3** . . . . **SELECT**
Select FLAPS 3 below VFE.

– **CONFIRM/ANNOUNCE** . . . . **"FLAPS 3"**

– **ECAM WHEEL page** . . . . **CHECK**
· ECAM WHEEL page appears below 800 feet, or at landing gear extension.
· Check for three landing gear green indications.
R · If residual pressure is indicated on the triple indicator, press the brake pedals several
R times to zero the residual alternate pressure. Select the AUTO BRK MED mode, if
R residual braking remains, in order to cancel residual pressure at touchdown.
R · Beware of possible braking asymmetry after touchdown, which can be controlled
R using pedals.
R · Do not switch off the A/SKID & NWS : The antiskid function limits the effect of the
R residual braking and prevents tireburst.

– **ORDER** . . . . **"FLAPS FULL"**

– **FLAPS FULL** . . . . **SELECT**
· Select FLAPS FULL below VFE. (VFE – 15 knots is recommended to minimize flaps wear).
· Retract the speedbrakes before selecting FLAPS FULL to avoid an unexpected pitch down, when the speedbrakes retract automatically.

– **CONFIRM/ANNOUNCE** . . . . **"FLAPS FULL"**
Check deceleration towards VAPP.

– **A/THR . . . . CHECK IN SPEED MODE OR OFF**

– **WING ANTI ICE . . . . OFF**
Switch the WING ANTI ICE ON, only in severe icing conditions.

– **EXTERIOR LIGHTS . . . . SET**
Set NOSE switch to TAXI.
RWY TURN OFF switch to ON, and
LAND switch to ON.

– **SLIDING TABLE ◁* . . . . STOW**

– **LDG MEMO . . . . CHECK NO BLUE LINE**

– **CABIN REPORT . . . . OBTAIN**

– **CABIN CREW . . . . ADVISE**

– **LANDING CHECKLIST . . . . COMPLETE**

– **FLIGHT PARAMETERS . . . . CHECK**
PF announces any FMA modification.
The PNF calls out, if :
– Speed goes lower than the speed target – 5 knots, or greater than the speed target + 10 knots.
– Pitch attitude goes lower than – 2.5°, or greater than 10° nose up.
– Bank angle becomes greater than 7°.
– Descent rate becomes greater than 1000 feet/min.
– Excessive LOC or GLIDE deviation occurs.

AT DH + 100 FT (or MDA/MDH + 100 FT) :

– **MONITOR (or ANNOUNCE) . . . . "ONE HUNDRED ABOVE"**

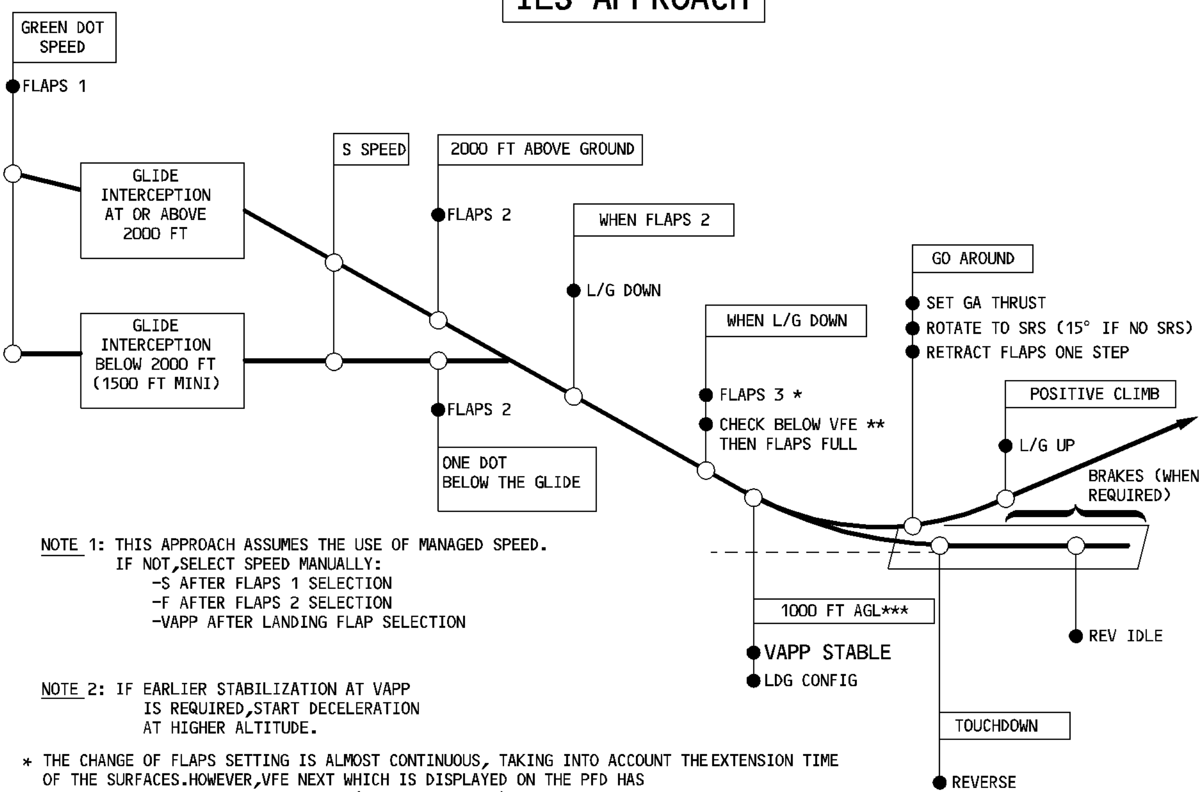
AT DH (or MDA/MDH)

– **MONITOR (or ANNOUNCE) . . . . "MINIMUM"**

– **ANNOUNCE . . . . "LANDING" or "GO AROUND/FLAPS"**
Do not duck under the glideslope. Maintain a stabilized flight path down to the flare.
At 50 feet, one dot below the glideslope is 14 feet below the glideslope.

NFC5-03-0318-009-A001AA

ILS APPROACH



NOTE 1: THIS APPROACH ASSUMES THE USE OF MANAGED SPEED.
IF NOT,SELECT SPEED MANUALLY:
-S AFTER FLAPS 1 SELECTION
-F AFTER FLAPS 2 SELECTION
-VAPP AFTER LANDING FLAP SELECTION

NOTE 2: IF EARLIER STABILIZATION AT VAPP IS REQUIRED,START DECELERATION AT HIGHER ALTITUDE.

* THE CHANGE OF FLAPS SETTING IS ALMOST CONTINUOUS, TAKING INTO ACCOUNT THE EXTENSION TIME OF THE SURFACES.HOWEVER,VFE NEXT WHICH IS DISPLAYED ON THE PFD HAS TO BE CONSIDERED IN CERTAIN CASES (AIRCRAFT HEAVY).

** TO MINIMIZE FLAPS WEAR,EXTEND FLAPS AT VFE-15 Kt WHEN POSSIBLE.

*** 1000Ft AGL MINIMUM IMC,
500Ft AGL MINIMUM VMC OR AS RESTRICTED BY AIRLINE POLICY/REGULATIONS.

INTRODUCTION

APPROACH GUIDANCE FOR NON PRECISION APPROACHES OTHER THAN LOC AND RNAV NON PRECISION APPROACHES

Three different approach strategies are available to perform non-precision approaches :

1. Lateral and vertical guidance, selected by the crew : TRK-FPA (or HDG-V/S) modes.
2. Lateral guidance, managed by the FM, and vertical guidance selected by the crew : NAV-FPA (or NAV-V/S) modes.
3. Lateral and vertical guidance, managed by the FM : FINAL APP mode.
   In all cases, the recommended flying reference is FPV, which should be selected during the initial approach.

- Approach procedures including a PI-CF leg (PROC-T indicated on the MCDU F-PLN) are not eligible for the use of NAV and FINAL APP modes.
- Lateral managed guidance (NAV) can be used, provided the approach is stored in the navigation database and the final approach is laterally and vertically monitored, using the adequate raw data (reference navaid, altimeter).
- Lateral and vertical managed guidance (FINAL APP) in IMC conditions can be used, provided the following conditions are met :
  · The approach stored in the navigation database has been validated, and is approved by the operator for use of FINAL APP mode.

  Note : For navigation database vertical flight path validation refer to the approach coding guidelines and recommendations given in FCOM Bulletin N° 53, and in the FMGS Pilot's Guide (Refer to 4.02.22).

  · The final approach (FAF to runway or MAP), as extracted from the navigation database and inserted in the primary F-PLN including altitude constraints, is not revised by the crew.
  · Before starting the approach, the crew must check the lateral and the vertical FM F-PLN against the published approach chart, using the MCDU and ND.
  · The approach trajectory is laterally and vertically intercepted, before the FAF, or equivalent waypoint in the FM F-PLN, so that the aircraft is correctly established on the final approach course before starting the descent.
  · The final approach is laterally and vertically monitored, using the appropriate raw data (navaids, distance to the runway or MAP, altitude, FPV).

  Note : For additional information on recommended flight crew procedures, refer to the dedicated FCOM Bulletin N° 53 on the FMGS Pilot's Guide (Refer to 4.05.70).

If the FM/GPS POS DISAGREE ECAM caution is triggered during the approach, use selected guidance to continue the approach with radio navaid raw data.
If GPS PRIMARY is lost, NAV and FINAL APP mode can be used to continue the approach, provided the radio navaid raw date indicates the correct navigation.

R **APPROACH GUIDANCE FOR RNAV APPROACH**

R Two different approach strategies are available to perform RNAV approaches :
R 1. Lateral guidance, managed by the FM, and vertical guidance selected by the crew :
R NAV-FPA (or NAV-V/S) modes.
R This strategy applies, when LNAV ONLY (Lateral Navigation only) RNAV approach is
R intended.
R 2. Lateral and vertical guidance, managed by the FM : FINAL APP mode.
R This strategy applies, when LNAV/VNAV (Lateral and Vertical Navigation) RNAV
R approach is intended.
R In all cases, the recommended flying reference is FPV, which should be selected during
R the initial approach.
R RNAV approach can be performed, provided :
R – The approach procedure does not include a PI-CF leg (PROC T indicated on the MCDU
R F-PLN).
R – The approach stored in the navigation database has been validated, and is approved by
R the operator,

R *Note : For navigation database vertical flight path validation, refer to the approach*
R *coding guidelines and recommendations given in FCOM Bulletin N° 53, and in the*
R *FMGS Pilot's Guide (Refer to 4.02.22).*

R – The final approach (FAF to runway or MAP), as extracted from the navigation database
R and inserted in the primary F-PLN including altitude constraints, is not revised by the
R crew.
R – Before starting the approach, the crew must check the lateral and the vertical FM F-PLN
R against the published approach chart, using the MCDU and ND.
R – Before starting the approach, two navigation systems must be operative : 2 FMGS and
R 2 sensors (2 GPS, 2 DME, 2 VOR as appropriate).
R – The approach trajectory is laterally and vertically intercepted, before the FAF, or
R equivalent waypoint in the FM F-PLN, so that the aircraft is correctly established on the
R final approach course before starting the descent.
R – The final approach is laterally and vertically monitored, using the appropriate raw data
R (distance to the runway, altitude, FPV).

R *Note : For additional information on recommended flight crew procedures, refer to the*
R *dedicated FCOM Bulletin N° 53, and the FMGS Pilot's Guide (Refer to 4.05.70).*

R **For RNAV approach with GPS PRIMARY**

R An instrument approach procedure, not requiring GPS PRIMARY, must be available at
R destination or destination alternate (and at required takeoff alternate, and en route
R alternate). Check RAIM availability, using the PREDICTIVE GPS MCDU page. Before starting
R the approach, check that GPS PRIMARY is available on both MCDUs.
R If the GPS PRIMARY LOST indication appears on the ND during the approach, discontinue
R the approach, unless :
R – For RNAV approach not requiring GPS, HIGH accuracy is displayed on the MCDU with
R the appropriate RNP value.
R – If GPS PRIMARY is lost on only one, FMGC, the approach can be continued, using the
R AP/FD associated to the other FMGC.
R If the FM/GPS POS DISAGREE ECAM caution is triggered during the approach, discontinue
R the approach.

R **For RNAV approach without GPS PRIMARY**

R Before starting the approach, check the FM position accuracy with radio navaid raw data.
R Check, in addition, that HIGH accuracy is displayed on the MCDU with the specified RNP
R value.
R If HIGH accuracy is lost on one FMGC, the approach can be continued with the AP/FD
R associated to the other FMGC.
R If HIGH accuracy is lost on both FMGCs, discontinue the approach.

APPROACH GUIDANCE FOR LOC NON PRECISION APPROACHES

The Standard Operating Procedure of this section can be used for flying LOC approaches, provided the following approach guidance items are observed.
The FM NAV mode can be used down to LOC interception.
For LOC intermediate and final approach, use the LOC AP/FD mode for lateral navigation, associated with the FPA (or V/S) for vertical navigation.
Vertical navigation must be monitored using raw data (altimeter, distance to the runway given by radio-navaid).
The VDEV indication on the PFD must be disregarded, since it may be incorrect if the MAP is located before the runway threshold.

APPROACH SPEED TECHNIQUE

In all cases, the crew should use managed speed.
The standard speed technique is to make a stabilized approach using AP/FD and A/THR :
The aircraft intercepts the final descent path in landing configuration, and at VAPP. For this purpose, the flight crew should insert VAPP as a speed constraint at the FAF.
If the operator adopts a decelerated approach technique and the crew uses managed guidance, the aircraft should intercept the final descent path at S speed in CONF 1.
The objective is to be stabilized on the final descent path thrust above idle, in the landing configuration at 1000 feet.
To be stabilized, all of the following conditions must be achieved prior to, or upon, reaching this stabilization height :
- The aircraft is on the correct lateral flight plan,
- The aircraft is in the desired landing configuration,
- The thrust is stabilized above idle, to maintain the target speed on the desired descent path,
- No excessive flight parameter deviation.

If the aircraft is not stabilized on the approach and in landing configuration, at 1000 feet in instrument conditions, or at 500 feet in visual conditions, or as restricted by airline policy/regulations, a go-around must be initiated.
If the forecast tailwind at landing is greater than 10 knots, decelerated approach is not allowed, and the speed should be stabilized around VREF + 5 knots in final.

INITIAL APPROACH

– **ENG START selector . . . . AS RQRD**
Select IGN if the runway is covered with standing water, or heavy rain, or if severe turbulence is expected in the approach or go-around area.

– **SEATBELTS . . . . ON/AUTO**

– **APPROACH PHASE . . . . ACTIVATE**
· In NAV mode, the APPR phase automatically activates at the DECEL pseudo waypoint.
· In HDG or TRK mode, manually activate the APPR phase on the PERF APPR page, when the distance to land is approximately 15 NM.

– **POSITIONING . . . . MONITOR**
· In NAV mode, use VDEV information on the PFD and PROG page.
· In HDG or TRK mode, use the energy circle displayed on ND representing the required distance to land.

– **MANAGED SPEED . . . . CHECK**
If the ATC requires a particular speed, use selected speed. When the ATC speed constraint no longer applies, return to managed speed.

– **SPEEDBRAKES . . . . AS RQRD**

– **NAVIGATION ACCURACY . . . . MONITOR**

· When GPS PRIMARY is available, no accuracy check is required.

· When GPS PRIMARY is lost, check the PROG page to ensure that the required navigation accuracy is appropriate to the phase of flight. Perform a navigation accuracy check (as described in 3.03.15).

If the approach is stored in the navigation database, determine the strategy to be used for the final approach, according to the table below :

R

<table>
<tr><th rowspan="2">NAVIGATION ACCURACY</th><th rowspan="2">Approach guidance</th><th colspan="2">ND</th><th rowspan="2">AP/FD mode</th><th rowspan="2">TERR pushbutton</th></tr>
<tr><th>PF</th><th>PNF</th></tr>
<tr><td>GPS PRIMARY</td><td rowspan="3">Managed***</td><td colspan="2" rowspan="3">ARC or ROSE NAV *
With navaid raw data</td><td rowspan="3">NAV-FPA or APP-NAV/ FINAL ***</td><td rowspan="3">ON</td></tr>
<tr><td>NAV ACCUR HIGH</td></tr>
<tr><td>NAV ACCUR LOW and NAV ACCURACY check ≤ 1NM</td></tr>
<tr><td>GPS PRIMARY LOST and NAV ACCUR LOW and NAV ACCURACY check > 1 NM</td><td rowspan="2">Selected</td><td rowspan="2">ROSE VOR **</td><td rowspan="2">ARC or ROSE NAV or ROSE VOR **
With navaid raw data</td><td rowspan="2">TRK-PFA</td><td rowspan="2">OFF</td></tr>
<tr><td>GPS PRIMARY LOST and aircraft flying within unreliable radio navaid area</td></tr>
</table>

(*) For VOR approaches, one pilot may select ROSE VOR.

(**) For LOC approaches, select ROSE ILS.

(***) Managed vertical guidance can be used, provided the approach coding in the navigation database has been validated.

R *Note :* *1. During approach in overlay to a conventional radio navaid procedure, monitor raw*
R *data. If raw data indicates unsatisfactory managed guidance, revert to selected*
R *guidance.*

2. The pilot can continue to fly a managed approach, after receiving a NAV ACCUR DOWNGRADED message, if raw data indicates that the guidance is satisfactory.

– **RADAR TILT . . . . ADJUST**

Increase tilt, as required (+ 3° to + 4°).

– **APPROACH CHECKLIST . . . . PERFORM**

INTERMEDIATE/FINAL APPROACH

R ● **For RNAV approach :**

R – **GPS 1+2 on GPS MONITOR page . . . . CHECK BOTH IN NAV**

R – **GPS PRIMARY on PROG page . . . . CHECK AVAILABLE**

R ● **If GPS PRIMARY is not available**

R – **RNP for approach . . . . CHECK/ENTER**

R – **HIGH accuracy . . . . CHECK**

R *Note : RNAV approach without GPS is subject to a specific operational approval.*

● **For approach in managed vertical guidance :**

– **APPR pushbutton on FCU . . . . PRESS**
Once cleared for the approach, press the pushbutton when flying towards the FAF. Check that APPR NAV is engaged, FINAL is armed, and the VDEV scale is on the PFD.

Note : For instructions for switching from a non ILS to an ILS approach, see the FMGS pilot's guide. (Refer to 4.05.70)

AT GREEN DOT SPEED

– **ORDER . . . . "FLAPS 1"**

– **FLAPS 1 . . . . SELECT**

– **CONFIRM/ANNOUNCE . . . . "FLAPS 1"**

– **TCAS Mode Selector . . . . TA OR TA/RA**
· See ILS approach (Refer to 3.03.18)

– **ND DISPLAY . . . . SELECT RANGE/MODE**

AT S SPEED

– **ORDER . . . . "FLAPS 2"**

– **FLAPS 2 . . . . SELECT**

– **CONFIRM/ANNOUNCE . . . . "FLAPS 2"**

WHEN FLAPS ARE AT 2

– **ORDER** . . . . **"GEAR DOWN"**

– **L/G DOWN** . . . . **SELECT**

– **GROUND SPOILERS** . . . . **ARM**

– **AUTO BRK** . . . . **AS RQRD**
Use of the autobrake is recommended.
The use of MAX mode is not recommended at landing.
On short or contaminated runways, use MED mode.
On long and dry runways, LO mode is recommended.

Note : If, on very long runways, the pilot anticipates that braking will not be needed, autobrake use is unnecessary.

Firmly press the appropriate pushbutton, according to runway length and condition, and check that the related ON light comes on.

– **CONFIRM/ANNOUNCE** . . . . **"GEAR DOWN"**

WHEN LANDING GEAR DOWN :

– **ORDER** . . . . **"FLAPS 3"**

– **FLAPS 3** . . . . **SELECT**
· Select FLAPS 3 below VFE.

– **CONFIRM/ANNOUNCE** . . . . **"FLAPS 3"**

– **ECAM WHEEL page** . . . . **CHECK**
· The ECAM WHEEL page appears below 800 feet, or at landing gear extension.
· Check the three landing gear green indications.
R · If residual pressure is indicated on the triple indicator, press the brake pedals several
R times to zero the residual alternate pressure. Select the AUTO BRK MED mode, if
R residual braking remains, in order to cancel residual pressure at touchdown.
R · Beware of possible braking asymmetry after touchdown, which can be controlled
R using pedals.
R · Do not switch off the A/SKID & NWS : The antiskid function limits the effect of the
R residual braking and prevents tireburst.

– **ORDER** . . . . **"FLAPS FULL"**

– **FLAPS FULL** . . . . **SELECT**
· Select FLAPS FULL below VFE. VFE – 15 knots is recommended to minimize flaps wear.
· Retract the speedbrakes before selecting FLAPS FULL to avoid an unexpected pitch down when the speedbrakes automatically retract.

– **CONFIRM/ANNOUNCE** . . . . **"FLAPS FULL"**
· Check deceleration towards VAPP.
R · Check correct TO waypoint on the ND.

MANAGED VERTICAL GUIDANCE	**SELECTED VERTICAL OR SELECTED LATERAL AND VERTICAL GUIDANCE**
. After the FAF : **– FINAL APP . . . . CHECK** Check FINAL APP green on the FMA. **– GO AROUND ALTITUDE . . . . SET** Set, when below the go-around altitude.	**. At FAF :** **– FPA for final approach . . . . SET** **. After the FAF :** **– GO AROUND ALTITUDE . . . . SET** Set, when below the go-around altitude.
– POSITION/FLIGHT PATH . . . . MONITOR **· For approach in overlay to a conventional radio navaid procedure :** Use radio navaid raw data and altitude to monitor the lateral and vertical navigation. If the navigation is unsatisfactory, revert to selected guidance. In particular, monitor the vertical guidance, using altitude indication versus radio navaid position, and be prepared to revert to NAV-FPA, if the vertical guidance is unsatisfactory. **· For RNAV approach :** Monitor VDEV and FPV (on the PFD) and XTK error (on the ND). Use altitude indication versus distance to the runway to monitor the vertical navigation. If the vertical guidance is unsatisfactory, revert to NAV/FPA or consider the go-around. If the lateral guidance is unsatisfactory, perform a go-around.	**– POSITION/FLIGHT PATH . . MONITOR/ADJUST** **· For approach in overlay to a conventional radio navaid procedure :** Use radio navaid raw data to monitor the lateral navigation. Using altitude indication versus radio navaid position, adjust the FPA, as necessary, to follow the published descent profile, taking into account the minimum altitudes. Do not use the FMGC VDEV on the PFD. If the lateral navigation is unsatisfactory, revert to TRK/FPA. **· For RNAV approach :** Monitor XTK error on ND. Using altitude indication versus distance to the runway, adjust the FPA as necessary to follow the published descent profile, taking into account the minimum altitudes. If the lateral guidance is unsatisfactory, perform a go-around.

– **A/THR . . . . CHECK IN SPEED MODE OR OFF**

– **WING ANTI ICE . . . . OFF**
Switch WING ANTI ICE ON only in severe icing conditions.

– **EXTERIOR LIGHTS . . . . SET**
Set NOSE switch to TAXI, RWY TURN OFF switch to ON, and LAND switch to ON.

– **SLIDING TABLE . . . . STOW**

– **LDG MEMO . . . . CHECK NO BLUE LINE**

– **CABIN REPORT . . . . OBTAIN**

– **CABIN CREW . . . . ADVISE**

– **LANDING CHECKLIST . . . . COMPLETE**

– **FLIGHT PARAMETERS . . . . CHECK**
PF announces any FMA modification.
PNF calls out, if :
– Speed becomes lower than speed target – 5 knots, or greater than speed target + 10 knots.
– Pitch attitude becomes lower than – 2.5°, or greater than 10° nose up.
– Bank angle becomes greater than 7°.
– Descent rate becomes greater than 1000 feet/min.

R ● **AT MDA/MDH + 100 FT :**

– **MONITOR or ANNOUNCE . . . . "ONE HUNDRED ABOVE"**

● **At MDA or MDH**

– **MONITOR or ANNOUNCE . . . . "MINIMUM"**

● **If ground references are visible :**

– **ANNOUNCE . . . . "LANDING"**

– **AP . . . . OFF**
Continue as visual approach (Refer to 3.03.20).

● **If ground references are not visible :**

– **ANNOUNCE . . . . "GO AROUND/FLAPS"**
Initiate a go-around.

<u>Note</u> : *1. In managed guidance (FINAL APP mode engaged), when the aircraft reaches MDA (MDH) – 50 feet or 400 ft (if no MDA/MDH entered), the autopilot automatically disengages.*
2. In selected guidance, if ground references are not visible when the aircraft reaches MDA, the pilot should make an immediate go-around. However, if the distance to the runway is not properly assessed, a step descent approach may be considered and a level-off at MDA may be performed while searching for visual references. If he has no visual reference at MAP, at the latest, he must begin a go-around.

CIRCLING APPROACH

For a circling approach, the flight crew should prepare the flight plan as follows :
Primary flight plan : Introduce the instrument approach
Secondary flight plan : – Copy the ACTIVE F-PLN
– Revise the Landing runway
The aircraft should circle in CONF 3 at F speed.
Upon reaching MDA :
– Push the V/S/FPA knob to level off.
– Search for visual reference.

● **If the flight crew finds no visual reference :**

  – **AT MAP : Initiate go-around**

● **If the flight crew finds sufficient visual references :**

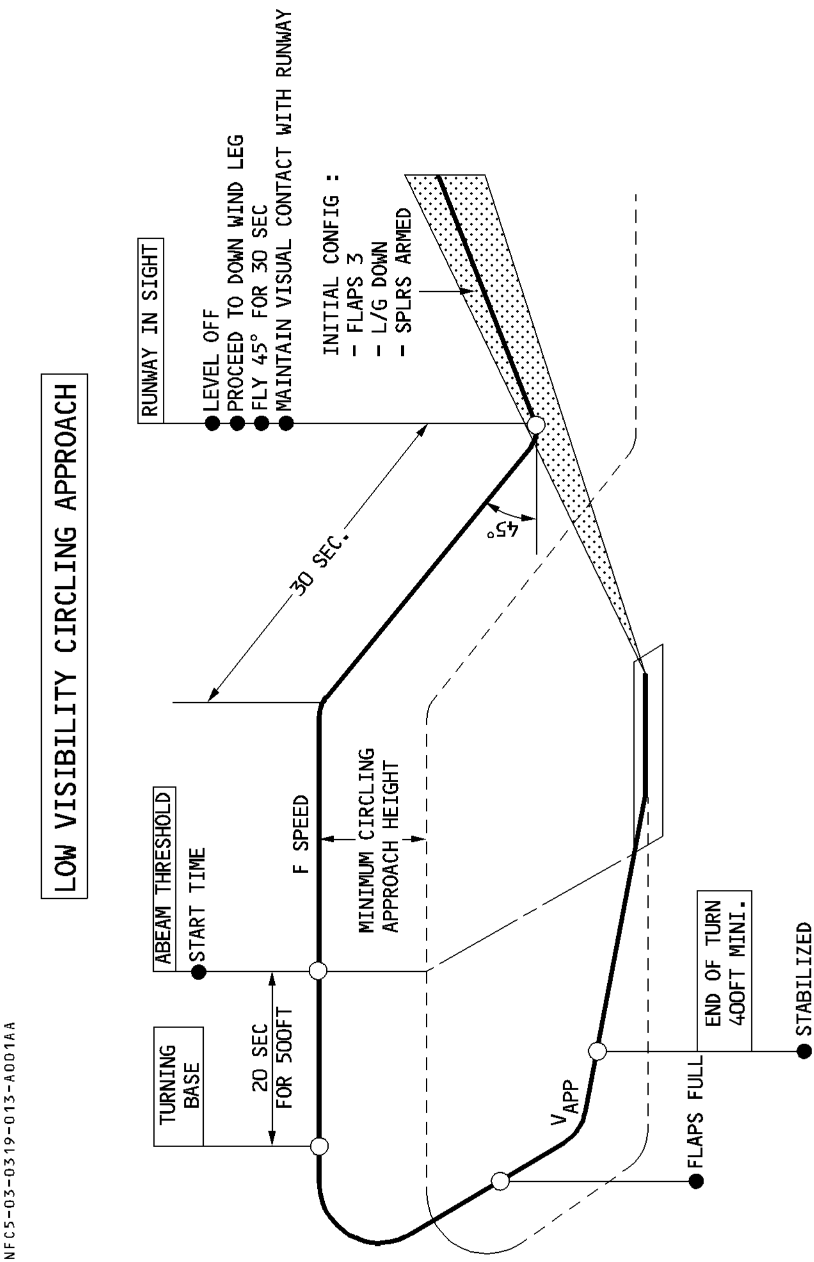
  – **Select TRK for downwind**

  – **Early on downwind : Activate SEC F-PLN**

> CAUTION
> The PNF should activate the SEC F-PLN.
> The PF should maintain visual contact during all the circling.

  – **Disengage autopilot before reaching the base leg.**

LOW VISIBILITY CIRCLING APPROACH



OBJECTIVE

Perform the approach on a nominal 3 degree glideslope using visual references. Approach to be stabilized by 500 feet AGL on the correct approach path, in the landing configuration, at VAPP.
Method :
- The autopilot is not used.
- Both FDs are off.
- FPV use is recommended.
- A/THR use is recommended with managed speed.

R Bear in mind the possible risk of optical illusions due to hindered night vision.

Note : If the forecasted tailwind at landing is greater than 10 knots, decelerated approach is not allowed, and the speed should be stabilized around VREF + 5 knots in final.

VISUAL CIRCUIT

INITIAL/INTERMEDIATE APPROACH

The flight plan selected on the MCDU should include the selection of the landing runway. The downwind leg may also be part of the flight plan. This may be a useful indication of the aircraft position in the circuit on the ND.
However, visual references must be used.
Therefore, at the beginning of the downwind leg :

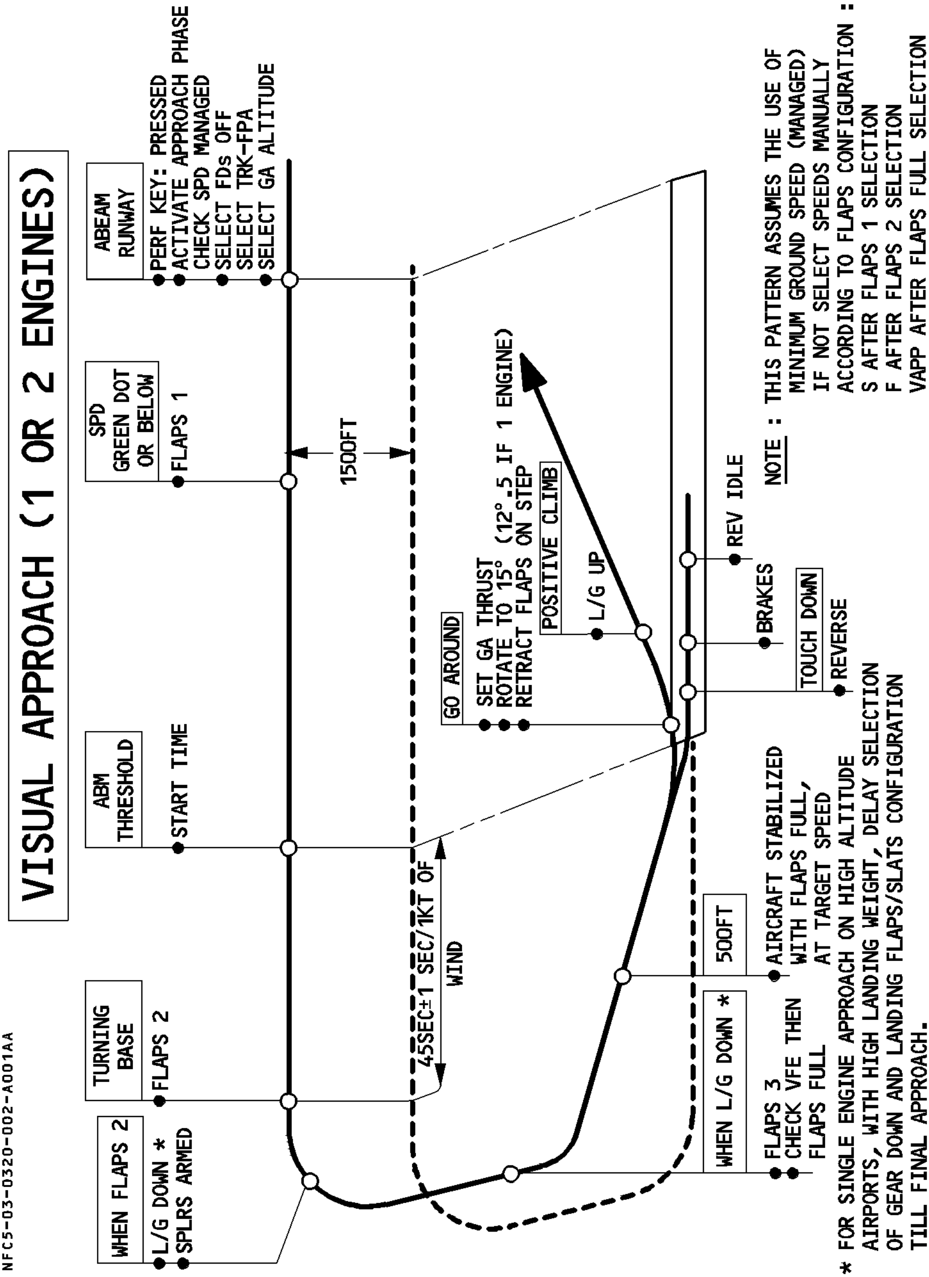
- **Manually ACTIVATE APPR phase.**

- **Select FDs to OFF. Select TRK-FPA to have FPV displayed.**

- **Check A/THR active.**
  Extend the downwind leg to 45 seconds (± wind correction). Turn into base leg with a maximum of 30° of bank. Descent with approximate FPA, in FLAPS 2, at F speed.

FINAL APPROACH

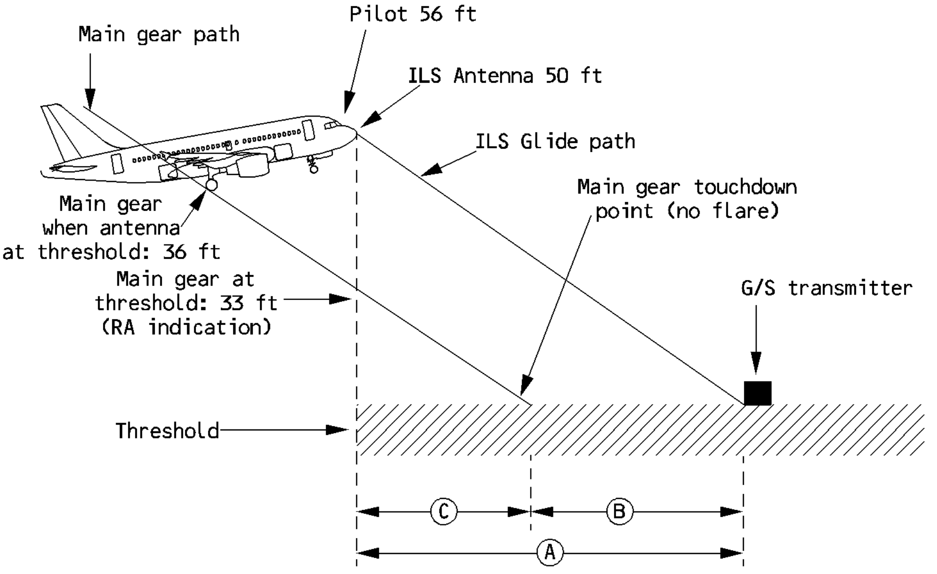
- The speed trend arrow and FPV help the flight crew make timely and correct thrust settings (if in manual thrust), and approach path corrections. Avoid descending through the correct approach path with idle thrust. (Late recognition of this situation without a prompt thrust increase may lead to considerable speed decay and altitude loss).
- Have the aircraft stabilized by 500 feet AGL, on the correct approach path at VAPP (or ground speed mini) with the appropriate thrust applied. If not stabilized, a go-around should be considered.
- Avoid any tendency to “duck under” in the late stages of the approach.
- Avoid destabilizing the approach in the last 100 feet, in order to have the best chance of performing a good touchdown at the desired position.


VISUAL APPROACH (1 OR 2 ENGINES)
ABEAM RUNWAY
PERF KEY: PRESSED
ACTIVATE APPROACH PHASE
CHECK SPD MANAGED
SELECT FDs OFF
SELECT TRK-FPA
SELECT GA ALTITUDE
SPD GREEN DOT OR BELOW
FLAPS 1
1500FT
ABM THRESHOLD
START TIME
45SEC±1 SEC/1KT OF WIND
TURNING BASE
FLAPS 2
WHEN FLAPS 2
L/G DOWN *
SPLRS ARMED
WHEN L/G DOWN *
FLAPS 3
CHECK VFE THEN
FLAPS FULL
500FT
AIRCRAFT STABILIZED
WITH FLAPS FULL,
AT TARGET SPEED
GO AROUND
SET GA THRUST
ROTATE TO 15° (12°.5 IF 1 ENGINE)
RETRACT FLAPS ON STEP
POSITIVE CLIMB
L/G UP
TOUCH DOWN
REVERSE
BRAKES
REV IDLE
NOTE : THIS PATTERN ASSUMES THE USE OF
MINIMUM GROUND SPEED (MANAGED)
IF NOT SELECT SPEEDS MANUALLY
ACCORDING TO FLAPS CONFIGURATION :
S AFTER FLAPS 1 SELECTION
F AFTER FLAPS 2 SELECTION
VAPP AFTER FLAPS FULL SELECTION
* FOR SINGLE ENGINE APPROACH ON HIGH ALTITUDE
AIRPORTS, WITH HIGH LANDING WEIGHT, DELAY SELECTION
OF GEAR DOWN AND LANDING FLAPS/SLATS CONFIGURATION
TILL FINAL APPROACH.
NFC5-03-0320-002-A001AA

PRECISION APPROACH

R (Refer to FCOM 4.05.70).

ILS FINAL APPROACH AND LANDING GEOMETRY



CONDITIONS : - FLAPS FULL - ILS ANTENNA AT 50 ft AT THRESHOLD - NO FLARE	PITCH ANGLE	GLIDE PATH (°)	A	B	TOUCHDOWN POINT C
	4°8	2°5	349 m 1145 ft	114 m 375 ft	235 m 771 ft
	5°3	3°	291 m 954 ft	100 m 329 ft	191 m 625 ft

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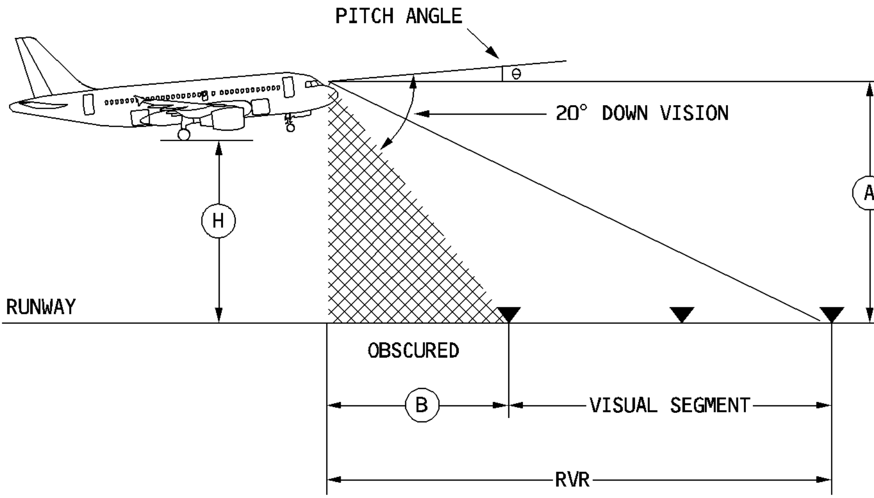
MINIMUM VISUAL GROUND SEGMENTS (Flare phase)



	CAT III		CAT II
H	15 ft (θ = 4.9°)	50 ft (θ = 5.3°)	100 ft (θ = 5.3°)
VISUAL SEGMENT	60 m (197 ft)		120 m (394 ft)
A	35 ft	71 ft	121 ft
OBSCURED B	40 m (131 ft)	82 m (269 ft)	140 m (460 ft)
MINIMUM RVR	100 m (328 ft)	142 m (466 ft)	260 m (854 ft)

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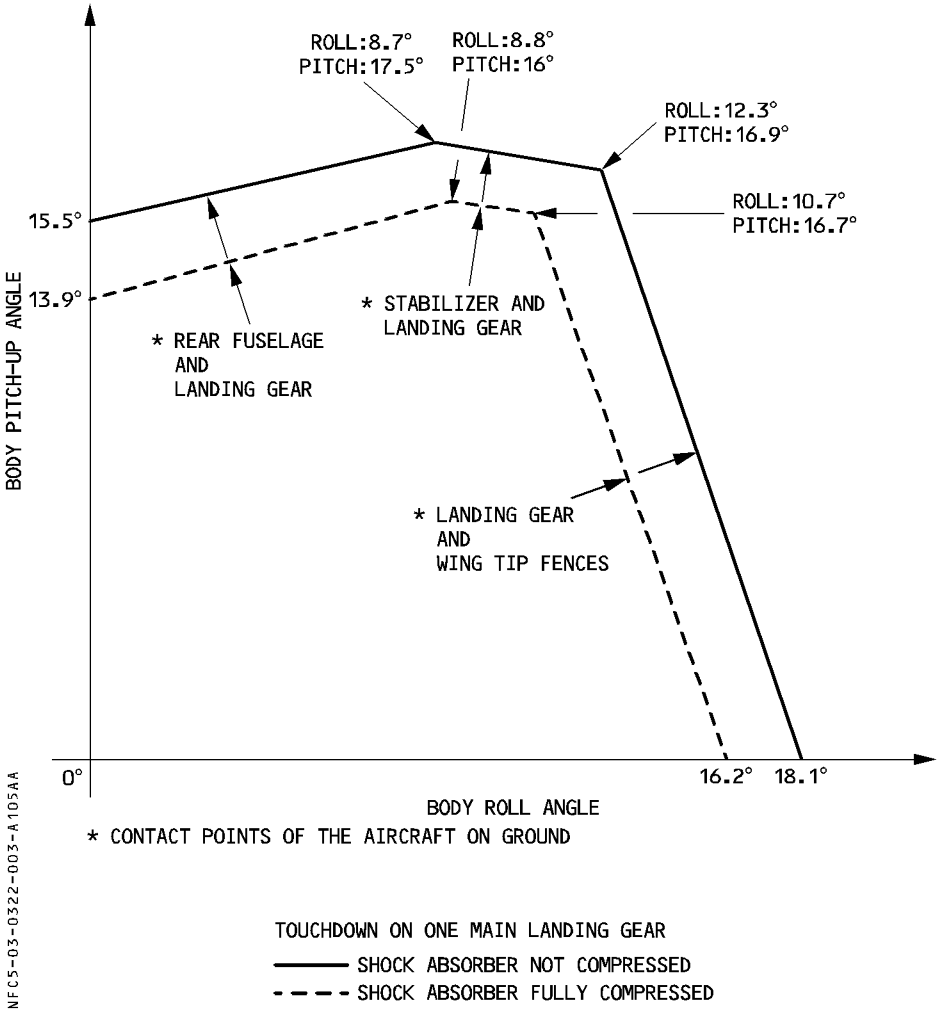
Note : This drawing shows that, for a CAT III landing (60 meters minimum visual segment), the minimum RVR is 100 meters at 15 feet.

GROUND CLEARANCE DIAGRAM

R



LANDING

The cockpit cut-off angle is 20 degrees.

● **At about 20 feet :**

– **FLARE** . . . . **PERFORM**

R – **ATTITUDE** . . . . **MONITOR**
R The PNF should monitor the attitude, and call out :
R – “PITCH, PITCH”, if the pitch angle reaches 10°.
R – “BANK, BANK”, if the bank angle reaches 7°.

– **THRUST levers** . . . . **IDLE**
In manual landing conditions, the “RETARD” callout is generated at 20 feet RA, as a reminder. Start a gentle progressive flare, and allow the aircraft to touch down without prolonged float.

Crosswind landings

· The preferred technique is to use the rudder to align the aircraft with the runway heading, during the flare, while using lateral control to maintain the aircraft on the runway centerline. Routine use of into wind aileron is not recommended, because sidestick deflection commands the roll rate until touchdown.
In strong crosswind conditions, small amounts of lateral control may be used to maintain the wings level. This lateral stick input must be reduced to zero at first main landing gear touchdown.

Ground clearance

· Avoid flaring high.
· A tailstrike occurs, if the pitch attitude exceeds 15.5° (13.5° with the landing gear compressed).
A wingtip or engine scrape occurs, if the roll angle exceeds 18° (16° with the landing gear compressed).
· Be aware of the pitch-up tendency, with ground spoiler extension.

● **At touchdown :**

– **REV . . . . MAX**

· Select MAX REV immediately after the main landing gear touches down.
If the airport regulations restrict the use of reversers, select and maintain reverse idle until taxi speed is reached.
A slight pitch-up, easily controlled by the crew, may appear when the thrust reversers are deployed before the nose landing gear touches down.
Lower the nosewheel without undue delay, if MED is selected.

· In case of engine failure, the use of the remaining reverser is recommended.

· Braking may be commenced before nosewheel is down, if required for performance reasons ; but when comfort is the priority, it should be delayed until the nosewheel has touched down.
During roll out, sidestick inputs (either lateral or longitudinal) should be avoided.
If directional control problems are encountered, reduce thrust to reverse idle until directional control is satisfactory.

· After reverse thrust is initiated, a full stop landing must be made.

– **GROUND SPOILERS . . . . CHECK**

Check that the ECAM WHEEL page shows the ground spoilers fully deployed after
R touchdown. Announce “Ground spoilers” then “reverse green”.

– **DIRECTIONAL CONTROL . . . . ENSURE**

· Use rudder pedals for directional control.

· Do not use the nosewheel steering control handle before reaching taxi speed.

– **BRAKES . . . . AS RQRD**

· Monitor the autobrake, if it is on. When required, brake with the pedals.

· Although the green hydraulic system supplies the braking system, if pedals are pressed quickly a brief brake pressure indication appears on the BRAKE PRESS indicator.

● **At 70 knots :**

– **THRUST levers . . . . REV IDLE**

70 knots is the minimum recommended speed with full reverse thrust.

CAUTION

Avoid using high levels of reverse thrust at low airspeed, because gases re-entering the compressor can cause engine stalls that may result in excessive EGT.

● **At taxi speed :**

– **THRUST levers . . . . FWD IDLE**

· Deselect the REV position upon reaching taxi speed and before leaving the runway. On snow-covered grounds, reversers should be stowed when the aircraft speed reaches 25 knots. When deselecting REV, be careful not to apply forward thrust by moving the thrust levers beyond the FWD IDLE position.

CAUTION

On taxiways, the use of reversers, even when restricted to idle thrust, may have the following effects :

– The engines may ingest fine sand and debris that may be detrimental to both the engines and the airframe systems.
– On snow covered areas, snow will recirculate into the air inlet, which may result in engine flame-out or roll back.

Except in an emergency, do not use reverse thrust to control aircraft speed while taxiing.

● **Before 20 knots :**

– **AUTO BRK . . . . DISENGAGE**

Disengage the autobrake to avoid some brake jerks at low speed.

GO AROUND

Apply the following three actions simultaneously :

– **THRUST LEVERS . . . . TOGA**

– **ANNOUNCE . . . . “GO AROUND – FLAPS”**

– **ROTATION . . . . PERFORM**
· Rotate the aircraft to get a positive rate of climb, and establish the required pitch attitude, as directed by the SRS pitch command bar.
· Check and announce the FMA : MAN TOGA, SRS, GA TRK.

– **FLAPS . . . . RETRACT ONE STEP**
Announce “FLAPS...” when indicated.

– **ANNOUNCE . . . . “POSITIVE CLIMB”**

– **ORDER . . . . “GEAR UP”**

– **L/G UP . . . . SELECT**

– **CONFIRM/ANNOUNCE . . . . “GEAR UP–FLAPS”**

Note : Consider retarding to CL detent, if TOGA thrust is not required.

– **NAV or HDG mode . . . . SELECT**
Reselect NAV or HDG, as required (minimum height 100 feet).

Note : Go-around may be flown with both autopilots engaged. Whenever any other mode engages, AP 2 disengages.

● **At go-around thrust reduction altitude (LVR CLB flashing on FMA) :**

R – **THRUST LEVERS . . . . CL**

- **At go-around acceleration altitude :**

  – **Monitor target speed increases to green dot.**

R ● **If target speed does not increase to green dot :**

R – **FCU ALT . . . . CHECK and PULL**

  – **Retract flaps on schedule.**

  Note : Consider the next step :
  – Engage NAV mode, to follow the published missed approach procedure, or
  – Prepare for a second approach by selecting the ACTIVATE APP PHASE, and CONFIRM on the PERF page.

LEFT INTENTIONALLY BLANK

LEFT INTENTIONALLY BLANK

AFTER LANDING

– **LAND LIGHTS . . . . RETRACT**
Retract landing lights, unless they are needed.
Set the STROBE lights to AUTO, when leaving the runway.

– **GROUND SPOILERS . . . . DISARM**

– **FLAPS . . . . RETRACT**
· Set the FLAP lever to position 0.
· If the approach was made in icing conditions, or if the runway was contaminated with slush or snow, do not retract the flaps and slats until after engine shutdown and after the ground crew has confirmed that flaps and slats are clear of obstructing ice.
· On ground, hot weather conditions may cause overheating to be detected around the bleed ducts in the wings, resulting in "AIR L(R) WING LEAK" warnings. Such warnings may be avoided during transit by keeping the slats in Configuration 1 when the OAT is above 30°C.

– **ENG MODE selector . . . . NORM**

– **ATC . . . . STBY/OFF**
This is not applicable to transponder panels equipped with an AUTO position, if AUTO is selected.

– **TCAS Mode selector ⩤ . . . . STBY**
This is only applicable to transponder panels equipped with an AUTO position, if AUTO is selected.

– **ANTI ICE . . . . AS RQRD**
If engine anti-ice is used, take care to control taxi speed, especially on wet or slippery surfaces. (N1 ground idle is increased).

– **APU . . . . START**
APU START may be delayed until just prior to engine shutdown.

– **RADAR . . . . OFF/STBY**

– **PREDICTIVE WINDSHEAR SYSTEM ⩤ . . . . OFF**
Switching the radar and predictive windshear system OFF after landing avoids risk of radiating persons at the gate area.

– **BRAKE TEMPERATURE . . . . CHECK**

· Check brake temperature on the ECAM WHEEL page for discrepancies and high temperature.

· If brake fans are installed (◁*) :

R Brake fans selection should be delayed for a minimum of about 5 minutes, or done just
R before stopping at the gate (whichever occurs first), to allow thermal equalization and stabilization and thus avoid oxidation of brake surface hot spots.

However, when turnaround times are short, or brake temperatures are likely to exceed 500°C, use the brake fans, disregarding possible oxidation phenomenon.

· Refer to 3.04.32 for the brake temperature limitations requiring maintenance actions.

– **AFTER LANDING CHECKLIST . . . . COMPLETE**

Ensure that the after-landing checks are completed, once the aircraft has cleared the runway.

PARKING

Prior to performing this check, consideration should be given to "GROUND OPERATIONS IN HEAVY RAIN" (Refer to 3.04.30).

– **PARKING BRAKE ACCU PRESS . . . . CHECK**
The ACCU PRESS indication must be in the green band. In case of low accumulator pressure, chocks are required before engine 1 shutdown.

– **PARKING BRK . . . . ON**
· Above 500°C, parking brake application should be avoided, unless operationally necessary.

R – **ANTI-ICE . . . . OFF**

– **APU BLEED . . . . ON**
Select APU bleed ON just before engine shutdown to prevent engine exhaust fumes from entering the air conditioning.

– **ENG MASTER switch 1 and 2 . . . . OFF**

CAUTION

> If JP4 fuel is used at ambient temperatures higher than 10°C, dry motor the engines for 2 minutes after engine shutdown. This dry motor period should start approximately 90 seconds after the master lever is selected off.

· Following high thrust operation, such as maximum reverse thrust during landing, operate the engine at idle for 3 minutes prior to shutdown to thermally stabilize the engine's hot section. Operating time at idle, as during taxiing, is included in this 3-minute period. If operational requirements dictate, the engine may be shut down after a one-minute cooling period.
· If APU is not available, set EXT PWR at ON before setting ENG MASTERS OFF.
· Check that engine parameters decrease.

<u>Note</u> : *If the engine fails to shut down, switch the affected master lever ON then OFF. If the engine still fails to shut down, press the affected ENG FIRE pushbutton (Engine will shut down after about 1 minute, during which it uses the fuel between the LP valve and the nozzles).*

· The DOOR page is displayed on the lower ECAM display.

– **GROUND CONTACT . . . . ESTABLISH**
· Establish ground communication.
· Check chocks in place.

– **SLIDE DISARMED . . . . CHECK**
Check slides disarmed on the ECAM DOOR page. Warn the cabin crew, if any slide is not disarmed.

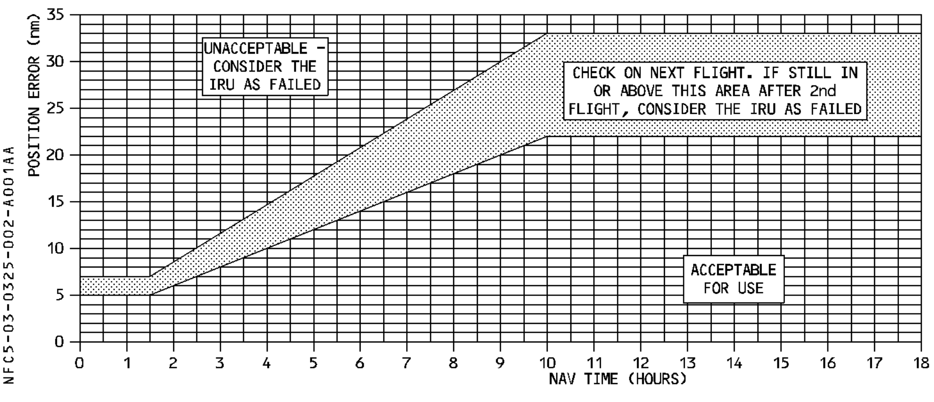
– **EXTERIOR LIGHTS . . . . AS RQRD**
Switch off the BEACON switch, when all engines have obviously spooled down.

– **SEAT BELTS . . . . OFF**

– **ELAPSED TIME (⊲*) . . . . STOP**

– **FUEL PUMPS . . . . OFF**

– **IRS PERFORMANCE . . . . CHECK**
· Drift check
– Call up the POSITION MONITOR page. Check that the drift does not exceed the following:



· Residual ground speed check :
 – CAPT and F/O NDs display the IRS 1 and 2 residual ground speeds respectively. The IRS 3 residual ground speed can be read on the CAPT ND by switching the ATT HDG selector to CAPT ON 3.
  · If ground speed ≥ 15 knots : Report (The IR part of the ADIRU must be considered as failed, if the excessive deviation occurs after two consecutive flights).
  · If ground speed ≥ 21 knots : Report (The IR part of the ADIRU must be considered as failed).

  Note : On aircraft equipped with LITTON IRS, the ground speed check must be performed within the 2 minutes following aircraft stop. (Ground speed reset to 0 after 2 minutes).

– **FUEL QUANTITY . . . . CHECK**
Check that the sum of the fuel on board and the fuel used is consistent with the fuel on board at departure. If an unusual discrepancy is found, maintenance action is due.

– **STATUS (ECAM Control panel) . . . . PRESS**
 – Check the STATUS page.
 If maintenance status messages are displayed :
  · At transit : Disregard, unless AIR BLEED maintenance status.
  · At main base, or at an airport where repairs can easily be made (at the end of the last flight of the day) : Report for maintenance analysis.

– **BRAKE FAN (◁) . . . . OFF**
Switch off, when not required.

– **PARKING BRAKE . . . . AS RQRD**
 · The parking brake should be released after chocks are in place, if the "BRAKES HOT" ECAM caution is displayed.
 Releasing the parking brake prevents the critical structures from being exposed to high temperature levels for an extended time. However, if operational conditions dictate (e.g. slippery tarmac), the parking brake may remain applied.
 · When parking with a flat tire on the nose gear, keep the parking brake on, to avoid aircraft yawing at parking brake release.

– **DUs . . . . DIM**
Dim EFIS, ECAM and MCDU display units.

– **PARKING CHECKLIST . . . . COMPLETE**

– **REPORT SEVERE ICING CONDITIONS**
Report severe icing conditions in the log book, requiring inspection of the fan accoustic panels of the engines during the walkaround.

SECURING THE AIRCRAFT

Prior to performing this check consideration should be given to COLD WEATHER (Refer to 3.04.91).

- **PARKING BRAKE . . . . CHECK ON**
  Keep the parking brake on to reduce hydraulic leak rate in the brake accumulator.

- **OXYGEN CREW SUPPLY . . . . OFF**

- **ADIRS (1 + 2 + 3) . . . . OFF**
  ADIRS should not be switched off during transits at latitudes above 82°N, in order to avoid their requiring excessive alignment time.
  After having switched off the ADIRS, wait at least 10 seconds before switching off the electrical supply to ensure that the ADIRS memorize the last data.

- **EXTERIOR LIGHTS . . . . OFF**

- **MAINT BUS switch . . . . AS RQRD**
  Should electrical power be required for crew or servicing personnel consider selecting the MAINT BUS switch (overhead in the forward cabin) to the ON position prior to selecting aircraft power off.

- **APU BLEED . . . . OFF**

- **APU MASTER switch . . . . OFF**
  Switch off the APU after the passengers have disembarked.

- **EMER EXIT LT . . . . OFF**

- **NO SMOKING . . . . OFF**
  Switching off the NO SMOKING signs permits the emergency batteries to be charged (provided external power is supplying the aircraft network).

- **EXT PWR . . . . AS RQRD**

- **BAT 1 and 2 . . . . OFF**
  Wait until the APU flap is fully closed (about 2 minutes after the APU AVAIL light goes
  R out) before switching off the batteries. Switching the batteries off before the APU flap
  R is closed may cause smoke in the cabin during the next flight. If the batteries are off
  R while the APU is running, there is no APU fire extinguishing.

- **SECURING THE AIRCRAFT CHECKLIST . . . . COMPLETE**

COMMUNICATIONS AND STANDARD TERMS

Standard phraseology is essential to ensure effective crew communication. The phraseology should be concise and exact. The following Chapter lists the calls that should be used as standard. They supplement the callouts identified in the SOP.
These standard Airbus callouts are also designed to promote situational awareness, and to ensure crew understanding of systems and their use in line operation.

R
CHECKLIST CALLOUTS

– "CHECK" : A command for the other pilot to check an item.
– "CHECKED" : A response that an item has been checked.
– "CROSSCHECKED" : A call verifying information from both pilots stations.
R If a checklist needs to be interrupted, announce : "HOLD CHECKLIST AT ___" and "RESUME
R CHECKLIST AT ___" for the continuation.
Upon completion of a checklist announce : "__CHECKLIST COMPLETE".

ACTIONS COMMANDED BY PF

The following commands do not necessarily initiate a guidance mode change, eg : selected to managed/managed to selected. The intent is to ensure clear, consistent, standard communication between crewmembers.
All actions performed on the FCU must be verified on the PFD/ND.

SET

The "SET" command means using an FCU knob to set a value, but not to change a mode. SET is accomplished by only rotating the appropriate selection knob. Example :
– "SET GO AROUND ALTITUDE__"
– "SET QNH __"
– "SET FL __"
– "SET HDG __"

MANAGE/PULL

The "MANAGE" command means pushing an FCU knob to engage, or arm, a managed mode or target.
The "PULL" command means pulling an FCU knob to engage, or arm, a selected mode or target. Example :

– "HDG 090 PULL"	(Heading knob is turned and pulled).
– MANAGE NAV	(Heading knob is pushed).
– "FL 190 PULL"	(Altitude knob is turned and pulled).
– "FL 190 MANAGE"	(Altitude knob is turned and pushed).
– SPEED 250 KTS PULL	(Speed knob is turned and pulled).
– MANAGE SPEED	(Speed knob is pushed).

Note : *1. If the value was previously set, there is no requirement to repeat the figure. Simply call e.g. HDG PULL : SPEED PULL : FL PULL*
2. It is sometimes preferable to first pull the FCU knob before setting the value (e.g. a long turn).

The VS/FPA selector knob has no managed function. The standard calls for the use of this knob are as follows :

V/S Plus (or Minus) 700 PULL or –	
FPA Minus 3° PULL	(V/S (FPA) knob is turned and pulled)
PUSH TO LEVEL OFF	(V/S (FPA) knob is pushed)

ARM

The "ARM __" command means arming a system by pushing the specified FCU button.
e.g. : "ARM APPROACH"
e.g. : "ARM LOC."

ON/OFF

The simple ON or OFF command is used for the autopilot, flight directors, autothrust and the bird (flight path vector).
e.g. : BIRD ON (The HDG-V/S/TRK-FPA pushbutton is pushed.)

Note : All actions on the FCU and MCDU must be verified on the PFD and ND, as follows :
- *First, ensure that the correct FCU knob is used, then verify indications on the PFD/ND.*
- *Mode changes should be confirmed by calling the color when appropriate (e.g. BLUE, MAGENTA).*

FMA

Unless listed otherwise (eg CAT II & III task sharing), all FMA changes will be normally called by the PF.

ALTITUDE

The PNF calls when passing 1000 feet before the cleared altitude or FL, and is acknowledged by the PF calling : "CHECKED".
R e.g. : 1000 below 4000
R e.g. : 1000 above 290

FLAP OR GEAR CONFIGURATION

FLAPS CALLS

FLAPS CONFIGURATION	CALL
1	One
1 + F	One
0	Zero

The reply will be given when selecting the new flap position.
e.g. :

	CALL	REMARK
PF	"FLAPS FULL"	PF commands Flaps Full
PNF	"SPEED CHECKED" "FLAPS FULL"	PNF replies when selecting the Flap position, and checks the blue number on the ECAM flap indicator to confirm the correct selection has been made.

GEAR CALL

	CALL	REMARK
PF	"GEAR UP (DOWN)"	PF commands Gear Up (Down)
PNF	"GEAR UP (DOWN)"	PNF replies when selecting the Gear position, and checks the lights on the landing gear indicator panel to confirm gear operation.

FLIGHT PARAMETERS

PNF will make call-outs for the following conditions during final approach. Attitude callouts also to be made through to landing.

- "SPEED" when speed becomes less than Vapp – 5 or more than speed target + 10.
- "SINK RATE" when V/S is greater than – 1000 ft/min.
- "BANK" when bank angle becomes greater than 7°.
- "PITCH" when pitch attitude becomes lower than – 2.5° or higher than + 10°.
- 'LOC" or "GLIDE" when either localizer or glide slope deviation is one dot.
- "COURSE" when greater than 1/2 dot (VOR) or 5 degrees (ADF).
- "__ FT HIGH (LOW)" at altitude checks points.

PF/PNF DUTIES TRANSFER

Transfer of control is initiated by a command and followed by an acknowledgement.
- "I HAVE CONTROL" is either the command that the other pilot is to pass control and assume PNF duties ; or the acknowledgement by the other pilot that he has assumed PF duties.
- "YOU HAVE CONTROL" is either the command that the other pilot is to take control and assume PF duties ; or the acknowledgement by the other pilot that he has assumed PNF duties.

ABNORMAL AND EMERGENCY CALL OUTS

ECAM Procedures

1. "ECAM ACTION" is commanded by PF when required.
2. "CLEAR __ (title of the system)" is asked by the PNF for confirmation by the PF, that all actions have been taken/reviewed on the present ECAM WARNING/CAUTION or SYSTEM PAGE.
   e.g. : CLEAR HYDRAULIC
3. "CLEAR __ (title of the system)" is the command by the PF that the action and review is confirmed.
4. "ECAM ACTIONS COMPLETE" is the announcement by the PNF that all APPLICABLE ACTIONS have been completed.
5. Should the PF require an action from the PNF during ECAM procedures, the order "STOP ECAM" will be used. When ready to resume the ECAM the order "CONTINUE ECAM" will be used.

SUMMARY FOR EACH PHASE

TO REMOVE GROUND SUPPLY		
EVENT	**PF or PNF**	**GND Mech**
Initial ground contact	GROUND (from) COCKPIT	COCKPIT (from) GROUND
External __ disconnection	REMOVE EXTERNAL __	EXTERNAL__ REMOVED

BEFORE ENGINE START/PUSH BACK		
EVENT	**PF**	**PNF**
Before start up clearance received	BEFORE START C/L TO THE LINE	BEFORE START C/L TO THE LINE COMPLETE
After start up clearance received	BELOW THE LINE	BEFORE START C/L COMPLETE

PUSH BACK/ENGINE START		
EVENT	**PF**	**GND Mech.**
When ready for push back and push back clearance received from ATC	GROUND (from) COCKPIT, CLEARED FOR PUSH	COCKPIT (from) GROUND, RELEASE BRAKES
Start of push	BRAKES RELEASED CLEAR TO PUSH	
When ready to start engines	CLEAR TO START ? STARTING ENG(S)__	CLEAR TO START
When push back completed	BRAKES SET	SET BRAKES
When ready to disconnect (after engine started and parameters are stabilized)	CLEAR TO DISCONNECT (hand signals on left/right)	DISCONNECTING (hand signals on left/right)

AFTER ENGINE START		
EVENT	**PF**	**PNF**
All engines started and stabilized and GND is disconnected	AFTER START C/L	AFTER START C/L COMPLETE

TAXI		
EVENT	**PF**	**PNF**
When taxi clearance obtained	CLEAR LEFT (RIGHT) SIDE	CLEAR RIGHT (LEFT) SIDE
Brake transfer check	BRAKE CHECK	PRESSURE ZERO
Flight control check in following sequence (can be done before start of taxi)	FLIGHT CONTROL CHECK	
1. Elevators	FULL UP, FULL DOWN, NEUTRAL	CHECKED
2. Ailerons	FULL LEFT, FULL RIGHT, NEUTRAL	CHECKED
3. Rudder *	FULL LEFT, FULL RIGHT, NEUTRAL	CHECKED
During taxi	BEFORE TAKE-OFF CHECK LIST TO THE LINE	BEFORE TAKE-OFF C/L TO THE LINE COMPLETE
Lining up on the runway	BELOW THE LINE	BEFORE TAKE-OFF C/L COMPLETE

*Note : * The PNF should follow pedal movement with his/her feet*

R

TAKE-OFF		
EVENT	**PF**	**PNF**
Setting thrust levers to initial stabilisation value	TAKE-OFF	
When thrust levers set to FLEX/TOGA	ANNOUNCE FMA	CHECKED
Before passing 80 kts	CHECKED	POWER SET
At 100 kts	CHECKED	ONE HUNDRED KNOTS
At V1		V1
At VR		ROTATE
When climbing clear of the ground (positive increase of V/S, BARO and RAD ALT)	GEAR UP	POSITIVE CLIMB GEAR UP
If AP is engaged by PNF If AP is engaged by PF	AP 1(2) ON AP 1(2)	CHECKED
When F Speed and accelerating	FLAPS ONE	SPEED CHECKED FLAPS ONE
When S Speed and accelerating	FLAPS ZERO	SPEED CHECKED FLAPS ZERO
After T/O check (not normally requested before flap retraction completed)	AFTER TAKE-OFF C/L	AFTER TAKE-OFF C/L COMPLETED TO THE LINE

ALTIMETER SETTING CHANGES TO/FROM QNH/QFE-STD		
EVENT	**PF**	**PNF**
Barometric setting change and subsequent altimeter cross-check	PULL STANDARD (PUSH QNH/QFE) CHECKED	STANDARD (QNH/QFE) CROSS-CHECKED PASSING FL__(__FT) NOW

R

APPROACH AND LANDING

EVENT	PF	PNF
When cleared below transition level, or when appropriate	APPROACH C/L	APPROACH C/L COMPLETE
Activation of approach Phase (approx 15nm from touchdown ; automatic, if in managed nav)	ACTIVATE APPROACH PHASE	APPROACH PHASE ACTIVATED
Beginning of radio altimeter indication (could be auto callout of 2500 ft)	CROSS CHECKED	RAD ALT ALIVE (see Note 4 below)
At green dot speed or < VFE	FLAPS ONE	SPEED CHECKED FLAPS ONE
"GS*", "FINAL APP", or "FAF"	SET GA ALTITUDE__FT	GA ALTITUDE__SET,
2000 ft AGL min (ILS) ; or S speed (non-precision)	FLAPS TWO	SPEED CHECKED FLAPS TWO
When at flaps at two	GEAR DOWN	GEAR DOWN
When gear is down	FLAPS THREE	SPEED CHECKED FLAPS THREE
When flaps at three (unless landing with Flap 3)	FLAPS FULL	SPEED CHECKED FLAPS FULL
FAF	CHECKED	PASSING__(Fix Name),__FT,
When landing flaps set, and landing memo is displayed on ECAM	LANDING C/L	LANDING C/L COMPLETE
1000 ft above TDZE (may be auto callout)	CHECKED	ONE THOUSAND
FMA "LAND GREEN" (ILS approach)	LAND GREEN	CHECKED
100 ft above MDA/DH	CHECKED	ONE HUNDRED ABOVE (if no Auto Callout)
MDA/DH visual reference	LANDING	MINIMUM
MDA/DH no visual reference	GO AROUND-FLAPS	MINIMUM
PNF monitors pin-programmed auto callout, or announces if inoperative		ONE HUNDRED FIFTY
After touchdown		GROUND SPOILERS, REVERSE GREEN, (See the note 5 below)
If autobrake armed		DECEL (See note 6 below)
At 70 knots	CHECK	SEVENTY KNOTS

Note 4 : Crew awareness, crew should now keep RA in scan to landing.
Note 5 : If reverse deployment is not as expected, call NO REVERSE ENGINE__ or NO REVERSE, as appropriate.
Note 6 : If autobrake is armed, and no positive deceleration is observed, call NO DECEL.

04.00 CONTENTS

GENERAL

This chapter shows the symbology and definition of speeds.
Source of computation is also given when applicable.

CHARACTERISTIC SPEEDS

The characteristic speeds displayed on the PFD are computed by the FAC (Flight Augmentation Computer) according to aerodynamic data.
VLS (of normal landing configuration : CONF 3 or FULL), F, S and Green Dot speeds are also displayed on the MCDU TAKEOFF and/or APPR pages.
These values are computed by the FMGC, based on the aircraft gross weight (which is computed according to the entered ZFW and the FOB) or predicted grossweight (for approach or go around).

VS : Stalling speed.
Not displayed.
For a conventional aircraft, the reference stall speed, VSmin, is based on a load factor that is less than 1g. This gives a stall speed that is lower than the stall speed at 1g. All operating speeds are expressed as functions of this speed (for example, VREF = 1.3 VSmin).
Because aircraft of the A320 family have a low-speed protection feature (alpha limit) that the flight crew cannot override, the airworthiness authorities have reconsidered the definition of stall speed for these aircraft.
All the operating speeds must be referenced to a speed that can be demonstrated by flight test. This speed is designated VS1g.
Airworthiness authorities have agreed that a factor of 0.94 represents the relationship between VS1g for aircraft of the A320 family and VSmin for conventional aircraft types. As a result the authorities allow aircraft of the A320 family to use the following factors :
V2 = 1.2 × 0.94 VS1g = 1.13 VS1g
VREF = 1.3 × 0.94 VS1g = 1.23 VS1g
These speeds are identical to those that the conventional 94 % rule would have defined for these aircraft. The A319, A320 and A321 have exactly the same maneuver margin that a conventional aircraft would have at its reference speeds.
The FCOM uses VS for VS1g.

VLS : Lowest Selectable speed.
Represented by the top of an amber strip along the airspeed scale on the PFD.
Computed by the FAC based on aerodynamic data, corresponds to 1.13 VS during takeoff or following a touch and go.
Becomes 1.23 VS after retraction of one step of flaps.
R Becomes 1.28 VS when in clean configuration.

Note : If in CONF 0 VLS were 1.23 VS (instead of 1.28 VS), the alpha protection strip would hit the VLS strip on the PFD.

Above 20000 feet, VLS is corrected for Mach effect to maintain a 0.2g buffet margin.

F : Minimum speed at which the flaps may be retracted at takeoff.
In approach, used as a target speed when the aircraft is in CONF 2 or CONF 3.
Represented by "F" on the PFD speed scale. Equal to about 1.26 VS of CONF 1 + F.

S : Minimum speed at which the slats may be retracted at takeoff.
In approach, used as a target speed when the aircraft is in CONF 1.
Represented by "S" on the PFD airspeed scale.
Equal to about 1.23 VS of clean configuration.

0 : Green dot speed.
Engine out operating speed in clean configuration.
(Best lift to drag ratio speed).
Corresponds also to the final takeoff speed.
Represented by a green dot on the PFD scale.
Below 20000 feet equal to 2 × weight (tonnes) + 85
Above 20000 feet add 1 knot per 1000 feet

PROTECTION SPEEDS

Vα PROT, Vα MAX and VSW are computed by the FAC, based on aerodynamic data. They are only used for display on the PFD, and not for flight control protection (the activation of the protections is computed by the ELAC).

Vα PROT	:	Angle of attack protection speed. Corresponds to the angle of attack at which the angle of attack protection becomes active. Represented by the top of a black and amber strip along the PFD speed scale, in normal law.
Vα MAX	:	Maximum angle of attack speed. Corresponds to the maximum angle of attack that may be reached in pitch normal low Represented by the top of a red strip along the PFD speed scale, in normal law.
VSW	:	Stall warning speed. Represented by a red and black strip along the speed scale when the flight control normal law is inoperative.
VMAX	:	Represented by the bottom of a red and black strip along the speed scale. Determined by the FAC according to the aircraft configuration. Is equal to VMO (or speed corresponding to MMO), VLE or VFE.

LIMIT SPEEDS

VMCG	:	Minimum speed, on the ground during takeoff, at which the aircraft can be controlled by the use of primary flight controls only, after a sudden failure of the critical engine, the other engine remaining at takeoff power.
VMCA	:	Minimum control speed in flight at which the aircraft can be controlled with a maximum bank of 5°, if one engine fails, the other engine remaining at takeoff power (takeoff flap setting, gear retracted).
VFE	:	Maximum speed for each flap configuration.
VLE	:	Maximum speed with landing gear extended.
VLO	:	Maximum speed for landing gear operation.
VMO	:	Maximum speed.
VFE NEXT	:	Maximum speed for the next (further extended) flap lever position.

OTHER SPEEDS

V1 : The highest speed, during takeoff, at which the flight crew has a choice between continuing the takeoff or stopping the aircraft.
Represented by "1" on the airspeed scale (or the V1 value when it is off the airspeed scale).
Inserted manually through the MCDU by the crew.
Displayed on the MCDU TAKEOFF page.

VR : The speed at which the pilot rotates in order to reach V2 at an altitude of 35 feet at the latest after an engine failure.
Inserted manually through the MCDU by the crew.
Displayed on the MCDU TAKEOFF page.

V2 : Takeoff safety speed that the aircraft attains at the latest at an altitude of 35 feet with one engine failed and maintains during the second segment of the takeoff.
Represented by the SPEED SELECT symbol on the speed scale.
Minimum value equal to 1.13 VS for the corresponding configuration.
Inserted manually through the MCDU by the crew.
Displayed on the MCDU TAKEOFF page.

VREF : Reference speed used for normal final approach.
Equal to 1.23 × VS of configuration FULL.
Displayed on the MCDU APPR page if landing is planned in CONF FULL (VLS CONF FULL).

VAPP : Final approach speed.
Displayed on MCDU APPR page.
Calculated by the FMGCs.
Represents : VAPP = VLS + wind correction.
The wind correction is limited to a minimum of 5 knots and a maximum of 15 knots.
The flight crew may modify VAPP through the MCDU.
- During autoland or when A/THR is on or in case of ice accretion or gusty crosswind greater than 20 knots, VAPP must not be lower than VLS + 5 knots.
  For landing in configuration 3 with ice accretion VAPP must not be lower than VLS + 10 knots.

VAPP TARGET : Represented by a magenta triangle.
Calculated by the FMGCs
Gives efficient speed guidance in approach during various windy conditions.
Represents :
VAPP TARGET = GS mini + actual headwind (measured by ADIRS)
GS mini = VAPP – TOWER WIND (headwind component along runway axis calculated by FMGC from tower wind entered on MCDU).

AIR CONDITIONING

R An external HP source may be used for air conditioning, provided the air supply is
R confirmed to be free from oil contamination.

LEFT INTENTIONALLY BLANK

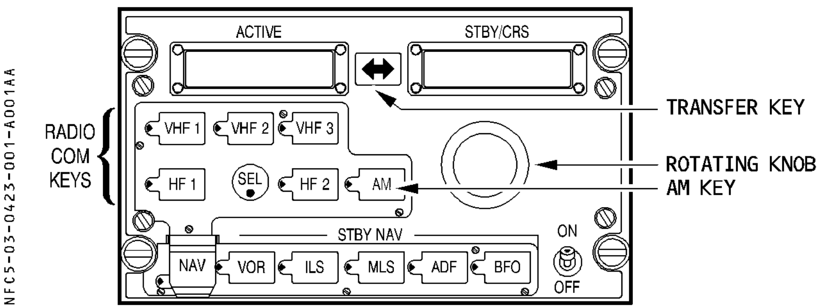
VHF, HF UTILIZATION

R *Note : 1. Reception of some frequencies could be noisy, on one or more VHFs. In such*
R *cases, try selecting an unaffected one.*

2. If two frequencies are closer than 2 MHz (between VHF1 and 2, or between VHF3 and 2), or closer than 6 MHz (between VHF1 and 3), some interference may occur.

TUNING

The pilot should normally use his onside RMP to tune any one of the VHF or HF radios. If the SEL lights come on, when tuning the radio, the pilot should turn them off by selecting the appropriate radio system dedicated to his RMP.



– **ON/OFF switch . . . . CHECK ON**

– **VHF or HF key . . . . PRESS**
The green light comes on.
ACTIVE and STBY/CRS windows display active and preset frequencies, respectively.

Note : When an RMP tunes a transceiver that is normally associated with another RMP, the SEL lights on both RMPs come on.

To change frequency :

– **Rotating knob** . . . . **TURN**
Make the STBY/CRS window display the new frequency.
Outer knob is for units, inner knob for decimals.

– **Transfer key** . . . . **PRESS**
This interchanges the ACTIVE and STBY frequencies.
The receiver is now tuned to the new ACTIVE frequency.

– **AM key (if necessary)** . . . . **PRESS**
Green light comes on.

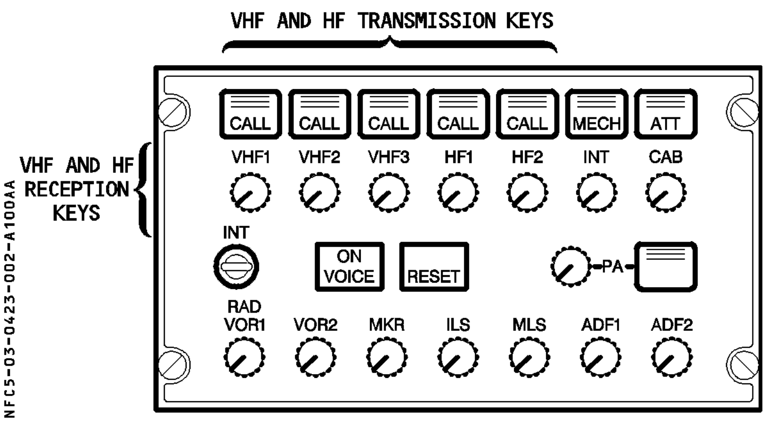
– **SEL lt . . . . CHECK OFF**
If SEL light is on, select the appropriate radio systems dedicated to the on side RMP.

Failure cases

When an RMP fails :
– The affected RMP no longer controls the selected receiver.
– The frequency displays disappear and the green VHF or HF lights go out.

– **Affected RMP . . . . SWITCH OFF**
One RMP can control all receivers.
· if RMP 1 fails tune VHF 1 through RMP 3
· if RMP 2 fails tune VHF 2 through RMP 3
· if RMP 3 fails tune, HF 1 (if installed) through RMP 1, HF 2 (if installed) through RMP 2
· if two RMP's fail, tune all receivers through the remaining RMP.

TRANSMISSION AND RECEPTION



– **VHF or HF transmission key . . . . PRESS**
Green bars on the selected system key light up.
Microphones and PTT command are connected to the selected system.

– **VHF or HF reception key . . . . PRESS**
The integrated white light comes on.
The receiver brings in the selected system.
To adjust the volume, turn the key.

Note : Do not use VHF 3 for communications with ATC if ACARS is installed unless VHF 1 and VHF 2 are inoperative.

CAPT-ATT CALL

PROCEDURE FOR CALLING ATT STATION WHEN PREVIOUS CALL HAS NOT BEEN RESET

If, after a call from cockpit to the attendant's station, the attendant does not press the RESET key on the attendant's panel, the pilot must use the following procedure to call the station :

- **CAB transmission key (on audio control panel) . . . . PRESS**
  Green lines light up.
- **INT/RAD (on ACP) . . . . MAINTAIN IN RAD POSITION for 2 seconds.**
  Wait 60 seconds for automatic cancellation of previous CAPT-ATT calls, then :
- **CAB transmission key . . . . PRESS**

<u>Note</u> : *This procedure will no longer be necessary after the introduction of CIDS Mark II standard, which includes a function to reset the system automatically after 60 seconds if no one has pressed the RESET key.*

R **TRIPPED C/B RE-ENGAGEMENT**

In flight, do not re-engage a circuit breaker that has tripped by itself, unless the Captain (using his/her emergency authority) judges it necessary for the safe continuation of the flight. This procedure should be adopted only as a last resort, and only one re-engagement should be attempted.

R On ground, do not re-engage any tank fuel pump circuit breaker. For all other circuit breakers, if the flight crew coordinates the action with maintenance, they may re-engage a tripped C/B, provided the cause of the tripped C/B is identified.

COMPUTER RESET

The normal purpose of a circuit breaker (C/B) is to protect wiring against short circuits, and to isolate equipment for maintenance.
Another circuit breaker function involves digital computers : The reset function. When a digital computer behaves abnormally due to an electrical transient, for example, the abnormal behavior can be stopped by briefly interrupting the power supply to its processor. The flight crew can reset most of this aircraft's computers with a normal cockpit control (selector or pushbutton). However, for some systems, the only way to cut off electrical power is to pull the associated circuit breaker.

PROCEDURE

To perform a computer reset :
- Set the related normal cockpit control to OFF, or pull the corresponding reset button or circuit breaker.
- Wait 3 seconds if normal cockpit control is used, or 5 seconds if a circuit breaker is used (unless a different time is indicated).
- Set the related normal cockpit control to ON, or push the corresponding reset button or circuit breaker.
- Wait 3 seconds for the end of the reset.

WARNING
Do not reset more than one computer at the same time, unless instructed to do so.

R **COMPUTER RESET TABLE**

R The computers that are most prone to reset are listed in the table of the next pages with
R the associated reset procedure, or FCOM reference when applicable.
R Specific reset procedures, included in OEB or Temporary revisions, are normally not
R referenced in this table and, when issued, superseed this table.

R *Note : Repetitive resets have to be reported to maintenance.*

R – On ground, almost all computers can be reset, and are not limited to the ones indicated
R in the table.
R Following computers are not allowed to be reset in all circumstances :
R · ECU (Engine Control Unit on CFM engines) or EEC (Electronic Engine Control on IAE
R engines) and EIU (Engine Interface Unit) while the engine is running.
R · BSCU (Brake Steering Control Unit) if the aircraft is not stopped. (Refer to 3.04.32).
R – In flight, as a general rule, the crew must restrict computer resets to those listed in the
R table, or to those in applicable TRs or OEBs. Before taking any action on other computer
R the flight crew must consider and fully understand the consequences.

CAUTION

R Do not pull the following circuit breakers :
R – SFCC (could lead to SLATS/FLAPS locked)
R – ECU or EEC, EIU.

R *Note : In the table's "reset" column, the "if applicable" note signifies that, depending on*
R *the computer standard, the reset procedure may no longer be necessary. If this is*
R *the case, the reset procedure is removed from the applicable FCOM section.*

ATA	System malfunction or ECAM warning/caution	Affected system	Reset
21	VENT AVNCS SYS FAULT	AEVC	On ground only – Pull C/B Y 17 on 122VU. – Wait 1 second before pushing the C/B.
	AIR PACK 1(2) REGUL FAULT	PACK CONTROLLER 1(2)	Refer to FCOM 3.02.21 if applicable.
22	AUTO FLT YAM DAMPER 1(2) FAULT	FAC 1(2)	Refer FCOM 3.02.22 if applicable.
	WINDSHEAR DET FAULT or REAC W/S DET FAULT (⊲)	FAC 1 + 2	
	AUTO FLT FCU 1(2) FAULT	FCU	On ground or in flight – PULL the C/B B05 on 49VU for FCU1 or M21 on 121VU for FCU2. – Push it after 5 seconds. – CHECK the displayed targets and the barometer reference, and correct them if necessary.
	AUTO FLT FCU 1+2 FAULT	FCU	On ground or in flight – RESET FCU1 and FCU2 successively : – Pull the C/B B05 on 49VU for FCU1. – Push it after 5 seconds. – Pull the C/B M21 on 121VU for FCU2. – Push it after 5 seconds. – CHECK the displayed targets and the barometer reference, and correct them if necessary. FCU targets are synchronized on current aircraft values and displayed as selected targets. – RE-ENTER the barometer altimeter setting value, if necessary.
	One MCDU locked or blank Both MCDU locked or blank FMGC malfunction	MCDU FMGC FMGC	Refer to FCOM 4.06.20

R

ATA	System malfunction or ECAM warning/caution	Affected system	Reset
23	COM CIDS 1+2 FAULT	CIDS	On ground, or in flight : – Pull the C/Bs in the following order : G01 on 49VU, M05 on 121VU. G02 on 49VU, M06 on 121VU. – Wait 10 seconds, then : – Push the C/Bs in the following order : M05, M06, G01, G02.
	Uncommanded EVAC horn actuation	CIDS	On ground, or in flight : Press the EVAC HORN SHUT OFF pushbutton. · IF UNSECCESSFUL : – Pull the C/Bs in the following order : G01 on 49VU, M05 on 121VU. G02 on 49VU, M06 on 121VU. – Wait 10 seconds, then : – Push the C/Bs in the following order : M05, M06, G01, G02.
	Frozen RMP	RMP	Refer to the FCOM 3.04.23.
	FAP freezing	Tape reproducer	On ground only : – Pull the tape reproducer/PRAM C/B F07 on 2000VU (cabin). – Wait 10 seconds before pushing the C/B.

ATA	System malfunction or ECAM warning/caution	Affected system	Reset
26	SMOKE LAV + CRG DET FAULT	SDCU	On ground only : – Pull C/B C06 on 49VU, and C/B T18 on 122VU. – Wait 10 seconds before pushing both C/Bs.
27	F/CTL ELAC 1(2) FAULT F/CTL ALTN LAW F/CTL ELAC 1(2) PITCH FAULT	ELAC	– Refer to the FCOM 3.02.27, if applicable.
	ELAC or SEC malfunction	ELAC or SEC	WARNING : Do not reset more than one computer at a time. · It is possible to reset flight control computers in flight, even if not requested by the ECAM, provided only one reset is performed at a time: For the ELAC only, the reset is not recommended in case of uncommanded maneuvers during the flight.

ATA	System malfunction or ECAM warning/caution	Affected system	Reset
30	ANTI ICE L(R)/WINDSHIELD (WINDOW)	WHC	Refer to FCOM 3.02.30 if applicable.
31	FWS FWC 1(2) FAULT	FWC	On ground or in flight Pull then push the C/B of the affected FWC – FWC 1 . . . . E2 or F01 (◁*) ON 49VU – FWC 2 . . . . Q7 ON 121VU
32	Braking malfunction	BSCU	Refer to 3.04.32 or OEB 50 if applicable.
	L/G LGCIU 1(2) FAULT	LGCIU 1(2)	On ground only LGCIU 1 : pull C/B Q34 on 121VU then C09 on 49VU. Then push C/B C09 and C/B Q34. LGCIU 2 : pull then push C/B Q35 on 121VU.
38	Failure messages on the CIDS FAP in the cabin	Vacuum System Controller	On ground or in flight – Pull C/B 35 MG on 2001 VU, aft cabin, – Wait 30 seconds, then push the C/B.
70	ENG IGN A+B FAULT	FADEC and EIU	Refer to FCOM 3.02.70 if applicable.
	ENG 1(2) FADEC A(B) FAULT	FADEC	Refer to FCOM 3.02.70 if applicable.

GENERAL

The fly-by-wire system has been designed and certificated to make the new generation of aircraft more cost effective and safer and smoother to fly or ride in than a conventional aircraft.

NORMAL OPERATIONS

The pilot uses the sidestick to fly the aircraft in pitch and roll (and indirectly, through turn coordination, in yaw).
The computers interpret the pilot's inputs and move the control surfaces as necessary.
However, regardless of the pilot's inputs the computers will prevent :
R – excessive load factor
– loss of control leading to excursions outside the safe flight envelope.

AIRCRAFT ON THE GROUND

At ground speeds below 70 knots, the sidesticks have full authority over the controls in pitch and roll to permit control checks.
At ground speeds above 70 knots, the authority in pitch is reduced from 30° up to 20° up.
In this ground mode, movements of the control surfaces in pitch and roll correspond directly to the stick inputs.
With the aircraft in the normal configuration and engines running on the ground :
– when the wheel brakes are released, the aircraft usually rolls with no added thrust.
– nose wheel steering is "fly.by.wire", with no mechanical connection between the nose wheel and the steering tiller. The control forces are light : the flight crew should be careful to move the tiller gently to avoid unnecessarily high-rate turns.
The aircraft can make very tight turns, but the flight crew should resist any tendency to overcontrol. When making tight turns at low ground speed, the crew should hold the selected tiller position, even if the turn radius is shorter than intended, so as to maintain a smooth turn.

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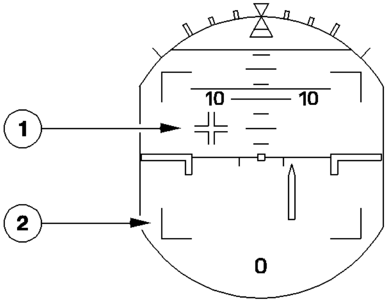

The PFD includes a symbol (1) that is the sum of sidestick positions given to the computers. It permits the PNF to check that the PF is making an appropriate control input
R during takeoff roll.
Small limit marks (2) indicate the limits of stick travel (± 16° in pitch, ± 20° in roll).
They are only displayed with the aircraft on ground. The flight crew must not use this display for control checks, because it does not necessarily indicate the control position in failure cases. The flight crew must use the ECAM flight controls page for making that check.

IN FLIGHT

TAKEOFF MODE

R

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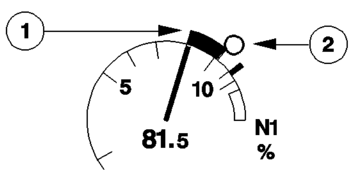

Thrust management is very easy. The pilot selects a FLX thrust by stopping the thrust levers in the FLX/MCT detent, and by checking that the resulting N1 (or EPR) (1) is compatible with N1 (or EPR) target (2). For maximum takeoff thrust, the pilot moves the thrust levers fully forward and performs the same thrust check (N1 or EPR).
To counter the nose-up effect of setting engine takeoff thrust, the pilot should apply half forward stick, until the airspeed reaches 80 knots. Then, he should release the stick
R gradually to reach neutral at 100 knots (Refer to SOP 3.03.12 for additional information).

Rotation is conventional. It takes about 1/3 to 1/2 back stick. The pilot continues the rotation to a typical all-engine attitude of about 15°. As the attitude changes and stabilizes, the control laws change to those for the flight mode in pitch, allowing the sidestick to return to the neutral position to maintain 1g at the chosen attitude. Pitch trim can begin to work at 50 feet.

R For crosswind takeoffs, routine use of into wind aileron is not recommended. In strong
R crosswind conditions, some lateral control may be used, but care should be taken to avoid
R using large deflections, resulting in excessive spoiler deployment which increases the
R tendency to turn into wind, reduces lift and increases drag. Spoiler deflection starts to
R become significant with more than one third sidestick deflection. As the aircraft lifts off,
R any lateral control applied will result in a roll rate demand.

FLIGHT MODE

Normally the sidestick is in the neutral position, with the aircraft stable in pitch and roll at the chosen altitude in straight or turning flight within certain limits. As a result, even in turbulence, the aircraft is flown best with little or no stick input.

Hands off, the system maintains 1g in pitch, corrected for pitch and roll attitude, and zero roll rate, within certain limits (+ 30°, – 15° in pitch and ± 33° roll). Hands off, within these limits the aircraft resists disturbance from the atmosphere and rides well even in heavy turbulence.

The system compensates almost 100% for changes of trim due to changes in speed and configuration. Changes of trim due to changes in thrust can be too large for the system to compensate, and the aircraft may respond to them in pitch in the conventional sense and then hold the new attitude at which it has stabilized after the trim change.

The pitch trim wheel moves as the control law compensates for these changes.

The control laws also make turning easier. They protect against overbanking, and at the chosen bank attitude (less than 33° of bank) the system maintains zero roll rate, stick free. Steep turns can be made at up to 67° of bank. This is the steepest bank at which it is possible to maintain level flight at 2.5g.

Beyond 33° of bank, the pitch trim stops working and a lateral stability term is introduced. This term becomes progressively stronger as bank angle increases, so that it equals a full sidestick demand at 67° of bank, hence forming the limiting system.

The lack of pitch trim makes it necessary for the pilot to hold the nose up in a steep turn. If he releases the stick, the nose drops and the aircraft eases its roll angle to less than 33° of bank and stabilizes at the pitch and bank angles it achieves at less than 33° of bank.

During a normal entry into a turn, the pilot must make an intentional initial change to the pitch attitude in order to maintain level flight. Once he has done this, he can release the stick. The system then maintains a level turn.

In climb, cruise, descent, and approach all these basic rules remain in effect.

LANDING MODE

The system's landing mode gives the aircraft a stabilized flight path and makes a conventional flare and touchdown. It carries out the initial approach as this manual described earlier. At 50 feet, the system memorizes the attitude, usually 3° or 4° nose up. From 30 feet down, this value washes out over eight seconds to – 2°. The result is that the pilot has to exert a progressive pull to increase pitch gently in the flare. He should pull the thrust levers back at or above 20 feet, and the landing should occur without a long flare. Touchdown quality is better and more repeatable at fairly flat attitudes. An audible "RETARD" callout reminds the pilot if he has not pulled back the thrust levers when the aircraft has reached 20 feet.

R Crosswind landings are conventional. The preferred technique is to use the rudder to align
R the aircraft with the runway heading, during the flare, while using lateral control to maintain
R the aircraft on the runway centerline (Refer to SOP 3.03.22). The lateral control mode does not change until the wheels are on the ground, so there is no discontinuity in the control laws. The aircraft tends to roll gently in the conventional sense as drift decreases, and the pilot may have to use some normal cross control to maintain roll attitude.

Even during an approach in considerable turbulence, the control system resists the disturbances quite well without pilot inputs. In fact, the pilot should try to limit his control inputs to those necessary to correct the flight path trajectory and leave the task of countering air disturbances to the flight control system.

Derotation is conventional. The pilot releases the back pressure he was holding for the flare and the nose wheel comes down nicely.

Pitch trim then resets to zero.

ABNORMAL OPERATIONS

ENGINE FAILURE AT TAKEOFF

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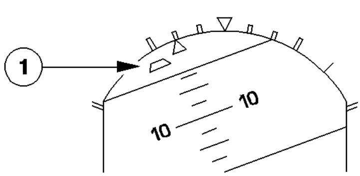


On the ground the aircraft is conventional. The pilot uses rudder to maintain direction. He should rotate to about 12.5° of pitch and adjust as required. The sideslip indication (1) changes to the engine-out mode (blue). When it is centered, the aircraft is close to the zero aileron position (best drag condition). It is therefore important to zero the slip indication accurately.

Trim the rudder conventionally.

When time permits, the pilot should check the ECAM's FLT CTL page, and refine the rudder trim to give neutral lateral control, and also trim the rudder toward the spoilers that are up or toward the aileron that is farthest up to bring the lateral controls back to neutral.

ENGINE-OUT LANDING

The engine-out landing is basically a conventional landing. The pilot should trim to maintain the slip indication centered. It is yellow, as long as N1 is less than 80%. Between 100 and 50 feet, the pilot he can reset rudder trim to make the landing run easier, and to recover full rudder travel in both directions.

R BOUNCE AT LANDING

R In case of a light bounce, maintain the current pitch attitude and complete the landing,
R while maintaining the thrust at idle. In case of a strong bounce, initiate a go-around, initially
R maintaining the pitch attitude. Retract the flaps one step, and then the landing gear, once
R the aircraft is properly established on the go-around segment. In all cases, do not attempt
R to soften the (potential) second touchdown by increasing the pitch attitude.

TRAINING TOUCH-AND-GO

With the nosewheel on ground, pitch trim automatically resets to zero. The pilot should select CONF 2 and add thrust. He must always move the thrust levers to TOGA to bring up the speed reference system (SRS), and then reduce to a lower thrust (not less than CL), if he chooses. Takeoff may be a little out of trim, which may affect the rotation slightly, but once the aircraft is off the ground, the control law holds the "out of trim", then retrims at 50 feet.

ABNORMAL CONTROL LAWS - GENERAL

ALTERNATE LAW

Pitch alternate and roll direct is the first level of degraded control law, resulting from some double failures.
The autopilot may be available, depending on the cause and type of failure(s).

DIRECT LAW

The sidestick is directly coupled to the controls via the computers, but without any of the stabilization feedbacks. In effect, this law turns the aircraft into a conventional aircraft, but is compensated for configuration and CG. The pilot must use manual pitch trim, as is signaled on the PFD. The autopilot is not available.

R **MECHANICAL BACKUP**

The pilot can use the pitch trim and rudder to control the aircraft for short periods of total loss of fly-by-wire.

ABNORMAL CONTROL LAWS - IN DETAIL

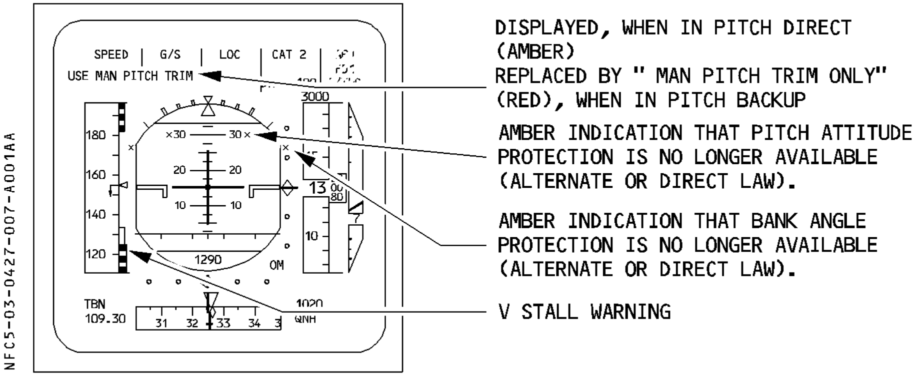
ALTERNATE LAW

Pitch

Alternate law in pitch is almost the same (for the pilot) as the normal control laws.
However, alternate law does not maintain any of the protections, except for the load factor limitation. As a result, the pilot must fly the aircraft more attentively to avoid inadvertently exceeding the normal limits.
Alternate law reduces VMO to 320 knots to restore a normal aircraft speed margin in case of upset. This is not necessary in the Mach range, because the margin there is, in any case, conventional.
An aural "STALL, STALL, STALL" warning sounds at low speeds. Upon hearing it, the pilot must return to the normal operating speed by taking conventional actions with the controls:
THRUST LEVERS . . . . .TOGA
At the same time :
PITCH ATTITUDE . . . . .REDUCE
BANK ANGLE . . . . .ROLL WINGS LEVEL
SPEEDBRAKES . . . . .CHECK RETRACTED

- If a danger of ground contact exists, reduce pitch attitude no more than necessary to allow the airspeed to increase. After initial recovery, maintain speed close to VSW, until it is safe to accelerate.
- If below 20000 feet, and if in clean, select FLAP 1.
- Out of stall, when no threat of ground contact :
  LANDING GEAR . . . . .UP
  – Recover to normal speeds, and select flaps are required.
  – In case of one engine inoperative, use power and rudder with care.

The aural stall warning may also sound at high altitude, where it warns that the aircraft is approaching the angle of attack for the onset of buffet. To recover, the pilot must relax the back pressure on the sidestick and reduce the bank angle, if necessary. When the stall warning stops, the pilot can increase the back pressure again, if necessary, to return to the planned trajectory.



At low speed the change in the speed scale is very noticeable. VLS remains, but Vα PROT and Vα MAX disappear, replaced by a single black and red strip the top of which is stall warning speed. Unlike VLS which is stable, VSW is g sensitive so as to give additional margin in turns.
As mentioned above, ALTERNATE reverts to DIRECT law for landing when the flight crew lowers the landing gear.

Roll
Roll control is direct. The rate of roll is generally higher than with normal law and at first the aircraft appears to be very sensitive.
Bank stability and protections are no longer active and the flight crew should take care to stay within normal limits.

DIRECT LAW

Normally direct law in pitch is transitory, due to undetected failures of, for example, a second IRS. Once the flight crew has isolated the failed system, it can reset the ELACs to acquire alternate law in pitch.
When the system goes into direct law, "USE MAN PITCH TRIM" appears on the PFDs. This message flashes for 5 seconds, then becomes steady.
The pilot should use small control inputs when the aircraft is in direct law at high speed, because the controls are powerful. Good trimming in pitch is required.
The pilot should avoid using large thrust changes or sudden speedbrake movements, particularly if the center of gravity is aft. If the speedbrakes are out and the aircraft has been retrimmed, the pilot should retract the speedbrakes gently, giving time to retrim so as to avoid a large nose-down trim change.
The flight crew must fly the aircraft carefully at all times. Control is precise, but there are no protections.
The aural stall warning for alternate law also serves direct law, and the technique for recovery is the same.
Any tendency to roll stick free can be corrected by conventional use of rudder. Residual rudder forces can be trimmed out by using rudder trim in the direction of the applied force.

After trimming, the sideslip index will be slightly displaced from center. With some failure conditions the asymmetric rolling tendency may be increased. It will always be possible to trim the aircraft to fly straight, hands off. There may then be an asymmetry in roll response, but the roll rate achieved is always adequate.
Landing in direct law is like landing a conventional aircraft. Trim changes to compensate for configuration changes are small, as is the trim change with speed change. Trim change with a large thrust change is quite large, so the pilot should make smooth thrust changes. The flare height for landing is the same (20 feet), and the pilot uses conventional techniques. (The controls remain light and powerful).
Pilots have landed this aircraft in direct law in moderate to heavy turbulence with gusting winds without undue difficulty.
Direct law works with or without the yaw damper. The aircraft is always convergent in dutch roll, so if an oscillation begins it will stop itself if not excited. To stop dutch roll the pilot should use lateral inputs, not rudder.

THE PROTECTION SYSTEMS

GENERAL

The aircraft has a comprehensive flight envelope protection system.
This system increases safety if the pilot has to make an extreme maneuver or the aircraft enters a very violent meteorological situation.
In either of these situations, the pilot can make full sidestick inputs in normal laws at any speed. The rudder is not protected in this way, but is not normally used during symmetrical flight.
The pilot will never see any aspect of this envelope protection take effect as long as he flies the aircraft normally.

Note : *The normal flight envelope is not different from that of a conventional aircraft, and is defined as VLS to VMO. Pilots should not deliberately fly at a speed that is lower than VLS except for properly authorized training or testing.*

PITCH ATTITUDE PROTECTION

The system limits the aircraft to 67° of bank, which corresponds approximately to the bank angle needed for a level 2.5g turn.
The system limits pitch attitude to + 30° and – 15°. The + 30° limit decreases to 25° at low speed. If the aircraft attitude approaches these limits, the pitch and roll rates start to decrease 5° before the limit so that it will stop at the limit without overshooting.

LOAD FACTOR LIMITATION

The aircraft is structurally designed to the same limits as any other large aircraft. The 2.5g limit (2g with flaps extended) allows the aircraft to make an abrupt maneuver without structural risk if such a maneuver becomes necessary.
When this occurs (after a ground proximity warning, for example), the pilot should quickly apply full control and hold it until the flight path is safe. Response time is a vital factor in avoidance : the system allows maneuvers that the pilot would not normally be able to perform safely at any altitude, low or high.

EXCEEDING VMO/MMO

During descent the aircraft may slightly exceed VMO/MMO with the autopilot engaged. This may happen when adverse conditions are encountered.
Using the following procedure prevents such an exceedance during descent :

1. The current speed is close to VMO (maximum operating speed) :
   - Monitor the speed trend symbol on the PFD :
     - If the speed trend reaches or slightly exceeds the VMO limit :
       - Use the FCU immediately to select a lower speed target.
     - If the speed trend significantly exceeds the VMO red band, without high speed protection activation :
     - Select a lower target speed on the FCU and, if the aircraft continues to accelerate, consider disconnecting the AP.
     - Before re-engaging the autopilot, smoothly establish a shallower pitch attitude.
2. If the aircraft accelerates above VMO with the AP engaged :
   The AP will disengage upon reaching the high speed protection. The high speed protection will apply a nose-up order up to 1.75 g, in addition to pilot input during VMO recovery. Consequently :
   - Make a smooth pitch correction in order to recover proper speed.

In all events :

- Check AP engagement status and re-engage it when appropriate. It may have tripped if VMO/MMO was significantly exceeded. The associated aural warning may have been superseded by the overspeed aural warning.

HIGH SPEED PROTECTION

The aircraft automatically recovers following a high speed upset. Depending on the flight conditions (high acceleration, low pitch attitude) the High Speed Protection is activated at/or above VMO/MMO.
When it is activated, the pitch trim is frozen, spiral static stability is introduced to 0° bank angle (instead of 33° in normal law), and the bank angle limit is reduced from 67° to 45°.
As the speed increases above VMO/MMO, the side-stick nose-down authority is progressively reduced, and a permanent nose-up order is applied to aid recovery to normal flight conditions.

The High Speed Protection is deactivated when the aircraft speed decreases below VMO/MMO, where the usual normal control laws are recovered.
The flight crew should never deliberately fly the aircraft beyond VMO/MMO, unless absolutely necessary for operational reasons, such as avoiding another aircraft.
The pilot should, as soon as possible, reduce resistance to the High Speed Protection and allow the aircraft to return to a speed below VMO/MMO, by smoothly relaxing the forward stick force to attain a comfortable nose-up pitch rate. It is not usually necessary to apply a pull force to recover. If a quicker recovery is required for operational reasons, the pilot should pull back smoothly and progressively, monitoring the g indication on the ECAM".

HIGH ANGLE OF ATTACK PROTECTION

The aircraft resists attempts by either a pilot or the atmosphere to stall it. If a pilot attempts a stall, he feels the aircraft trying to pitch down as speed approaches the amber and black strip. The pilot can resist this tendency until speed reaches the red band (alpha maximum), and then further nose-up control is not available. Between these two points, αfloor automatically sets go around thrust. The pilot can hold full back stick, if it is needed (see windshear), and the aircraft stabilizes at an angle of attack close to but short of the 1g stall.
WHEN FLYING AT αmax, THE PILOT CAN MAKE GENTLE TURNS, IF NECESSARY.
As the aircraft enters protection at the amber and black strip. (αprot), the system inhibits further nose-up trim beyond the point already reached. Nose-down trim remains available if the pilot pushes the stick forward.
The pilot should not deliberately fly the aircraft in αprot except for brief periods when maximum maneuvering is required. If the pilot enters αprot inadvertently, he should get out of it as quickly as possible by easing forward on the sidestick to reduce the angle of attack while simultaneously adding power (if αfloor has not already been activated or has been cancelled). The system will regain the normal load factor law if the stick is pushed forward of neutral, but it will re-enter αprot if the stick is released with the angle of attack still greater than the value set for αprot. Thus to exit αprot properly, the pilot should reduce angle attack to a value less than the value set for αprot.
The PFD shows this clearly, because the indicated speed is above the black and amber strip.
The pilot should now increase speed above VLS (clear of the amber strip) as soon as other considerations (ground clearance, for example) allow him to do so.
αfloor will usually be triggered just after αprot is entered, and go around thrust will automatically be applied. Thus, if the sidestick is held aft, either inadvertently or deliberately, the aircraft will start to climb at a relatively constant low airspeed. To recover to a normal flight condition, αprot should be exited by easing forward on the sidestick, as described above, and the αfloor should be cancelled by using the disconnect pushbutton on either thrust lever as soon as a safe speed is regained.

The aircraft can also enter αprot at a high level, where it protects the aircaft from the buffet boundary. The PFD shows that αprot is active in the same way it does so at low speed or low level : the amber and black strip rises to the actual speed of the aircraft. As at low speed or low level, if the stick is merely released to neutral the aircraft maintains the alpha for αprot. (This value of alpha is not however the same as the value used at low speed : alpha for αprot is reduced as a function of Mach so that a typical cruise value is in the order of 3.5° for the A321 or 4.5° for the A320.) Thus the aircraft may climb, stick free, when leaving a turn after entering αprot. If the pilot has flown into αprot, he should leave it as soon as other considerations allow by easing forward on the stick to reduce alpha below the value of αprot while simultaneously increasing thrust or speed as appropriate.

WINDSHEAR

Most of the recommended techniques for flight in windshear apply to aircraft in the A320 family, but for these aircraft the techniques are somewhat simpler.
The aircraft can only survive windshear if it has enough energy to carry it through the loss-of-performance field. It can sustain this energy level in the following three ways :
– Carry extra speed. The aircraft does this automatically in some cases.
– Add maximum thrust. The aircraft does this automatically.
– Trade height energy for speed. Any aircraft can do this.
Proper pilot technique helps in this survival process. The pilot must follow orders from the Speed Reference System (SRS) or, if the FD is not available or is switched OFF for a visual approach, maintain 17.5° of pitch, even if he has to use full backstick in order to do so. At this stage, maintain full backstick until the shear is passed. The aircraft will automatically hold close to the maximum angle of attack. The speed should stay close to the beginning of the red strip. But, in turbulence, it could be temporarily below it without significant effect. As speed begins to recover, the pilot can reduce backstick, while still following SRS orders until well clear of the shear.

ABNORMAL CONFIGURATIONS

In some flight control failure cases, such as loss of control of both elevators, or loss of flaps or slats, the landing configuration is Configuration 3.
With the horizontal stabilizer jammed, control is much easier than it is on a conventional aircraft, because the integrator holds the elevator required to maintain the 1g flight path. The control laws remain normal to touchdown.

AIRCRAFT TRIMMING

When the aircraft is :
- In normal cruise range (around M.77),
- In straight flight,
- With the autopilot engaged,
- With symmetrical engine thrust, and
- With fuel in the wing tanks distributed symmetrically,

the rudder trim should stay between 1° right and 2.3° left.

Note : *This indication corresponds to a true rudder deflection within ± 1.5°, taking into account the permanent offset of rudder trim indication, when the aircraft is in cruise conditions. (average 0.5° right, 0.8° left).*
An indicated, rudder trim above 1° right or 2.3° left is acceptable, if maintenance personnel establishes that the corresponding real rudder position is within 1.5° left, and 1.5° right.

FQI IN DEGRADED MODE

If, on upper ECAM display the FOB indication is displayed with two dashes across the two least significant digits, the FQI is in degraded mode.
In this case, the ECAM FUEL page must be called on ECAM lower display to determine which tank is affected.
The loss of accuracy resulting from the loss of FQI normal mode is as follows :

wing outer cell affected	:	+ 20 kg (+ 45 lb), – 200 kg (– 440 lb)
wing inner cell affected	:	± 110 kg (240 lb).
center tank affected	:	± 130 kg (290 lb).
all tanks affected	:	+ 390 kg (+ 860 lb), – 750 kg (– 1660 lb).

ICING CONDITIONS

Icing conditions may be expected when the OAT (on ground and for takeoff), or when TAT (in flight) is at or below 10°C, and there is visible moisture in the air (such as clouds, fog with low visibility of one mile or less, rain, snow, sleet, ice crystals) or standing water, slush, ice or snow is present on the taxiways or runways.

WARNING

Pilots must turn on the engine anti-ice system, when temperature and visible moisture meet these criteria, and should not wait until they see ice building up.

OPERATIONS IN ICING CONDITIONS

Flight in icing conditions

- **Engine anti-ice**

  ENGINE ANTI ICE must be ON during all ground and flight operations, when icing conditions exist, or are anticipated, except during climb and cruise when the SAT is below – 40° C.

  ENGINE ANTI ICE must be ON before and during a descent in icing conditions, even if the SAT is below – 40° C.

- **Wing anti-ice**

  WING ANTI ICE may either be used to prevent ice formation, or to remove ice accumulation from the wing leading edges.

  WING ANTI ICE should be selected ON, whenever there is an indication that airframe icing exists. This can be evidenced by ice accumulation on the visual ice indicator (located between the two cockpit windshields) or on the windshield wipers.

  CAUTION

  1. Extended flight, in icing conditions with the slats extended, should be avoided.
  2. In case of suspected significant ice accumulation on non de-iced parts of the airframe, the approach speed must not be lower than :
     – In configuration full, VLS + 5 knots and the landing distance must be multiplied by 1.1
     – In configuration 3, VLS + 10 knots and the landing distance must be multiplied by 1.15.

RAIN REPELLENT ⊲*

R If the rain repellent is operative, the flight crew should only use the rain repellent in
R moderate to heavy rain.

GROUND OPERATIONS IN HEAVY RAIN

When the aircraft is parked on the ground during heavy rain, it can take rainwater into the avionics ventilation system via the open skin air inlet valve.
To prevent this, the following procedure must be applied :

- **After landing :**

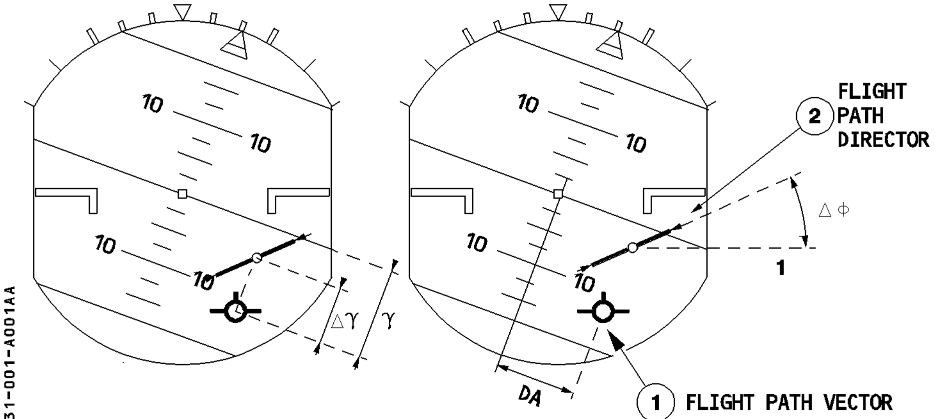
  – **EXTRACT . . . . OVRD**
  This closes the avionics ventilation system, preventing rainwater from entering.

  – **PACKS 1 and 2 . . . . CHECK ON**
  This adds air from the air conditioning system to ventilation air. If bleed air is not available, the arrangement can function for a limited time, as follows :
  · OAT ≤ 39°C : no limit
  · 39°C ≤ OAT ≤ 45°C : 3 hours
  · OAT ≥ 45°C : 30 minutes

- **After takeoff :**

  – **EXTRACT . . . . AUTO**

USE OF FLIGHT PATH VECTOR



Υ represents the flight path angle
DA represents the drift angle
ΔΥ represents the difference between the ordered flight path angle and the actual one
Δφ represents the difference between the ordered roll angle and the actual one

The flight path vector (FPV) indicates performance and does not direct or command. Because there is always a slight lag between an attitude change and the change in flight path that results from it, when the pilot uses the FPV he should make an attitude change first, then use the FPV to check the resulting flight path.
Vertically the FPV indicates the aircraft's flight path angle.
The FPV is particularly useful when the aircraft is doing visual circuits. For example, when the aircraft is flying downwind the pilot simply adjusts the aircraft attitude to put the FPV symbol on the horizon. This establishes the aircraft in level flight. On the final approach, the pilot puts the FPV three degrees below the horizon to establish the aircraft at a normal angle of descent. If this results in the aircraft going below the chosen approach path (undershooting the touchdown point), the pilot can reduce the angle of descent by raising the FPV. As soon as the aircraft regains the correct descent path, he should bring the FPV back to –3°.
Laterally, the FPV indicates the aircraft's track and its drift angle. It has the same displacement as the drift diamond on the heading scale and thus appears directly above it. It shows on the PFD the drift the aircraft is experiencing.
The pilot must take care when making a go-around with the FPV selected. There is inevitably some lag between the pilot's raising the nose to commence the go-around and the aircraft's responding by changing its trajectory. For the same reason the pilot does not use the FPV on takeoff: the primary parameter for rotation, either on takeoff or on go-around, is attitude.

The TRK-FPA Flight Director is particularly useful for guiding the aircraft during non-precision approaches, although it can also be used at other times. When using this mode of the FD, the pilot places the FPV symbol in the center of the flight path director (FPD) symbol. This is similar to using the FD in HDG-VS, when the pilot puts the center of the fixed aircraft symbol at the center of the crossed bars of the FD. If the FCU is set on the correct track and flight path angle, and if the FPV and the FPD are aligned, they will guide the aircraft along a trajectory that is stabilized with respect to the ground, whereas when the pilot is using HDG-VS the trajectory is stabilized with respect to the air. However, if the aircraft is disturbed from this ideal trajectory, merely following the FPD will result in its following a trajectory that is parallel to the intended trajectory. Thus, when the aircraft is disturbed from the original trajectory, the pilot must adjust either its track or its flight path angle or both in order to obtain guidance back to the original trajectory. Likewise, when the pilot uses the FPA to create a synthetic glide path, it will be positioned correctly only if it commences at the right point in space.

BSCU RESET

In case of braking/steering difficulty, the crew may perform a BSCU reset to recover correct functioning of the system. In particular, this applies in the case of any of the following ECAM warnings :
- WHEEL N.W. STEER FAULT
- BRAKES AUTO BRAKE FAULT (except in flight)
- BRAKES BSCU CH1 (2) FAULT or SYS 1(2) FAULT

R · On ground, aircraft stopped and parking brake applied, by switching OFF then ON the A/SKID & N/W STRG selector.
R After any BSCU reset on ground, check the braking efficiency of the normal braking
R system once the aircraft starts moving again (the aircraft must slow down when
R pressing the brake pedals).

Note : If a BRAKES BSCU CH 1(2) FAULT or SYS 1(2) FAULT cannot be cleared by resetting via the A/SKID & N/W STRG selector, a further reset may be attempted with the BSCU circuit breakers to clear the fault.

· In flight, with landing gear retracted, by switching OFF then ON the A/SKID & N/W STRG selector.
In the case of an AUTO BRAKE FAULT, a reset should not be performed in flight so as to avoid clearing a real tachometer failure (no tachometer test in flight).
If required, the autobrake has to be rearmed.

R *Note : Checking the normal braking after a BSCU reset in flight is not necessary (and*
R *not possible), since the BSCU would detect any loss of normal braking at*
R *touchdown, and the ECAM would inform the crew of the switch to alternate*
R *braking without anti-skid.*

BRAKING IN ALTERNATE MODE

Apply brakes with care, since initial pedal force or displacement produces more braking action in alternate mode than in normal mode. If anti-skid is lost, modulate brake pressure at or below 1000 psi. If the nosewheel steering is lost, steer the aircraft with differential braking.

BRAKE TEMPERATURE LIMITATIONS REQUIRING MAINTENANCE ACTIONS

Maintenance action is due in the following cases :

- The temperature difference between the 2 brakes on the same gear is greater than 150°C, and the temperature of either one of the brakes is higher than or equal to 600°C, or,
- The temperature difference between the 2 brakes on the same gear is greater than 150°C, and the temperature of one brake is lower than or equal to 60°C, or,
- The difference between the LH and RH brakes' average temperature is higher than or equal to 200°C , or,
- A fuse plug has melted, or,
- One brake's temperature exceeds 900°C.

OPERATION WITH NOSEWHEEL STEERING OFFSET

GENERAL

During taxi, the crew may notice an aircraft veering tendency. It can be due to some external conditions (crosswind, slope....), or it can be due to the nosewheel steering
R system itself. The latter case is identifiable due to flight crews' repetitive reports of
R permanent aircraft veering tendency. Such reports enable maintenance to determine when
R corrective action or troubleshooting is required.
A veering aircraft may still be operated before corrective action is taken, provided nosewheel steering deviation is within the values specified in the following table.

NWS OFFSET OPERATIONAL LIMITATION

NWS Offset	Offset ≤ 0.5°	0.5° < Offset ≤ 1.5°	Offset > 1.5°
Rudder trim to taxi straight	Trim ≤ 2.5°	2.5° < Trim ≤ 7.5°	Trim > 7.5°
Dispatch	YES	YES	NO
Procedures	No operational limitation	Apply the following procedure : Autoland : – MAX X WIND 10KT	Immediate maintenance action is due

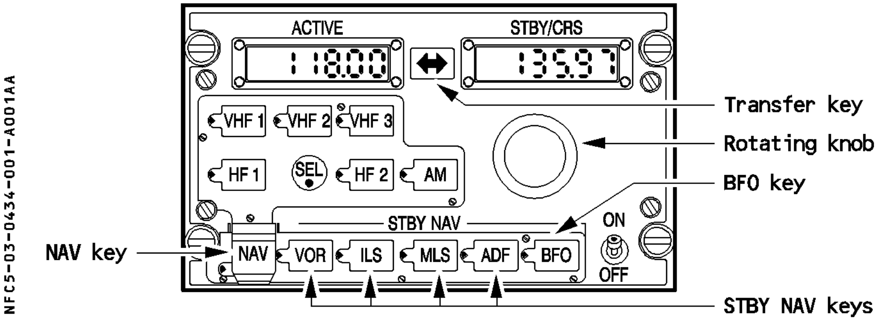
CAUTION

The tolerance required by maintenance guidelines (± 0.5° NWS offset, corresponding to
R the ± 2.5° rudder trim necessary to taxi straight) remains valid. Operating the aircraft
R outside the maintenance tolerance is possible by using the applicable procedure.
R However, in such cases, the flight crew must accurately and systematically make
R logbook entries (indicating the rudder trim input value to taxi straight) to ensure that
R maintenance can take corrective action within the applicable timeframe.
When using rudder trim to taxi straight for NWS offset identification, takeoff must only be performed after a rudder trim reset.

PROCEDURES FOR TUNING STANDBY NAVIGATION RADIOS

CAUTION

Pilots should use these procedures only when both FMGCs or both MCDUs are
R inoperative. When at least one FMGC is operative, the use of NAV key on RMP while
R the LOC update is active, may freeze the FM position during approach and must be
R avoided.
In this case they must press both RMP NAV keys (lighting the green lights).



FOR BOTH RMPs

– **ON/OFF Switch . . . . CHECK ON**

– **NAV key (guarded) . . . . PRESS**
Green light comes on.
A lighted STBY NAV key shows which system had been selected earlier in the radio-nav standby mode, and the windows show which frequencies had been used.

ON THE RMP ASSOCIATED WITH THE RECEIVER TO BE TUNED

Select a STBY NAV system :

● **ADF tuning :**

– **ADF key . . . . PRESS**
The green light comes on.
The windows show the previously selected frequencies.

– **Rotating knob . . . . TURN**
Watch the STBY/CRS window to set a frequency.
The outer knob changes units, inner knob decimals.

– **Transfer key . . . . PRESS**
This interchanges the ACTIVE and STBY frequencies. The ADF receiver is now tuned to the new ACTIVE frequency.

– **BFO key (if necessary) . . . . PRESS**
Green light comes on.

● **VOR (or ILS) tuning :**

– **VOR (or ILS) key . . . . PRESS**
Green light comes on.
Both windows display previously selected frequencies.

– **Rotating knob . . . . TURN**
Set the frequency in the STBY/CRS window.

– **Transfer key . . . . PRESS**
The ACTIVE window displays the selected frequency.
The STBY/CRS window displays the frequency that had been displayed in the ACTIVE window.

– **Rotating knob . . . . TURN**
Set the course in the STBY/CRS window.
The receiver is now tuned to the frequency of the new station, and the course is selected.
To select another station, press the transfer key (making both windows display the previously selected frequency) before retuning the VOR (or ILS).

Note : *When the radio-nav standby mode is active (NAV key ON) and VHF or HF tuning is required, select the VHF key or the HF key on the RMP (normal radio communications use). The NAV key, which has no effect on the selection of a radio communication frequency, must remain in the ON position in order to*
R *prevent radio navigation aid tuning from changing NAV receiver frequencies.*

AUTOMATIC IDENTIFICATION OF ADF/VOR/ILS

Although the navigation display automatically identifies the tuned ADF, VOR, or ILS station (auto ident decoded), the flight crew must, in the following cases, confirm the correct tuning of the desired station via the audio system :

- A station has either been autotuned or tuned manually by a crew member's entering the associated ident on the MCDU RAD NAV page, and the decoded ident appearing on the ND is the wrong one.
- A crew member has tuned the station manually on an RMP or by entering the frequency on the MCDU RAD NAV page.

WEATHER RADAR

INTRODUCTION

Airborne weather radar gives the flight crew an efficient tool for detecting bad weather during flight. The digital weather radar with its multicolor navigation display allows the crew to follow the best route to avoid weather problems.
To this end, some operational advice, based upon a general knowledge of the radar capabilities, is given in this chapter.

GENERAL

The radar is nothing more than a precipitation detector. How much weather it detects depends upon the raindrops, their size, composition and number.
The radar does not detect :
· clouds, fog or wind (too small droplets or no precipitation at all)
· clear air turbulence (no precipitation)
· windshear (no precipitation except in microburst)
· lightning.
The radar does detect :
· rainfall
· wet hail and wet turbulence
· ice crystals, dry hail and dry snow (above 30 000 feet) will only give small reflections.

OPERATIONAL FUNCTIONS

TILT, RANGE AND GAIN

The three things that the flight crew must understand in order to take full advantage of the weather radar are :
- antenna tilt, which causes the center of the radar beam to scan above or below the attitude reference plane
- range control which, in coordination with tilt governs the range of the navigation display
- gain control, which adjusts the sensitivity of the receiver (and should normally be set
R to AUTO). The sensitivity of the receiver may vary from one type of radar system to
R another.

COLOR CODE

A color code distinguishes areas according to their precipitation intensity :
- Black, for the lowest intensity (nothing appears on the ND)
- Green, amber, and red for progressively higher intensities.
- Magenta, for saturated areas, in the weather and turbulence mode (WX + T)

GROUND MAPPING AND GCS

Some radars have two additional modes :
- Ground mapping mode permits the radar to produce more returns from less reflective targets on the ground. The associated color codes are : Black for standing water (no returns), green for the ground, amber or red for cities and mountains (strong returns).
- Ground Clutter Suppression (GCS) erases up to 85 % of ground clutter return. The flight crew should only use this mode at shallow tilt angles (0 to 5°) and for short intervals, since it may incorrectly identify stationary weather targets. Steep tilt angles can make it difficult to distinguish between ground and weather targets.

OPERATIONAL USE

CAUTION

R Before selecting WX, WX/T or MAP mode on the control unit, make certain that :
R - No one is within a distance less than 5 meters from the antenna in movement, within
R an arc of plus or minus 135° on either side of the aircraft centerline.
R - The aircraft is not directed towards any large metallic obstacle, such as a hangar,
R which is within 5 meters in an arc of plus or minus 90° on either side of the aircraft
R centerline.

TILT AND RANGE

- Refer to the FCOM 3.03.

DETECTION AND INTERPRETATION

General

1. The flight crew should monitor the weather at long range, as well as at shorter ranges, in order to be able to efficiently plan course changes, and to avoid weather-defined blind alleys and box canyons.
2. Ground returns usually appear smaller, sharper, more packed, better-defined, and more angular than weather targets, whereas the latter usually appear larger, have less definite shapes, and tend to remain relatively unchanged.
3. The line-of-sight distance to the horizon is :
   $D(NM) = 1{,}23 \sqrt{\text{aircraft altitude (feet)}}$.

Red and magenta areas : thunderstorms, tornadoes, hail

The steeper the gradient of rainfall rate, the stronger the turbulence (magenta color) and the possibility of hail.

- To use the radar effectively for avoiding thunderstorms, the flight crew should select the following ranges on the NDs (if possible) :
  - 160 NM on the Pilot Non-Flying (PNF) ND
  - 80 NM on the Pilot Flying (PF) ND
- To avoid a large storm, the flight crew must make decisions while still 40 NM from it. Therefore the flight crew should :
  - Avoid magenta (WX+T mode) and red areas and fringes by at least 20 NM above the FL230 and by 5 to 10 NM below FL230.
  - Avoid single magenta areas of turbulence (not associated with heavy precipitation) by at least 5 NM.
- Flight crew should readjust the tilt frequently in order to monitor storm development and to get the best cell echo.
- Failure to tilt the antenna down periodically may cause a target to disappear.
- The following formula calculates the vertical distance between the top of the cell and the aircraft flight level :

  $$\boxed{\Delta h \text{ (feet)} \sim d(\text{NM}) \times \text{Tilt (degrees)} \times 100.}$$

  Example :
  Cell at 40 NM disappearing at less than 3 degrees downtilt
  $\Delta h \sim 40 \times 3 \times 100 = 12\ 000$ feet.
- The pilot should not attempt to penetrate a cell or clear its top by less than 5000 vertical feet, because otherwise the aircraft may encounter severe turbulence.
  R If the top of cell is at or above 25000 feet, overflying should be avoided due to the
  R possibility of encountering turbulence stronger than expected.
  In the same way, the pilot should avoid flying under a thunderstorm because of possible windshear, microbursts, severe turbulence, or hail.

Turbulence mode :

- The turbulence detection mode is most effective when the ND is set on 40 NM and the antenna is tilted to avoid ground return.
- When examining areas of heavy rainfall in WX+T mode, the flight crew should adjust antenna tilt frequently, because turbulence areas vary with the altitude.
- Closely spaced (or thin lines between) color gradations are usually associated with severe turbulence.

FLIGHT INSTRUMENT TOLERANCES

The values given below apply to aircraft in symmetrical flight (no sideslip), in clean configuration, and in straight and level flight.

ALTITUDE TOLERANCES

R – PFD 1 or 2 at ground check : ± 25 feet (8 m)
R – standby altimeter at ground check : ± 300 feet (91 m)

Note : On ground, as the standby altimeter's vibrator is off, the standby altimeter's tolerance value is high. In flight, the vibrator is on and the value is lower.

MAXIMUM DIFFERENCES BETWEEN ALTITUDE INDICATIONS

R

FL/SPEED	ALTITUDE (ft) COMPARISON BETWEEN		
	ADR 1 and ADR 2 (on PFD)	ADR 3 and ADR 1 or ADR 3 and ADR 2 (on PFD)	STBY ALTI and any ADR 1 or 2 or 3
GND CHECK	20 (6 m)	20 (6 m)	*
FL50/250 kt	50 (15 m)	80 (24 m)	130 (40 m)
FL100/250 kt	55 (17 m)	80 (24 m)	185 (56 m)
FL200/300 kt	90 (27 m)	145 (44 m)	295 (90 m)
FL300/.78	130 (40 m)	355 (108 m)	390 (119 m)
FL390/.78	130 (40 m)	365 (111 m)	445 (136 m)

* On ground, the check is meaningless because the standby altimeter's vibrator is off.

AIRSPEED/MACH TOLERANCES

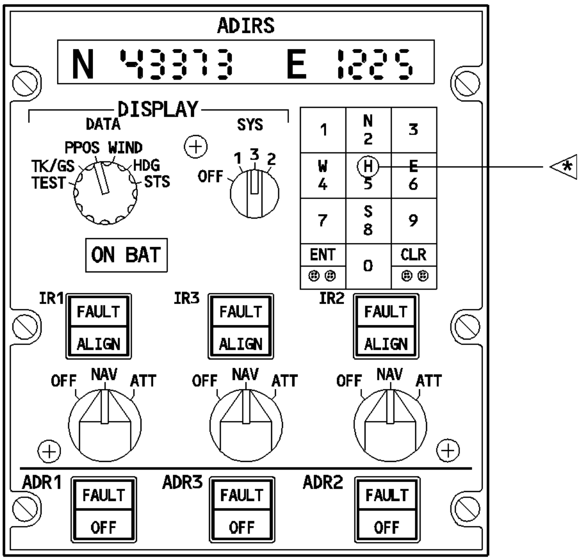
Maximum differences between Speed/Mach indications :

FL/SPEED	SPEED (kt) MACH COMPARISON BETWEEN					
	ADR 1 and ADR 2 (on PFD)		ADR 3 and ADR 1 or ADR 3 and ADR 2		STBY ASI and any ADR 1 or 2 or 3	
	SPEED	MACH	SPEED	MACH	SPEED	MACH
GND CHECK	6	0.008	6	0.008	6	–
FL50/250 kt	4	0.005	5	0.011	7	–
FL100/250 kt	4	0.005	4	0.011	8	–
FL200/300 kt	3	0.007	4	0.008	9	–
FL300/0.78	3	0.010	7	0.017	9	–
FL390/0.78	3	0.010	6	0.019	8	–

HEADING TOLERANCES

Maximum differences between magnetic heading indications on the NDs : 4 degrees.

ADIRS ALIGNMENT



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ALIGNMENT (on the ground)

When an IR is off, the flight crew must align it before it can enter the navigation mode and
R supply data to various aircraft systems. The aircraft must be stationary during alignment.
R Any aircraft motion while in ALIGN mode will restart the alignment. Also avoid alignment
R during engine start or while engines are running. This will prevent the alignment from
R restarting due to power interrupts or aircraft movement.

Alignment takes approximately 10 minutes.

The system first uses gravity to determine level attitude, then determines true heading, based on the earth's rotation. The flight crew must manually enter the latitude and
R longitude of the present position just after switching the three mode rotary selectors to NAV. This becomes the navigation starting point from which the IRs determine subsequent aircraft position during flight.

R – **All 3 mode selectors . . . . OFF for more than 10 seconds.**

R – **All 3 mode selectors . . . . back to NAV**

ON BAT light comes on for 5 seconds. Then the ALIGN light for each IRU comes on and
R stays on.

– **DISPLAY DATA switch . . . . PPOS**

– **Present position PPOS . . . . ENTER**

R Enter the present position, immediately after switching the three mode rotary selectors to NAV. The flight crew uses the MCDU or ADIRS CDU keyboard to enter local latitude and longitude. One entry serves all IRs during the alignment phase.

Note : *Refer to Volume 4, for instructions on using the MCDU.*
R *For transit flights, or for any flight with GPS, the best PPOS to be used when*
R *performing an alignment are, by priority :*
R *1. The airport coordinates stored in the FMS database.*
R *2. The gate coordinates.*
R *3. The airport coordinates shown on the Jeppesen chart.*
R *For aircraft without GPS, and when flying long segments without radio updates,*
R *the best PPOS to be used when performing an alignment are, by priority :*
R *1. The gate coordinates.*
R *2. The airport coordinates stored in the FMS database.*
R *3. The airport coordinates shown on the Jeppesen chart.*

● **If the ALIGN light flashes :**

– **Status message . . . . CHECK**

· If the screen displays a message, the flight crew must take appropriate action (See the STATUS MESSAGES paragraph, 3.04.34 page 10).
· If there is no message, the flight crew should enter (identical) present position again. The ALIGN light then remains steady.

● **If the ALIGN light flashes at the end of the ten minute alignment phase :**

– **DISPLAY DATA switch . . . . PPOS**

The flight crew should check the entered present position, and enter the correct present position again.
Then :
· If the ALIGN light goes off, the IR portion of the ADIRU has entered NAV mode.
· If the ALIGN light stays on and the IR FAULT light flashes, the IR can only be used in ATT mode.
· If the ALIGN light stays on, but the IR FAULT does not flash, switch off the affected IR and perform a normal alignment again.

FAST REALIGNMENT (on the ground)

During transit or enroute stops with brief ground times, the flight crew may perform a realignment and zero the ground speed error, by selecting OFF from NAV then reselecting NAV within 5 seconds.

– **All 3 ADIRS CDU selectors . . . . OFF**

– **All 3 ADIRS CDU selectors . . . . back to NAV within 5 seconds**
The ALIGN light stays off, as long as selector is at OFF (5 seconds maximum), then comes on during the 30-second realignment period.
If the DATA DISPLAY switch is in the STS position, the CDU displays REALN DESN 5 SEC (realign decision 5 seconds).

– **DATA DISPLAY switch . . . . PPOS**

– **Present position . . . . ENTER**
Enter the local latitude and longitude, using the MCDU or ADIRS CDU keyboard.

Note : Refer to Volume 4, for instructions on using the MCDU.
R *For transit flights, or for any flight with GPS, the best PPOS to be used when*
R *performing an alignment are, by priority :*
R *1. The airport coordinates stored in the FMS database.*
R *2. The gate coordinates.*
R *3. The airport coordinates shown on the Jeppesen chart.*
R *For aircraft without GPS, and when flying long segments without radio updates,*
R *the best PPOS to be used when performing an alignment are, by priority :*
R *1. The gate coordinates.*
R *2. The airport coordinates stored in the FMS database.*
R *3. The airport coordinates shown on the Jeppesen chart.*

If present position has not been entered, or if the entered values disagree (within given limits) with the calculated values, the ALIGN light flashes.
The flight crew must check the present position it has entered, and enter present position again. If the ALIGN light still flashes, the flight crew must switch off the affected IR and perform a normal alignment.
After the 30-second realignment, the system automatically goes to NAV mode.

SHUTDOWN

– **Mode selectors . . . . OFF**
Pull and turn the 3 mode selectors to OFF.
The message screen displays REALN DESN 5 SEC (realign decision) for 5 seconds, then a 5 seconds countdown to off (OFF TIME 5 SEC displayed). Flight crew must not pull circuit breakers until after the final countdown is completed.

STATUS MESSAGES

Status messages appear when the DISPLAY DATA switch is set to STS. If there is more than one condition calling for a message, the display scrolls to the next message every 2 seconds.

R

MESSAGE	DESCRIPTION
STS IR FAULT	Hard failure. Select ATT (if corresponding message is displayed) or refer to MMEL or remove ADIRU for maintenance.
STS-DELAY MAINT	Failure not affecting IR functioning. Service ADIRU when convenient.
STS-ENTER PPOS	Enter present position or check entered position is correct. Note : The confirmation of an erroneous longitude at the present position entry will create a wrong position of the aircraft symbol on the NDs.
STS-SELECT ATT	Hard IRU failure, select ATT mode.
STS-EXCESS MOTION	Excess motion detected during alignment. ADIRU will automatically restart alignment. Ensure aircraft is not moving.
STS-SWITCH ADR	ADR invalid.
STS-CHECK CK/BK	Check circuit breakers *
STS-CDU FAULT	Remove CDU for maintenance.
STS-ENT MAG HDG	Enter magnetic heading.

* If a corresponding FAULT light comes on, check BAT 1 load.

TCAS

For system description refer to 1. 34.
For operational procedures, refer to 3.02

CONFLICT RESOLUTION PRINCIPLES

– **Traffic Advisory (TA)**
If an intruder represents a potential collision threat, a visual and aural Traffic Advisory will be given. This advisory aids the crew to acquire visually the intruder. Also it prepares the crew for a possible Resolution Advisory. However not every RA has to be preceded by a TA.

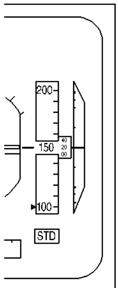
– **Resolution Advisory (RA)**
If the intruder is considered as a real collision threat an aural and visual Resolution Advisory is given.
The TCAS determines the optimum vertical maneuver that ensures effective separation with the minimum change of vertical speed.
Depending on each situation, the TCAS generates :
· preventive advisory i.e. the actual vertical speed may be maintained.
A range of vertical speed to avoid is displayed.
· corrective advisory i.e. the actual vertical speed is within the range to avoid and a range of recommended vertical speed (fly to) is displayed.
· modified corrective advisory which changes RA already displayed (for example if the intruder changes its vertical speed).

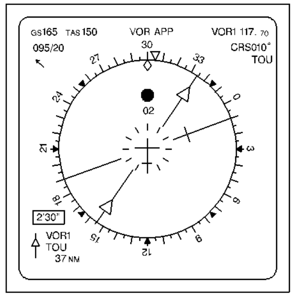
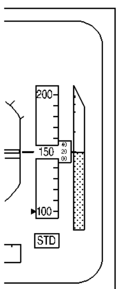
– **Advoidance generalities**
Always follow the TCAS orders, even if they lead to cross the altitude of the intruders, as they ensure the best global separation.

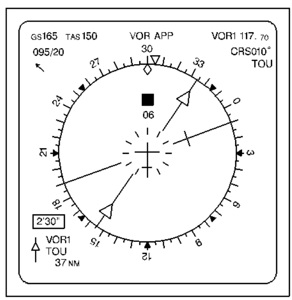
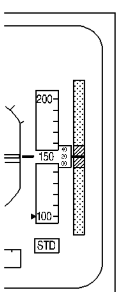
FAA OPERATIONAL RECOMMENDATIONS

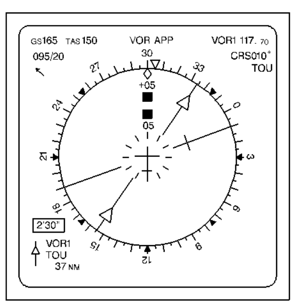
● **Avoidance generalities :**
Pilots should follow RAs unless they believe it is unsafe to do so or they have definitive visual acquisition of the intruding aircraft. If a pilot makes the decision not to follow an RA, he should be aware that the intruder may be TCAS equipped and may be maneuvering toward his aircraft in response to a coordinated RA.
Pilots should comply with the vertical speed limitations prescribed in the Airman's Information Manual during the last 2000 feet of a climb or descent. In particular, pilots should limit vertical speeds to 1500 feet/min during the last 2000 feet of a climb or descent, especially when they are aware of traffic that is converging in altitude and intending to level off 1000 feet above or below the pilot's assigned altitude.

- **Select TA only mode in the following cases :**
  - Engine failure
  - Dispatch with landing gear down (if applicable)
  - In case of known nearby traffic which is in visual contact.
  - At particular airports and during particular procedures identified by an operator as having a significant potential for unwanted a inappropriate RAs (closely spaced parallel runways, converging runways, low terrain along the final approach...)

<table>
<tr><th rowspan="2">SCENARIO</th><th colspan="2">AURAL WARNING and TYPICAL DISPLAY</th><th rowspan="2">CREW RESPONSE</th></tr>
<tr><th>PFD</th><th>ND</th></tr>
<tr><td>TRAFFIC ADVISORY
- one intruder is ahead at 12:00 o'clock beyond 6 NM, 200 ft below your altitude</td><td colspan="2">"TRAFFIC, TRAFFIC"



</td><td>- Do not maneuver on the traffic advisory symbol.
- Attempt to visually acquire the intruder.
- Be prepared to maneuver if the TA changes to an RA</td></tr>
<tr><td>RESOLUTION ADVISORY (PREVENTIVE)
- One intruder is ahead at 12:00 o'clock, 600 ft below your altitude</td><td colspan="2">"MONITOR VERTICAL SPEED"



</td><td>- Do not descend</td></tr>
<tr><td>RESOLUTION ADVISORY (CORRECTIVE)
- Two intruders are ahead at 12:00 o'clock
. one, at 500 ft above your altitude
. the other, at 500 ft below your altitude</td><td colspan="2">MAINTAIN VERTICAL SPEED MAINTAIN



</td><td>- Remain in level flight
- Do not climb or descend</td></tr>
</table>

V/S scale color legend: (hatched) : green (dotted) : red

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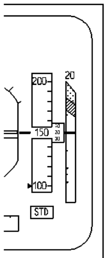
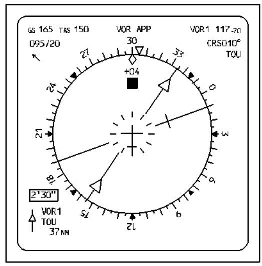
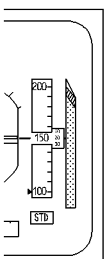
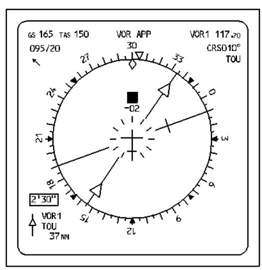
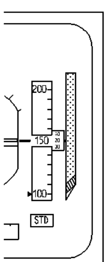
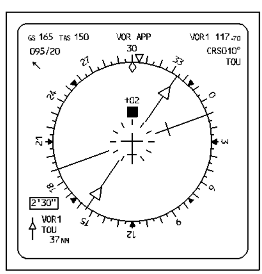
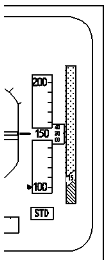
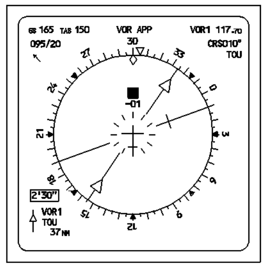
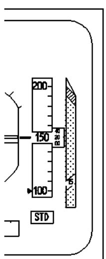
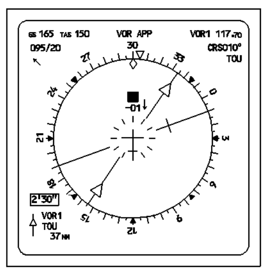
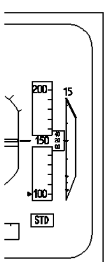
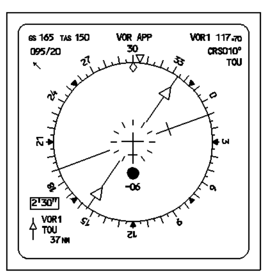
SCENARIO	AURAL WARNING and TYPICAL DISPLAY		CREW RESPONSE
	PFD	ND	
RESOLUTION ADVISORY (CORRECTIVE) - The intruder is ahead at 12:00 o'clock, 400 ft above your altitude - You are already climbing at 2000 ft/mn	"ADJUST VERTICAL SPEED ADJUST" 		- Reduce climb at present rate
- The intruder is ahead at 12:00 o'clock, 200 ft below your altitude	"CLIMB, CLIMB" 		- Promptly (within 5 seconds) smoothly establish a climb rate of 1 500 ft/mn
- The intruder is ahead at 12:00 o'clock, 200 ft above your altitude	"DESCEND, DESCEND" 		- Promptly (within 5 seconds) and smoothly establish a descent rate of 1 500 ft/mn

V/S scale color legend: (hatched) : green (dotted) : red

NFC5-03-0434-014-A105AA

SCENARIO	AURAL WARNING and TYPICAL DISPLAY — PFD	ND	CREW RESPONSE
RESOLUTION ADVISORY (ADDITIONAL CORRECTIVE) - The intruder ahead has stopped its climb - It is now 100 ft below your altitude	"INCREASE DESCEND INCREASE DESCEND" 		- Immediately (within 2.5 seconds) and smoothly increase your descent rate to 2 500 ft/mn
- The intruder has changed from level flight to a rapid descent after TCAS issued a DESCEND RA - TCAS is now changing that to a CLIMB RA	"CLIMB, CLIMB, NOW CLIMB, CLIMB, NOW" 		- Initiate a change from a descent to a climb maneuver, within 2.5 seconds.
RA CLEARED - The intruder has passed behind and is now 600 ft below your altitude - It is no longer a threat	"CLEAR OF CONFLICT" 		- Return promptly to the previous ATC clearance.

V/S scale color legend: (hatched) : green (dotted) : red

NFC5-03-0434-015-A120AA

APPROACH ON PAPI

R Eye to wheel height on approach is 25 feet and minimum recommended wheel clearance over the threshold is 20 feet. Do not follow Precision Approach Path Indicator (PAPI) guidance below 200 feet when PAPI Minimum Eye Height over Threshold (MEHT) is less
R than 45 feet.

R

QNH USE FOR TO/APPR/LDG ON QFE/QNH PIN PROGRAMMED AIRCRAFT

The QNH option is the basic reference on the aircraft.
For airlines using QFE reference, the switching from "QNH only" to QNH/QFE can be done by activating a specific pin program on the three following computers : FMGC, GPWC, FCU.
For various reasons, some airlines may use QNH reference for approach and landing on QNH/QFE pin programmed aircraft. The crew should be aware of the following consequences and should use the following procedures.

CONSEQUENCES

When the pin program is the QNH/QFE option, the 2R field of the MCDU PERF APPR page is named "MDH" independently of the baro setting reference selected by the crew.
On some airports in mountainous areas, GPWS warnings may be delayed by a maximum of five seconds.

PROCEDURES

No specific procedures are necessary for takeoff, climb, cruise, descent and go around phases.

Procedure for precision approaches (CAT 2 and CAT 3) :
· Insert the DH into the DH field of the PERF APPR page as usual.

Procedure for ILS approach (CAT 1) :
· Insert the DA into the MDH field of the PERF APPR page.

Procedure for non precision approach :
· Insert the MDA value into the MDH field of the PERF APPR page.

Note : If the MDA is greater than 5000 feet, the value is not accepted and the message OUT OF RANGE is displayed on the MCDU. In such a case, the MDH field remains blank and the PNF should announce the call outs.

· Do not use APPR NAV FINAL
Use selected mode TRK/FPA until visual references are met.
· The change of color from green to amber in the PFD altitude scale will occur at the correct altitude.

QFE USE FOR TO/APPR/LDG ON AIRCRAFT WITH QNH ONLY PIN PROGRAMMING

The crew should not use QFE on aircraft with a "QNH only" pin programming (incorrect profile computation of the managed vertical modes CLB, DES and FINAL APPR, possible false GPWS warnings in mountainous areas).

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ENHANCED GROUND PROXIMITY WARNING SYSTEM (EGPWS)

The Flight Management System (FMS) provides aircraft position inputs to the EGPWS for enhanced function processing purpose.
The TERR pushbutton located on the overhead panel enables the activation or de-activation of the enhanced functions of the EGPWS.
During all flight phases, when the check of the navigation accuracy performed by the pilots (as described in volumes 3.03 and 4.05) is positive, the enhanced functions should be switched ON.
During climb, descent, approach, and go around phases, when GPS PRIMARY is not available (or not installed) and the FMS navigation accuracy check prevents the crew from using the NAV mode in a phase of flight, the TERR pushbutton must be switched OFF. When the TERR pushbutton is switched OFF, the ECAM message "NAV GPWS TERR DET FAULT" is displayed only the basic GPWS modes 1 to 5 remain operative.
R If the TERR ON ND is not selected, and a terrain alert is generated, the terrain is
R automatically displayed on the ND.
R The brightness of the terrain indication on the ND is controlled via the weather radar
R brightness control knob. If the weather radar brightness was set to low (due to bad
R weather) and a terrain alert occurs, then the terrain display brightness will also be low.
R Thus when a terrain alert occurs, the ND weather/terrain image brightness may need to be
R adjusted.

THRUST CONTROL

GENERAL

The flight crew uses console-mounted levers to control engine thrust. Each lever sends electrical signals to the FADEC of the engine it controls. The FADEC responds to the thrust lever position or an autothrust command by setting the engine thrust.
The thrust lever quadrant is the equivalent of a thrust rating panel. For each lever it has five detents. Moving the thrust lever to the forward stop of the quadrant always gives maximum takeoff or go-around thrust, as appropriate, and signals the AP/FD to go to takeoff or go-around, as appropriate. The FMA (Flight Mode Annunciator) in the left window of each PFD displays the status of the thrust system to the pilot.
The engine instrument display gives a read-out of the engine thrust mode (CL, MCT, etc.) and the appropriate engine limit. It displays the actual limit set, thrust lever position, FADEC command, and maximum engine rating limit continually.

MANUAL THRUST CONTROL

With A/THR disconnected, thrust control between full reverse (on the ground only) and maximum takeoff or go-around thrust is entirely conventional.
TLA (Thrust Lever Angle) determines the thrust demanded.
The rating limit selected by the pilot and the actual engine limit appear on the engine instrument display.
With the thrust lever short of the CL position on the quadrant, the engine instrument display shows CL continually. If one or both thrust levers are above CL, it shows MCT/FLEX. If one or both thrust levers are beyond the MCT detent, it shows TOGA. With the thrust levers positioned in a detent, the detent setting controls the engines to that limiting parameter.

AUTOTHRUST

When active A/THR controls either speed, thrust or retard as appropriate. The engine limit corresponds to the thrust lever position. If the thrust lever is below the CL detent then the TLA determines the engine power limit.
With the thrust lever above the CL detent, autothrust reverts to arm (A/THR blue on FMA) except if alpha-floor is active. CLB (or LVR CLB) flashes on the FMA.
If the thrust levers are not aligned, an asymmetric message (ASYM or LVR ASYM) appears on the FMA. If so, each engine is limited to its appropriate TLA.
This allows the use of autothrust to continue if one engine has to have its maximum RPM limited for some operational reasons such as excessive vibration.

Autothrust disconnection

Autothrust disconnection will occur if :
- A/THR fails or
- the A/THR pushbutton of the FCU is pressed, or
- the instinctive disconnect button of the thrust lever(s) is pressed or
- both thrust levers are set to IDLE.

1. Disconnection due to a failure or the use of the FCU A/THR pushbutton.
   If the thrust levers are in the CL detent (both engines operating) or one thrust lever in the MCT (one engine operative), the thrust is locked at its actual value and FMA displays THR LK.
   A single chime sounds and an amber ECAM caution and a caution light appear every 5 seconds as long as thrust is locked.
   Movement of thrust lever(s) unlocks the thrust and the engine then responds to TLA at the normal rate.
2. Disconnection due to the use of instinctive disconnect button.
   When a pilot presses the instinctive disconnect button, the engines immediately develop thrust corresponding to the position of their thrust levers, whatever that might be.

Disconnection procedure

In order to avoid any confusion for those pilots flying the A319/A320/A321 with different modifications (with and without energy management), Airbus recommends that pilots use one procedure for disconnecting with the instinctive disconnect button.
- Set the thrust levers to the current thrust setting by adjusting the levers until the N1 (or EPR) TLA white circle is adjacent to the actual N1 (or EPR).
- Use the instinctive button to disconnect the A/THR.
- Check that "AUTO FLT A/THR" is OFF on ECAM and that there is no annunciator in the first column of the FMA.
- Set the thrust manually.

Use of autothrust in approach

The pilot should use autothrust for approaches. On final approach, it usually gives more accurate speed control, although in turbulent conditions the actual airspeed may vary from the target speed by as much as five knots. Although the change-over between auto and manual thrust is easy to make with a little practice, the pilot should, when using autothrust for the final approach, keep it engaged until he retards the thrust levers to idle for touchdown. If the pilot is going to make the landing using manual thrust, he should disconnect the A/THR by the time he has reached 1000 feet on the final approach.
If he makes a shallow flare with A/THR engaged, it will increase thrust to maintain the approach speed until he pulls the thrust levers back to idle. Therefore he should avoid making a shallow flare or should retard the thrust levers as soon as it is no longer necessary to carry thrust, and if necessary before he receives the "retard" reminder.

When using autothrust, the pilot can always change thrust by moving the thrust levers above the CL detent. The thrust then increases to what corresponds to the thrust lever position. However, autothrust stays armed, and takes effect immediately when the thrust levers are returned to the CL detent. Therefore the pilot should normally put the thrust levers back to CL as soon as the aircraft has made the change for which he increased thrust. This feature gives the pilot a means of advancing phase on the autothrust in very difficult environmental conditions, but it should only be needed in exceptional circumstances.
Although the use of autothrust is recommended for the entire approach, this does not absolve the pilot from his responsibility to monitor its performance and to disconnect it if it fails to maintain speed at the selected value. Such monitoring should include checking on whether or not the managed speed calculated by the FMGC is reasonable.

Engine failure

The pilot can continue to use autothrust after an engine failure, but some pilots feel that directional control is more difficult when autothrust changes the thrust instead of the pilot making the thrust changes manually. The choice between using or not using autothrust after engine failure is a personal one. As far as speed control is concerned, autothrust is usually more accurate than a pilot.

MANUAL ENGINE START

Pilots normally use automatic starting to start an engine. However, manual starting is recommended in the following cases :

– **After aborting a start because of :**
  · Engine stall
R · Engine EGT overlimit
  · Low start air pressure

– **When expecting a start abort because of :**
  · degraded bleed performance due to a hot condition or at a high-altitude airfield
R · an engine with a reduced EGT margin in hot conditions or at a high-altitude airfield
  · marginal performance of the external pneumatic power group

MANUAL ENGINE START PROCEDURE

● **In case of an engine start after a cold soaked period**

– **GEN . . . . OFF**

– **HYD ENG PUMP . . . . OFF**

– **THR LEVERS . . . . IDLE**

CAUTION
The engine will start, regardless of the thrust lever position, and will rapidly accelerate to generate the thrust demanded by the TLA, causing an hazardous situation if the thrust levers are not at idle.

– **ENG MODE selector . . . . NORM THEN IGN**
Lower ECAM displays the engine page.

– **ENG MAN START . . . . ON**
· Do not set MAN START pushbutton to ON before all amber crosses have disappeared on engine parameters (upper ECAM display).
· On ECAM lower display check that the START VALVE is in line
· On ECAM displays check that OIL PRESS increases, N2 increases.

R ● **When N2 reaches maximum motoring speed (minimum 22 %) :**
Maximum motoring speed is defined as the speed at which N2 acceleration is less than 1% in approximately 5 seconds.

R ● **If N2 does not get up to 22 %, check that the pack valve autoclosure functions. If the autoclosure functions, shed APU loads as follows.**

– **GALLEY . . . . OFF**
If needed, also shed :

– **BLUE ELEC PUMP (ground only) . . . . OFF**

– **FUEL X FEED . . . . ON**

– **FUEL PUMPS except R TK PUMP 2 . . . . OFF**

– **BLOWER . . . . OVRD**

– **CAB FANS . . . . OFF**

– **MASTER switch . . . . ON**
The CM 2 starts the timing for monitoring the light up delay.

– **ECAM displays . . . . CHECK**
Check : Indication of igniters A and B.
Fuel flow increase.
EGT and N1 increase 15 seconds (max) after fuel is on.
In case of electrical power supply is interrupted during the start sequence (indicated by loss of ECAM CRTs) abort the start by switching OFF the MASTER
R switch. Then perform a 30 second dry crank.

● **When N2 reaches 50 %**

– **ECAM displays . . . . CHECK**
Check : START VALVE cross line.
Igniter indication off.

– **MAIN AND SECONDARY ENG. IDLE PARAMETERS . . . . . . CHECK NORMAL**
Grey background on N2 indication disappears.

Note : *CFM Eng. 56-5-B1/B2 engines accelerate slowly from 50 % N2 to idle. Start abort is not required as long as N2 is increasing.*

– **MAN START . . . . OFF**

– **ENG MODE SELECTOR . . . . NORM**

– **GEN . . . . ON**

– **HYD ENG PUMP . . . . ON**

Note : *If for any reason, in particular for an engine start after a cold soaked period, the generator and/or the hydraulic engine pump have been selected off, it is necessary to select them on again.*

ENGINE START WITH EXTERNAL PNEUMATIC POWER

- **Before connecting external pneumatic power :**

  – **PACKS 1 and 2 . . . . OFF**
  (To prevent pack contamination).

- **Before start :**

  – **APU BLEED . . . . OFF**

  – **ENG BLEED (both engines) . . . . OFF**

  – **X BLEED . . . . OPEN**

- **Cleared to start :**

R – **Start Engine 2 first.**

R *Note : As necessary, Engine 1 can also be started by using the external pneumatic*
R *power. If Engine 1 is started first, check the brake accu pressure prior to*
R *engine start.*

  – **Use the normal engine start procedure.**
  The minimum recommended starter air supply pressure is 30 psi, when the start valve is open.
  Two external pneumatic power units may be used in parallel, if the pressure/flow relation is expected to be marginal.

- **After Engine 2 is started :**

  – **Request removal of the external pneumatic power unit(s).**

  – **PACKS 1 and 2 . . . . ON**

  – **ENG 2 BLEED . . . . ON**

  – **CROSSBLEED ENGINE START PROCEDURE . . . . APPLY**

CROSSBLEED ENGINE START

CAUTION

The use of engine bleed supply and external pneumatic power supply simultaneously is prohibited.

- **Before start :**

  - **APU BLEED . . . . OFF**
    The BLEED valve of the running engine reopens and the cross bleed valve closes.

  - **ENG BLEED (running engine) . . . . check ON**

  - **ENG BLEED (receiving engine) . . . . OFF**
    The bleed valve of engine to be started is closed to eliminate reverse flow leakage.

  - **X BLEED . . . . OPEN**

- **Cleared to start :**

  - **Confirm area is clear of obstacles.**
    Ensure increased power jet wake does not constitute any hazard to people or installation behind the aircraft.
    Adjust thrust of supplying engine to obtain 30 psi at start air valve before start initiation and at least 25 psi during start.
R Do not exceed 80 % N2 to limit jet wake.
    Apply the normal engine start procedure.

- **After start :**

  - **THRUST LEVER (supplying engine) . . . . IDLE**

  - **X BLEED . . . . AUTO**

  - **ENG BLEED (receiving engine) . . . . ON**

  - **PACKS . . . . Check ON**

START VALVE MANUAL OPERATION

Advise ground crew to prepare for manual start valve operation.

– **AUDIO CONTROL PANEL . . . . CAB**

● **When ground crew member is ready, order "START 1 or 2"**

– **ENG MODE SEL . . . . IGN**

– **ENG MASTER . . . . ON**

– **START VALVE . . . . "ORDER OPEN AND KEEP OPEN"**
If not maintained in OPEN position by the ground crew member, the start valve closes.

● **When N2 at 50 %**

– **START VALVE . . . . "ORDER CLOSE"**
Continue with normal procedure.

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PUSHBACK WITH POWER PUSH UNIT BY THE MAIN LANDING GEAR

GENERAL

At several airports, the pushback is performed using a power push unit (PPU), which pushes the aircraft by the main landing gear while the flight crew provides the steering via the green hydraulic system. Steering guidance will be given by the ground personnel via interphone communication.
This section provides the flight crew with the Airbus operational recommendation for such a pushback and replaces the standard operating procedure "BEFORE PUSHBACK or START".

PREPARATION

– **LOADSHEET . . . . CHECK**
The Captain should thoroughly check the load and trim sheet, particularly for gross errors. Make sure that the loadsheet data is correct : Correct flight, correct aircraft, dry operating index, configuration, fuel onboard, etc.
Compare ZFW/ZFCG with previously entered data and adjust if necessary.

– **TAKEOFF DATA . . . . PREPARE and CHECK/REVISE**
Once the loadsheet is checked :
  – The PNF checks or recomputes the takeoff speeds and flexible temperature using the RTOW charts.
  – The PF independently calculates the takeoff speeds and flexible temperature, as a crosscheck.
    Take particular care to determine the takeoff configuration (refer to 2.02.20).
    Confirm any takeoff weight limitation.
  – Set V2 and green dot speed on STBY ASI (all remaining bugs at 12 o'clock).
  – The PF checks (or revises) the takeoff data in the INIT B and PERF pages of the MCDU.

– **SEATS, SEAT BELTS, HARNESSES, RUDDER PEDALS, ARMRESTS . . . . ADJUST**
The seat is correctly adjusted when the pilot's eyes are in line with the red and white balls.

– **MCDU . . . . IN TAKEOFF CONFIGURATION**
It is recommended that the crew displays F-PLN on the PNF side and PERF TAKEOFF on the PF Side.

– **EXT PWR . . . . CHECK OFF**
Request that external power be removed.

– **BEFORE START CHECKLIST down to the line . . . . COMPLETE**

– **TOWING LEVER . . . . NORMAL POSITION**
To be confirmed by the ground personnel and no NW STRG DISC indication on the ECAM.

– **PUSHBACK/START UP CLEARANCE . . . . OBTAIN**
Obtain ATC pushback/start up clearance.
Obtain clearance from the ground personnel. Due to the face-to-face position of flight crew and ground personnel it is necessary that the flight crew ensure the clear and correct understanding of the directional phraseology used by the ground personnel.

– **WINDOWS and DOORS . . . . CHECK CLOSED**
R – Check cockpit windows closed and locked (red circle on handle fully visible).
– Check on ECAM lower display that all doors are closed.

– **BEACON . . . . ON**

– **THR LEVERS . . . . IDLE**

CAUTION

Engine will start regardless of thrust lever position; thrust will increase rapidly to the corresponding thrust lever position, causing a hazardous situation, if thrust levers are not in idle.

– **ENG 2 . . . . START**
Engine 2 is usually started first, to pressurize the yellow hydraulic system to maintain the parking brake pressure. Engine 1 must be started after the pushback is completed to ensure that the power push unit is able to push the aircraft.

CAUTION

If during engine start with parking brake ON, the aircraft starts to move due to a parking brake failure, immediately release the PARKING BRK handle to restore braking by pedals.

– **PTU . . . . CHECK AUTO**
The green hydraulic system must be pressurized via the PTU to ensure that nose wheel steering is available.

PUSHBACK

– **PARKING BRK . . . . OFF**
Advise the ground personnel that the parking brake is OFF and that pushback can be started.

CAUTION
Do not use brakes during pushback unless required, due to an emergency.

R In case of an emergency, advise the ground personnel that the PPU should be removed
R and moved out of the evacuation area.

– **NW STRG . . . . AS RQRD**
Steer the aircraft following guidance from the ground personnel.

– **PARKING BRK . . . . ON**
After pushback is completed, set the PARKING BRK to ON and inform the ground personnel that the power-push unit can be removed.

– **ENG 1 . . . . START**

GENERAL

When the aircraft is not in such unusual operational environments as an uphill slope, slippery taxiways, or high gross weight, it may be advisable to taxi on one engine. The pilot must exercise caution when taxiing on one engine to avoid generating excessive jet blast.

DEPARTURE

The pilot should use the following procedures for taxiing out if company policy and regulations permit.

– **BRAKE ACCU PRESS . . . . CHECK**
If necessary, use the Y ELEC PUMP to pressurize the brake accumulator.

– **ENGINE 1 . . . . START**
Use the engine 1 for taxiing because it pressurizes the green hydraulic system (nose wheel steering + normal braking), without using the PTU.

– **X BLEED . . . . OPEN**
This supplies both packs from engine 1.

– **Apply normal "AFTER START" procedures except :**
· Keep the APU running to avoid additional electrical transients and to allow the galley to operate.
· Do not run the wing anti-icing, engine anti-icing, and ECAM STATUS checks.
· Switch off APU BLEED in order to prevent the air conditioning system from ingesting engine exhaust gases.

• **Before releasing the parking brake :**

– **Y ELEC PUMP . . . . ON**
This pressurizes the yellow hydraulic system.

– **Use normal "TAXI" procedures.**

• **Before ENG 2 start :**

– **Y ELEC PUMP . . . . OFF**
Correct operation of the PTU will be checked during engine 2 start.

– **APU BLEED . . . . ON**

- **No less than 2 minutes before takeoff :**

  – **ENGINE 2 . . . . START**

  Note : Do not press on the brake pedals during engine start, if the aircraft is moving.

  – **APU . . . . AS RQRD**

  – **X BLEED . . . . AUTO**

  Proceed with the "AFTER START" checklist (wing anti-ice, engine anti-ice, and ECAM STATUS).

ARRIVAL

The flight crew may use the following procedure for taxiing in :

– **APU . . . . START**
Start the APU before shutting down the engine, in order to avoid one electrical transient.

R • **No less than 3 minutes after reverse operation, and when taxiing straight :**

  – **Y ELEC PUMP . . . . ON**
  This avoids running the PTU.

  – **ENG 2 . . . . SHUT DOWN**

  Note : Do not press on the brake pedals during engine shutdown, if the aircraft is moving.

- **At parking :**

  – **Y ELEC PUMP . . . . OFF**

  – **ENG 1 . . . . SHUT DOWN**

SEVERE TURBULENCE

GENERAL

R Whenever possible, avoid areas with known or forecasted severe turbulence. If turbulence
R is unavoidable, aim to keep the speed in the region of the target speed given in this section,
R so as to provide the best protection against the effect of gust on the structural limits, whilst
R maintaining an adequate margin above VLS.
R Consider requesting a lower flight level to increase margin to buffet onset.
R Sufficient buffet margin exists at optimum altitude.

SIGNS

Before entering an area of known turbulence, the flight crew and the cabin crew must secure all loose equipment and turn on the "SEAT BELTS" and "NO SMOKING" signs.

AUTOPILOT/AUTOTHRUST

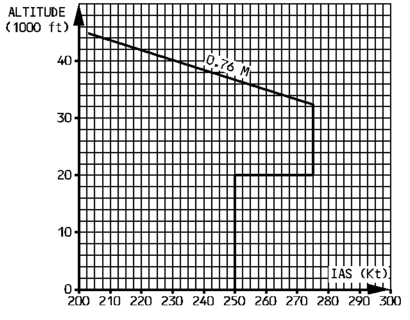
R – **Keep the autopilot ON.**

R – **When thrust changes become excessive : Disconnect Autothrust.**

R – **For approach : Use A/THR for managed speed.**

THRUST AND AIRSPEED

R Set the thrust to give the recommended speed (see table on next page). This thrust setting
R attempts to obtain, in stabilized conditions, the speed for turbulence penetration given in
R the graph below.
R Only change thrust in case of an extreme variation in airspeed, and do not chase your Mach
R or airspeed.
R A transient increase is preferable to a loss of speed, that decreases buffet margins and is
R difficult to recover.
R



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THRUST SETTING FOR RECOMMENDED SPEED

FL	SPD or Mach	GROSS WEIGHT (1000 kg)							
		40	44	48	52	56	60	64	68
		N1 %							
390	0.76	77.9	78.8	79.8	81	82.3	–	–	–
370	0.76	77	77.8	78.6	79.4	80.4	81.7	83	–
350	0.76	76.7	77.3	77.9	78.7	79.4	80.3	81.3	82.5
330	0.76	76.9	77.3	77.8	78.4	79	79.7	80.6	81.4
310	275	76.3	76.7	77.1	77.6	78.1	78.9	79.6	80.3
290	275	74.8	75.3	75.7	76.2	76.8	77.3	78	78.7
270	275	73.3	73.7	74.2	74.8	75.3	75.9	76.6	77.2
250	275	72	72.5	72.9	73.4	73.9	74.5	75.2	75.9
200	250	64.6	65.2	65.9	66.6	67.4	68.3	69.2	70.3
150	250	61	61.6	62.2	62.8	63.5	64.3	65.2	66.1
100	250	57.8	58.6	59.2	59.8	60.4	61	61.8	62.6
50	250	53.9	54.5	55	55.7	56.5	57.3	58.2	59.2

R **ALTITUDE**

If the crew flies manually the aircraft :
– Expect large variations in altitude, but do not chase altitude.
– Maintain attitude and allow altitude to vary.

SPEEDBRAKES

Whenever speedbrakes are applied, keep a hand on the speedbrake handle, except while performing some other specific cockpit function (changing power, resetting altimeter, etc.).

LANDING

Configuration FULL or 3 can be used. However configuration 3 provides more energy and less drag.

OPERATIONS IN WINDSHEAR OR DOWNBURST CONDITIONS

PRECAUTIONS FOR SUSPECTED WINDSHEAR

- **Before TAKEOFF**

  - **Delay takeoff until conditions improve.**
  - **Evaluate takeoff conditions :**
    · Using observations and experience.
    · Checking weather conditions.
  - **Select the most favorable runway (considering location of the likely windshear).**
  - **Use the weather radar or the predictive windshear system (◁*) before commencing takeoff to ensure that the flight path clears any potential problem areas.**
  - **Select TOGA thrust.**
  - **Monitor closely airspeed and airspeed trend during the takeoff run for early signs of windshear.**

- **During APPROACH**

  - **Delay landing or divert to another airport until conditions are more favorable.**
  - **Evaluate condition for a safe landing by :**
    · Using observations and experience.
    · Checking weather conditions.
  - **Use the weather radar.**
  - **Select the most favorable runway, considering also which has the most appropriate approach aid.**
  - **Select FLAPS 3.**
  - **Use managed speed in the approach phase.**
  - **Check both FDs engaged in ILS, FPA or V/S.**

- **Engage the autopilot, for a more accurate approach and earlier recognition of deviation from the beam, when ILS is available.**

  Note : – *When it is using the GS mini-function, associated with managed speed, the system will carry extra speed in strong wind conditions.*
  – *If downburst is expected, increase Vapp displayed on the MCDU up to a maximum of VLS + 15 knots.*

RECOVERY TECHNIQUE AT TAKEOFF

- **Before V1 :**

  The takeoff should only be rejected if unacceptable airspeed variations occur below the indicated V1, and the pilot decides that there is sufficient runway remaining to stop the aircraft.

- **After V1 :**

  - **Set thrust levers to TOGA**
  - **Rotate normally.**
  - **Follow SRS orders.**

- **During initial climb :**

  - **Set or maintain TOGA.**
  - **If the autopilot is engaged, use it ; but, be aware that automatic disengagement may occur, if $\alpha > \alpha$ prot.**
  - **Follow SRS orders (including use of full backstick, if demanded).**

    Note : *If SRS is not available, use pitch attitude up to 17.5°, with full backstick, if necessary.*

  - **Do not change configuration (gear, flaps), until out of shear.**
  - **Closely monitor the flight path and speed.**
  - **Recover smoothly to a normal climb, when out of shear.**

RECOVERY TECHNIQUE AT LANDING

– **Set thrust levers to TOGA.**

– **If the autopilot is engaged, use it ; but, be aware that automatic disengagement may occur, if $\alpha > \alpha$ prot.**

– **Follow SRS orders.**

Note : If the FD is not available, or if it is switched off for a visual approach, use pitch attitude up to 17.5° with full backstick, if necessary.

– **Do not change configuration.**

– **Closely monitor the flight path and speed.**

– **Recover smoothly to a normal climb, when out of shear.**

COLD WEATHER

For flight operations in icing conditions, see the Ice and Rain Protection Chapter (3.04.30).
For ground operations on contaminated runways, see the FCOM Volume 2 (2.04.10).
The preparation and ground operation of the aircraft, after it has been sitting idle in very low temperatures, may present particular problems. In such cases, the flight crew should use the following procedures, which complement the normal operating procedures.
Ice accumulates on the aircraft when the air temperature approaches, or falls below, freezing (0°C) and there is precipitation or condensation. Ice may also build up when the aircraft is exposed to any form of moisture, after the surfaces have been cold-soaked during previous cruise flight at high altitudes, after the aircraft has been refueled with cold fuel, or after it has been exposed to low overnight air temperatures.

EXTERIOR INSPECTION

– **PRELIMINARY COCKPIT PREPARATION (normal procedures) . . . . COMPLETED**
APU is started and air conditioning is on.

– **PROBE/WINDOW HEAT . . . . ON**

– **SURFACES . . . . CHECKED FREE OF FROST, ICE AND SNOW**
All surfaces of the aircraft (critical surfaces : leading edges and upper surfaces of wings, vertical and horizontal stabilizers, all control surfaces, slats and flaps) must be clear of snow, frost and ice for takeoff.
Thin hoarfrost is acceptable on the upper surface of the fuselage.

Note : *Thin hoarfrost is typically a white crystalline deposit which usually develops uniformly on exposed surfaces on cold and cloudless nights ; it is so thin that a person can distinguish surface features (lines or markings) beneath it.*

On the underside of the wing tank area, a maximum layer of 3 mm (1/8 inch) of frost will not penalize takeoff performance.

– **FOLLOWING EQUIPMENT . . . . CHECKED FREE OF FROST, ICE AND SNOW**
  – Landing gear assemblies (lever locks) and tires, landing gear doors.
  – Engine inlets, inlet lips, fans (check for rotation), spinners, fan exhaust ducts, reverser assemblies.
  – Drains, bleeds, probes (pitots, static ports, TAT sensors, angle of attack sensors).
  – Fuel tank ventilation.
  – Radome.
  – Verify that the commercial water supplies are not frozen and have been refilled (these should have been emptied prior to the cold soak).

R ● **After first engine start**

R – **PROBE/WINDOW HEAT . . . . AUTO**
R Heating will continue to operate but under automatic control.

PROCEDURE FOR GROUND DE-ICING AND ANTI-ICING

In all circumstances, it is the Captain's responsibility to decide whether or not to de-ice/anti-ice the aircraft, or to order a repeated treatment.

CAUTION

R — Check that no external air is supplied to the aircraft, via the low or high pressure
R ground connectors.
— If repeated anti-icing is necessary, ground crew must de-ice the surfaces with a hot fluid mixture before applying a new layer of anti-icing fluid.

Ensure that the ground crew is using de-icing/anti-icing fluids, in accordance with applicable company requirements and Aircraft Maintenance Manual instructions.
The flight crew must establish good communication with the ground personnel, responsible for de-icing or anti-icing, before the procedure begins.
R The aircraft may be de-iced or anti-iced with its engines and APU stopped, or with the APU
R running, and/or with the engines running. However, the flight crew should not start the engines or APU while the fluid is being sprayed on the aircraft.

CAUTION

— Avoid indiscriminate use of de-icing fluid and its ingestion by the engine or APU.
— Do not move flaps or slats, flight control surfaces, or trim surfaces, if they are not free of ice.
— Always have the aircraft treated symmetrically: The left and right sides must receive the same and complete treatment.

BEFORE FLUID SPRAYING :

— **CAB PRESS MODE SEL . . . . CHECK AUTO**

— **ENG BLEED 1 + 2 . . . . OFF**

— **APU BLEED . . . . OFF**

— **DITCHING pushbutton . . . . ON**
R Outflow valve, pack valves, and avionic ventilation inlet and extract valves close.

This prevents de-icing fluid from entering the aircraft. Avionic ventilation is in closed circuit with both fans running. In view of the low OAT, there is no time limit for this configuration.

Note : If the "VENT AVNCS SYS FAULT" warning appears, reset the AEVC circuit breaker at the end of the aircraft de-icing procedure.
AIR COND/AVNCS VENT/CTL D06 on 49VU.
AIR COND/AVNCS/VENT/MONG Y17 on 122 VU.

– **THRUST LEVERS . . . . CHECK IDLE**

– **"AIRCRAFT PREPARED FOR SPRAYING" . . . . INFORM GROUND CREW**

UPON COMPLETION OF THE SPRAYING OPERATION :

– **DITCHING pushbutton . . . . OFF**

R – **OUTFLOW VALVE . . . . CHECK OPEN**
R On the ECAM PRESS page, confirm that the outflow valve indication reaches the open
R green position to avoid any unexpected aircraft pressurization.

– **ENG BLEED 1 + 2 . . . . ON**

• **At least 60 seconds after APU start, or on completion of spraying operation :**

– **APU BLEED . . . . ON**

– **PITOTS and STATICS (ground crew) . . . . CHECK**

– **GROUND EQUIPMENT . . . . REMOVE**

– **DE-ICING/ANTI-ICING REPORT . . . . RECEIVED**
The information from ground personnel, who performed the de-icing and post-application check, must include (ANTI-ICING CODE) :
· Type of fluid used.
· The mix ratio of fluid to water (for example 75/25).
· When the holdover time began.

– **NORMAL PROCEDURE . . . . RESUME**
Apply appropriate normal procedures. Pay special attention to the flight control check. In freezing precipitation, perform the appropriate checks to evaluate aircraft icing. Base the decision on whether to takeoff, or to re-protect the aircraft, on the amount of ice that has built up on the critical surfaces since the last de-icing, as revealed by a personal inspection from the inside and outside of the aircraft. Make this inspection before the holdover time expires, or just before takeoff.

Note : If the fuselage has been sprayed, there is a risk of de-icing fluid ingestion by the APU air intake, resulting in specific odors, or SMOKE warnings. Thus, consider APU BLEED OFF during takeoff.

SECURING THE AIRCRAFT FOR COLD SOAK

Close the outflow valve before leaving the aircraft.

● **After switching off all bleeds, and before switching off AC power :**

– **CAB PRESS MODE SEL . . . . MAN**

– **MAN V/S CTL . . . . FULL DN**
Hold the toggle switch in the DN position, until the outflow valve is closed. Monitor the ECAM's CAB PRESS page.

● **After switching off the batteries :**

– **CAB PRESS MODE SEL . . . . AUTO**

– **PARKING BRAKE . . . . OFF**
Check chocks in place, and release the parking brake to prevent brakes from freezing.

– **PROTECTIVE COVERS . . . . INSTALL**
Install protective covers and plugs to protect the aircraft and engines from snow and ice.

WATER SYSTEM DRAINING

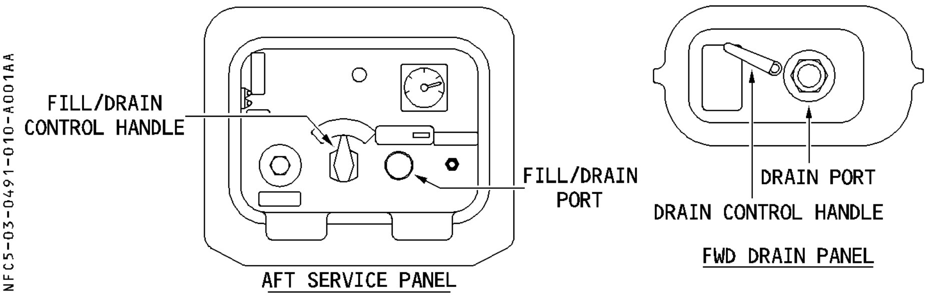
Drain the water system, if the OAT requires it, as shown below :

R

<table>
<tr><th colspan="3">Configuration</th><th rowspan="2">Exposure time</th><th rowspan="2">Water tank drain</th></tr>
<tr><th>Air Conditioning</th><th>Cabin temperature</th><th>Outside Air Temperature</th></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">Above 10° C (50° F)</td><td>Between 0° C and – 15° C (32° and 5° F)</td><td>None</td><td>Not required</td></tr>
<tr><td>Below – 15° C (5° F)</td><td>1 h 15 min</td><td rowspan="4">Required</td></tr>
<tr><td rowspan="3">OFF</td><td rowspan="3"></td><td>Between 0° C and – 7° C (32° and 19.4° F)</td><td>1 h 30 min</td></tr>
<tr><td>Between – 7° C and – 15° C (19.4° and 5° F)</td><td>0 h 30 min</td></tr>
<tr><td>Below – 15° C (5° F)</td><td>Any</td></tr>
</table>

R **FOR DRAINING WATER PROCEDURE**

R This procedure uses electrical power.
R



R – **ACCESS PLATFORM(S) . . . . PUT IN POSITION**

R – **SHUTOFF VALVE IN GALLEYS/TOILETS . . . . CHECK OPEN**

R – **FWD/AFT ACCESS PANEL DOORS . . . . OPEN**

R – **DRAIN PORT CAPS . . . . REMOVE**
R Remove drain port caps on forward drain and aft service panels.

R – **DRAIN HOSES . . . . CONNECT**
R Connect drain hoses to :
R · the drain port on the forward drain panel.
R · the full/drain port on the aft service panel.

R ■ **On the forward drain panel**

R – **DRAIN CONTROL HANDLE . . . . TURN LEFT**
R Turn the control handle to drain.

R ■ **On the aft service panel**

R – **FILL/DRAIN CONTROL HANDLE . . . . TURN TO "DRAIN" AND PULL**
R Turn the handle to the "DRAIN" position and pull it out to its mechanical stop to drain.
R The indicator light comes on.

R ■ **When the water system is drained**
R In freezing conditions, the drain valves must stay open to prevent damage to the
R system. Do not put on the caps and leave the access door open.

R – **DRAIN HOSES . . . . DISCONNECT**

R – **PANELS . . . . CLEAN AND DRY**

R – **ACCESS PLATFORM(S) . . . . REMOVE**

R **OPERATIONS IN VOLCANIC ASH**

R The following procedures are recommended for operators who fly routes that could take
R their aircraft through the material emerging from active volcanoes.
R Because volcanic ash is composed of very abrasive particles it can do serious damage to
R aircraft parts and impair the operation of aircraft systems significantly.
R Operators should avoid airports with volcanic ash deposits if possible. If operations at such
R airports are unavoidable, operators should heed the following recommendations.

R **GROUND OPERATIONS ON AIRPORTS COVERED WITH ASH OR DUST**

R **Preparation of the cockpit**

R – **APU . . . . DO NOT USE**
R Use the APU only to start the engines, and then only if ground power is not available.
R Request ground supply for air conditioning and for electricity.

R – **WINDSHIELD WIPERS . . . . DO NOT USE**
R Do not use windshield wipers to remove ash, or for anything else.

R **Exterior inspection**

R – **SURFACES AND EQUIPMENT . . . . CHECK FREE OF ASH DEPOSITS**
R Ground maintenance should remove ash that has settled on exposed lubricated surfaces
R and could penetrate seals or enter the engine gas path, air conditioning system, air data
R probes, and other orifices on the aircraft.

R – **ENGINE INLETS . . . . CHECK FREE OF ASH DEPOSITS**
R Inspect the inlets and order them cleaned of any volcanic ash. Have the area within 25
R feet of the engine inlet cleaned of volcanic ash (as much as practical).

R **Engine start**

R Use external pneumatic supply for starting the engines, if it is available. (Refer 3.04.70).

R – **ENGINE . . . . CRANK**
R Before starting the engines, ventilate them by dry cranking at maximum motoring speed
R for two minutes. This will blow out any ash that may have entered the booster area.

R **Taxi**

R After releasing the brakes :

R – **THRUST LEVERS .. ADVANCE SMOOTHLY THEN MOVE TO IDLE WHEN ROLLING**
R Advance the levers smoothly to the minimum required for breakaway.
R Avoid making sharp or high-speed turns.

R – **ENG 1, ENG 2 BLEED . . . . OFF**
R Keep bleed valves closed for taxiing.

R **Takeoff**

R – **Allow ash and dust (if present) to settle on runway before starting the takeoff roll.**

R – **Use the rolling takeoff technique if possible.**

R – **Adjust progressively engine power as for normal takeoff procedures.**

R **Landing**

R – **REVERSERS . . . . USE AS LIGHTLY AS FEASIBLE**
R If it appears that maximum reverse thrust will be needed, apply reverse thrust when the
R main landing gear touches down. Limit the use of reverse thrust as much as possible,
R because reverse flow may throw up ash and impair visibility.

R *Note : The abrasive effect of volcanic ash on windshields and landing lights may reduce*
R *the pilot's visibility for approach and landing significantly. Consider diverting to*
R *an airfield where it is possible to use AUTOLAND.*

R – **BRAKE PERFORMANCE . . . . CONSIDER PENALTY**
R A layer of ash on the runway may degrade braking efficiency. Treat landing performance
R as if it is similar to that on a wet runway (dry ash) or on slush (wet ash).

Securing the aircraft

If the aircraft is to be parked at an airport contaminated with volcanic ash, install engine inlet covers and other protective covers and plugs.
In addition,

- **After switching off all bleeds and before switching off AC power :**

  – **DITCHING pushbutton . . . . ON**
  This closes the outflow valve, pack valves and avionic ventilation inlet and extract valves.

- **After switching off the batteries :**

  – **DITCHING pushbutton . . . . OFF**

FLIGHT OPERATIONS

Avoid flight into areas of known volcanic activity.
If a volcanic eruption is reported while the aircraft is in flight, reroute the flight to remain well clear of the affected area (volcanic dust may spread over several hundred miles). If possible, stay on the upwind side of the volcano (at least 20 NM upwind of it if it is erupting).
In hours of darkness or in meteorological conditions that obscure volcanic dust, one or several of the following phenomena indicate that the aircraft may be flying into ash cloud:
· smoke or dust in the cockpit,
· acrid odor similar to that of electrical smoke,
· at night, the appearance of St. Elmo's fire and static discharges around the windshield,
· bright white or orange glow appearing in the engine inlets,
· sharp, distinct beams from the landing lights,
· multiple engine malfunctions, such as rising EGT, decreasing power, stall, or flame out.

- **If the aircraft enters a volcanic ash cloud :**

  – **ESCAPE MANEUVER (terrain permitting) . . . . INITIATE**
  Because the lateral dimensions of ash cloud are not known, the pilot should if possible turn 180°.

  – **ATC . . . . NOTIFY**

  – **A/THR . . . . OFF**
  This will prevent thrust variations.

  – **THRUST (terrain permitting) . . . . DECREASE**
  This helps to maintain the engine stall margin by reducing the amount of ash ingestion and limiting the EGT. It also holds the accumulation of molten volcanic ash on turbine vanes to a minimum. Do not climb, since this increases EGT.

R – **CREW OXYGEN . . . . ON/100 %**

R – **CABIN CREW . . . . NOTIFY**

R – **PASSENGER OXYGEN . . . . AS RQRD**
R Depending on contamination.

R – **ENG ANTI ICE . . . . ON**

R – **WING ANTI ICE . . . . ON**

R – **PACK FLOW . . . . HI**
R Maximum airbleed gives the engines additional stall margin.

R *Note : If the aircraft has a cargo ventilation system, switch off the CARGO ISOL*
R *valves to prevent a cargo smoke warning from being triggered.*

R – **APU (if available) . . . . START**
R This prepares the aircraft for a starter-assisted engine relight.

R – **ENGINE PARAMETERS . . . . MONITOR**
R Monitor the EGT carefully to see that it does not go over its limit.

R *Note : To prevent the engines from exceeding EGT limits it may become necessary*
R *to use a precautionary engine shut-down.*
R *· Restart when clear of the volcanic ash cloud.*
R *· Upon restart, the engine may accelerate very slowly. Do not misinterpret*
R *this as a failure to start.*
R *· Consider that the compressor and turbine blades have been eroded and*
R *avoid sudden changes in thrust. Fuel flow and EGT may increase.*

R – **AIRSPEED INDICATIONS . . . . MONITOR**
R Volcanic ash may clog the pitot probes. If the airspeed indication is lost or becomes
R unreliable, see the abnormal procedure "UNRELIABLE SPEED INDICATION" (Refer to
R 3.02.80).

R *Note : Electrostatic conditions may cause communication problems.*

R **Reporting**

R · Whenever operating in areas affected by volcanic activity, flight crews should be aware
R of volcanic reporting procedures and be familiar with the use of the ICAO Special Air
R Report of Volcanic Activity (Model VAR).
R · If the aircraft encounters a volcanic ash cloud, the flight crew should report the location,
R altitude, and direction of drift for the ash cloud to ATC, flight conditions and crew duties
R permitting.

INTRODUCTION

The Less Paper Cockpit (LPC) concept consists of a complete set of software tools, designed to :
- Improve access to pilot's operational information, and simplify some of their tasks.
- Reduce the quantity of paper documents in the cockpit, and replace them with electronic ones, enabling quicker and easier updates, while improving information retrieval.

The applicable areas include Performance and Weight and Balance computations, in addition to technical operational documentation (FCOM, MEL, Operations Policy Manual..).
This section addresses the procedures corresponding to the modules which are already available.
The various modules are linked via F.O.V.E. (Flight Operations Versatile Environment), which is designed to provide an interface between the various modules by enabling :
- Inter-module communication
- Software compatibility management
- Software version management
- Integrity control between data and the software versions
- Update management
- Context management

Each airline may choose to install one or several modules, each of which is able to work independently.

GENERAL

LPC PROGRAM AND REFERENCE VERSION NUMBER UPDATING

R Each pilot should check that the version of F.O.V.E, installed on their PC, corresponds to the latest updated version provided by their airline's Flight Operations.

POWER SUPPLY

Check that each available PC is electrically-supplied.

PC STOWAGE DURING TAKEOFF AND LANDING

PCs should be stowed during takeoff and landing.

LPC TAKEOFF MODULE

The takeoff module is designed to provide aircraft takeoff performance, based on actual daily environmental conditions, just prior to flight. It allows straightforward computations, and provides the best takeoff performance for the given conditions.

TAKEOFF PERFORMANCE TASKSHARING

The tasksharing policy for data computation, and introduction in the MCDU is consistent with the currently applicable policy, as per the SOP :
One pilot performs the computation, then introduces the resulting data in the MCDU.
The other pilot checks the :
– Computation by using the PC to verify that the entered data is correct.
– Data entered in the MCDU.
Data entry and computation are generally done by the PF, and checked by the PNF. These tasks can be swapped, as per company policy, or as circumstances dictate. For instance, during taxi, data entry and computation should be done by the PNF, since the PF is busy taxiing the aircraft.
The PF will then have to perform the check, by stopping the aircraft or, if a stop is not possible, by transferring command to the other pilot.

COCKPIT PREPARATION

TAKEOFF DATA COMPUTATION

R The PF checks that the version of F.O.V.E, available on the PC, is the applicable one. (The applicable version is indicated on the computerized F-PLN, or other document, as per airline policy).
The PF enters the data, then shows the screen to the PNF for data confirmation.

R ● **If the Weight and Balance module is to be used :**

– **Use the pilot's PC to compute the ZFCG and ZFW :**
The computed values will be automatically fed to the takeoff performance module.

– **Use the pilot's PC to compute takeoff data :**
Any NOTAM affecting airport data should be considered at this stage, and taken into account in the "Modify runway" frame of the pilot interface. When the computation has been performed, a summary of the results is available in the "REMINDER", which is equivalent to the MCDU PERF page. Only the values to be addressed are indicated.

FMGS DATA INSERTION (no change compared to current SOP)

The PF enters the data computed on the PC into the MCDU.

GROSS WEIGHT INSERTION (INIT B page)

– **ZFCG/ZFW . . . . INSERT**

– **BLOCK FUEL . . . . INSERT**

TAKEOFF DATA INSERTION (PERF TO page)

– **V1, VR, V2 . . . . INSERT**

– **FLEX TO TEMP/DERATE . . . . INSERT**

FMGS DATA CONFIRMATION

– **GROSS WEIGHT INSERTION . . . . CHECK**
The PNF checks FMGS data.
· If the Aircraft Loading module is used :
– Check on pilot PC that entered data are correct.
– Check that computed data have been correctly introduced in the MCDU.

– **TO DATA . . . . CALCULATE/CHECK**
The PNF checks on pilot PC that entered data are correct.
He checks that computed data have been correctly introduced in the MCDU.

BEFORE PUSHBACK or START

R – **LOADING . . . . CHECK**

– **TAKEOFF DATA . . . . PREPARE and CHECK/REVISE**
Once the loading is checked :
– Check or re-enter the data entered on the takeoff module performance.
– Check or revise the takeoff data on the MCDU's INIT B and PERF pages.
Data to be crosschecked by the other pilot.

BEFORE TAKEOFF

– **PILOT PC . . . . STOWED**

ILS (or NON PRECISION) APPROACH

● **When the landing gear is down :**

– **PILOT PC . . . . STOWED**

R **LPC WEIGHT AND BALANCE MODULE**

R The Weight and Balance (W & B) module provides a computerized loadsheet and trim
R sheet. This facilitates computation of the ZFW/ZFCG and TOW/TOCG, and enables
R last-minute changes to the passenger/cargo/fuel distribution.
R The following procedure applies to operators only using the W&B module. Operators using
R both the W&B module and the Takeoff module should refer to the LPC TAKEOFF MODULE
R section.

R **WEIGHT & BALANCE TASKSHARING**

R The tasksharing policy for data computation and introduction in the MCDU is consistent
R with the currently applicable policy, as per the SOP :
R One pilot performs the computation, then introduces the resulting data in the MCDU.
R The other pilot checks the :
R – Computation by using the PC to verify that the entered data is correct.
R – Data entered in the MCDU.
R Data entry and computation are generally done by the PF, and checked by the PNF. These
R tasks can be swapped, as per company policy, or as circumstances dictate.

COCKPIT PREPARATION

TAKEOFF DATA COMPUTATION

The PF checks that the version of F.O.V.E., available on the PC, is the applicable one. (The applicable version is indicated on the computerized F-PLN, or other document, as per airline policy).
The PF enters the data, then shows the screen to the PNF for data confirmation.

– **Use the pilot's PC to compute the ZFCG and ZFW.**

– **Use RTOW to compute takeoff data.**

FMGS DATA INSERTION (no change compared to current SOP).

The PF enters the data, computed on the PC, into the MCDU.

GROSS WEIGHT INSERTION (INIT B page)

– **ZFCG/ZFW . . . . INSERT**

– **BLOCK FUEL . . . . INSERT**

TAKEOFF DATA INSERTION (PERF TO page)

– **V1, VR, V2 . . . . INSERT**

– **FLEX TO TEMP/DERATE . . . . INSERT**

FMGS DATA CONFIRMATION

– **GROSS WEIGHT INSERTION . . . . CHECK**
The PNF checks FMGS data.
– Check on the pilot's PC, that the entered data is correct.
– Check that the computed data has been correctly introduced in the MCDU.

– **TO DATA . . . . CALCULATE/CHECK**
The PNF calculates and checks the takeoff data.

BEFORE PUSHBACK or START

– **LOADING . . . . CHECK**

– **TAKEOFF DATA . . . . PREPARE and CHECK/REVISE**
Once the loading is checked :
- Check or recompute the takeoff speeds and the flexible temperature, using the RTOW charts.
- Check or revise the takeoff data on the MCDU's INIT B and PERF pages.
  Data to be crosschecked by the other pilot.

BEFORE TAKEOFF

– **PILOT PC . . . . STOWED**

ILS (or NON PRECISION) APPROACH

● **When the landing gear is down :**

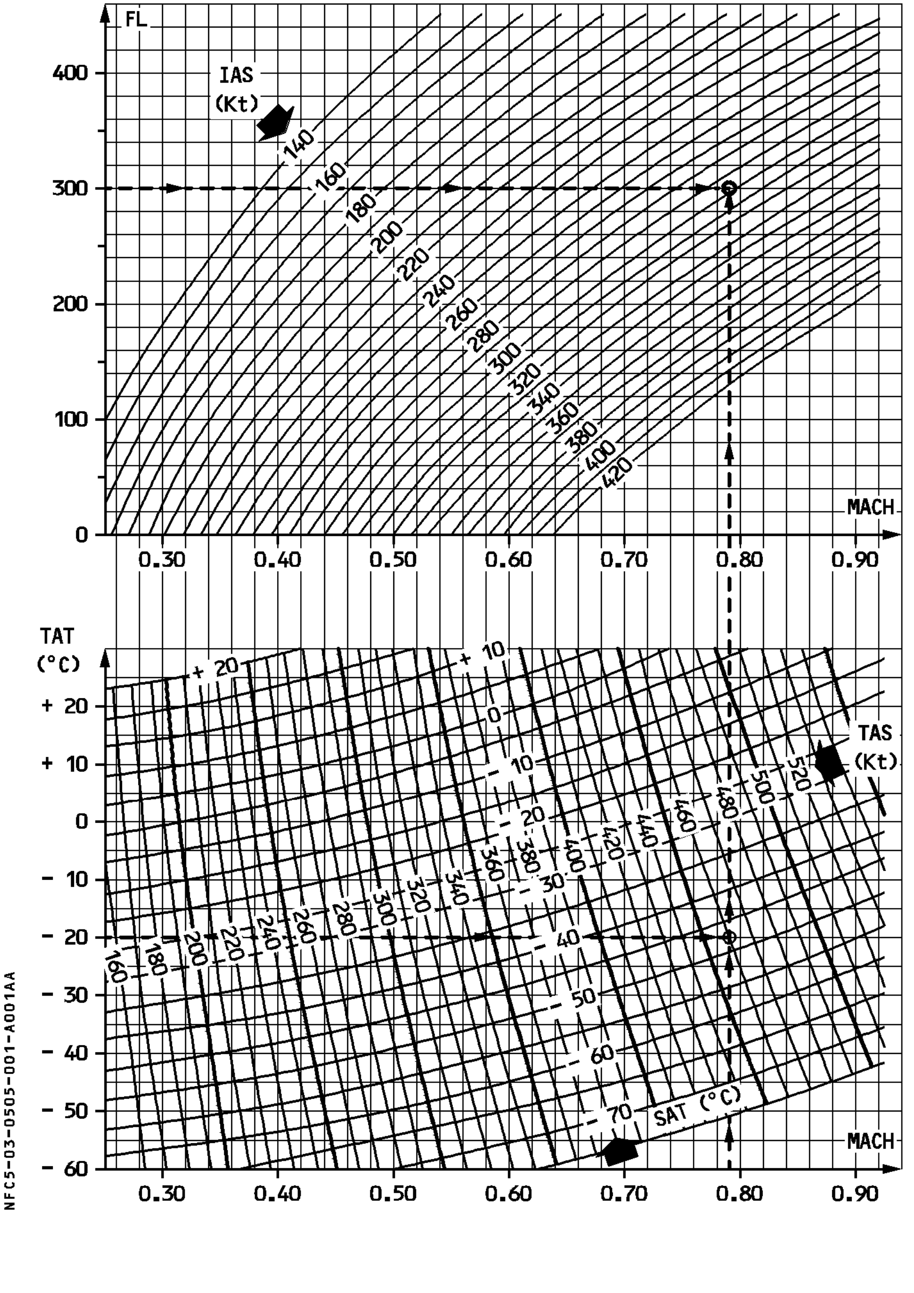
– **PILOT PC . . . . STOWED**

LPC MEL MODULE

TBD

05.00 CONTENTS

CONVERSIONS – IAS . MACH – TAS . MACH – SAT . TAT

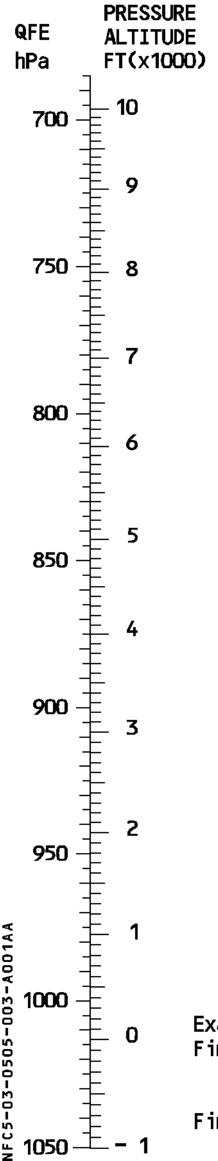


INTERNATIONAL STANDARD ATMOSPHERE (ISA)

R

ALTITUDE (Feet)	TEMP. (°C)	PRESSURE			PRESSURE RATIO $\delta = P / Po$	DENSITY $\sigma = \rho / \rho o$	SPEED OF SOUND (a) (kt)	ALTITUDE (meters)
		hPa	P.S.I.	in. Hg.				
40,000	– 56.5	188	2.72	5.54	0.1851	0.2462	573	12.192
39,000	– 56.5	197	2.85	5.81	0.1942	0.2583	573	11.887
38,000	– 56.5	206	2.99	6.10	0.2038	0.2710	573	11.582
37,000	– 56.5	217	3.14	6.40	0.2138	0.2844	573	11.278
36,000	– 56.3	227	3.30	6.71	0.2243	0.2981	573	10.973
35,000	– 54.3	238	3.46	7.04	0.2353	0.3099	576	10.668
34,000	– 52.4	250	3.63	7.38	0.2467	0.3220	579	10.363
33,000	– 50.4	262	3.80	7.74	0.2586	0.3345	581	10.058
32,000	– 48.4	274	3.98	8.11	0.2709	0.3473	584	9.754
31,000	– 46.4	287	4.17	8.49	0.2837	0.3605	586	9.449
30,000	– 44.4	301	4.36	8.89	0.2970	0.3741	589	9.144
29,000	– 42.5	315	4.57	9.30	0.3107	0.3881	591	8.839
28,000	– 40.5	329	4.78	9.73	0.3250	0.4025	594	8.534
27,000	– 38.5	344	4.99	10.17	0.3398	0.4173	597	8.230
26,000	– 36.5	360	5.22	10.63	0.3552	0.4325	599	7.925
25,000	– 34.5	376	5.45	11.10	0.3711	0.4481	602	7.620
24,000	– 32.5	393	5.70	11.60	0.3876	0.4642	604	7.315
23,000	– 30.6	410	5.95	12.11	0.4046	0.4806	607	7.010
22,000	– 28.6	428	6.21	12.64	0.4223	0.4976	609	6.706
21,000	– 26.6	446	6.47	13.18	0.4406	0.5150	611	6.401
20,000	– 24.6	466	6.75	13.75	0.4595	0.5328	614	6.096
19,000	– 22.6	485	7.04	14.34	0.4791	0.5511	616	5.791
18,000	– 20.7	506	7.34	14.94	0.4994	0.5699	619	5.406
17,000	– 18.7	527	7.65	15.57	0.5203	0.5892	621	5.182
16,000	– 16.7	549	7.97	16.22	0.5420	0.6090	624	4.877
15,000	– 14.7	572	8.29	16.89	0.5643	0.6292	626	4.572
14,000	– 12.7	595	8.63	17.58	0.5875	0.6500	628	4.267
13,000	– 10.8	619	8.99	18.29	0.6113	0.6713	631	3.962
12,000	– 8.8	644	9.35	19.03	0.6360	0.6932	633	3.658
11,000	– 6.8	670	9.72	19.79	0.6614	0.7156	636	3.353
10,000	– 4.8	697	10.10	20.58	0.6877	0.7385	638	3.048
9,000	– 2.8	724	10.51	21.39	0.7148	0.7620	640	2.743
8,000	– 0.8	753	10.92	22.22	0.7428	0.7860	643	2.438
7,000	+ 1.1	782	11.34	23.09	0.7716	0.8106	645	2.134
6,000	+ 3.1	812	11.78	23.98	0.8014	0.8359	647	1.829
5,000	+ 5.1	843	12.23	24.90	0.8320	0.8617	650	1.524
4,000	+ 7.1	875	12.69	25.84	0.8637	0.8881	652	1.219
3,000	+ 9.1	908	13.17	26.82	0.8962	0.9151	654	914
2,000	+ 11.0	942	13.67	27.82	0.9298	0.9428	656	610
1,000	+ 13.0	977	14.17	28.86	0.9644	0.9711	659	305
0	+ 15.0	1013	14.70	29.92	1.0000	1.0000	661	0
– 1.000	+ 17.0	1050	15.23	31.02	1.0366	1.0295	664	– 305

CONVERSIONS - QNH - QFE - PRESSURE ALTITUDE



QNH (hPa)	CORRECTION (ft)	QNH (in Hg)
949 – 951	+ 1900	28.01 – 28.10
952 – 955	+ 1800	28.11 – 28.20
956 – 958	+ 1700	28.21 – 28.30
959 – 961	+ 1600	28.31 – 28.40
962 – 964	+ 1500	28.41 – 28.45
965 – 968	+ 1400	28.46 – 28.56
969 – 971	+ 1300	28.57 – 28.66
972 – 974	+ 1200	28.68 – 28.77
975 – 978	+ 1100	28.78 – 28.86
979 – 981	+ 1000	28.87 – 28.95
982 – 984	+ 900	28.96 – 29.05
985 – 988	+ 800	29.06 – 29.15
989 – 991	+ 700	29.16 – 29.25
992 – 994	+ 600	29.26 – 29.35
995 – 997	+ 500	29.36 – 29.45
998 – 1001	+ 400	29.46 – 29.54
1002 – 1004	+ 300	29.55 – 29.64
1005 – 1007	+ 200	29.65 – 29.74
1008 – 1011	+ 100	29.75 – 29.84
1012 – 1014	0	29.85 – 29.94
1015 – 1018	– 100	29.95 – 30.04
1019 – 1021	– 200	30.05 – 30.14
1022 – 1025	– 300	30.15 – 30.24
1026 – 1028	– 400	30.25 – 30.34
1029 – 1031	– 500	30.35 – 30.44
1032 – 1035	– 600	30.45 – 30.54
1036 – 1038	– 700	30.55 – 30.65
1039 – 1042	– 800	30.66 – 30.75
1043 – 1045	– 900	30.76 – 30.85
1046 – 1050	–1000	30.86 – 30.95

Examples : 1) Elevation: 2500 ft QNH = 1020 hPa
Find : correction: −200 ft
Pressure altitude = 2300 ft QFE = 933 hPa
2) Elevation: 1500 ft QFE = 980 hPa
Find : Pressure altitude: 920 ft
Correction = − 580 ft QNH = 1032 hPa

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CONVERSIONS QFE hPa – in. Hg – ft

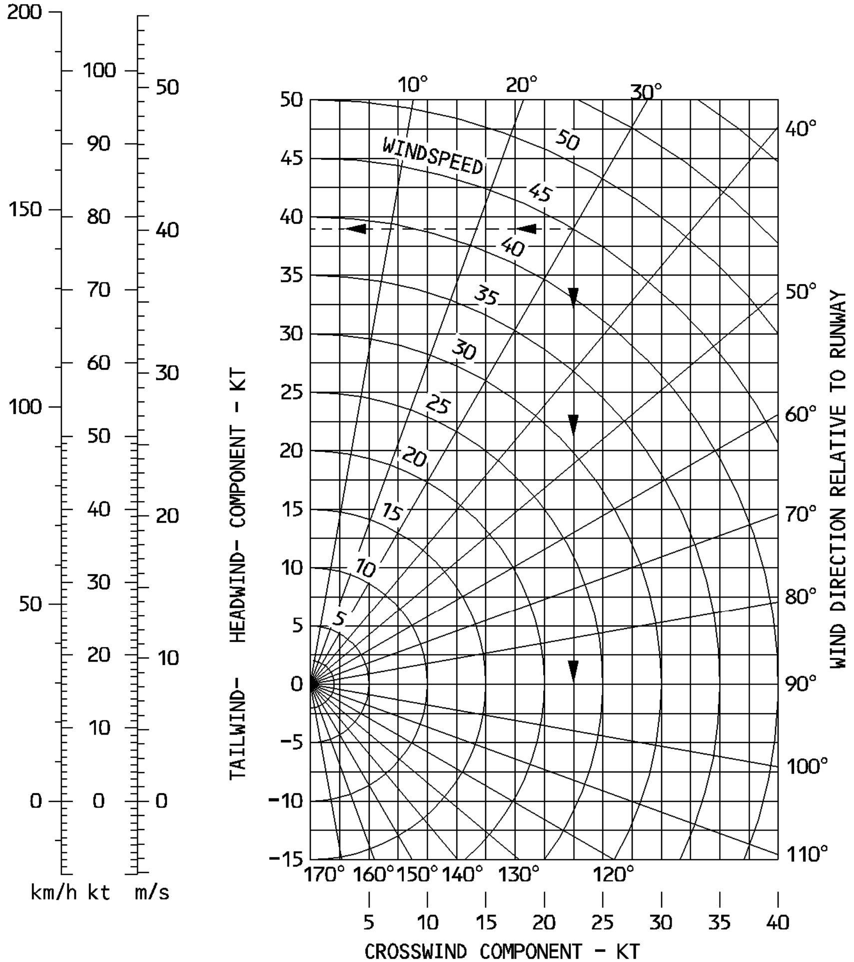
QFE hPa	in. Hg	PRESS. ALT. ft	QFE hPa	in. Hg	PRESS. ALT. ft	QFE hPa	in. Hg	PRESS. ALT. ft
1050	31.01	– 989	960	28.35	1486	870	25.69	4157
1048	30.95	– 936	958	28.29	1543	868	25.63	4219
1046	30.89	– 883	956	28.23	1601	866	25.57	4281
1044	30.83	– 830	954	28.17	1658	864	25.51	4343
1042	30.77	– 776	952	28.11	1715	862	25.45	4405
1040	30.71	– 723	950	28.05	1773	860	25.40	4468
1038	30.65	– 669	948	27.99	1831	858	25.34	4531
1036	30.59	– 615	946	27.94	1889	856	25.28	4593
1034	30.53	– 562	944	27.88	1947	854	25.22	4656
1032	30.47	– 508	942	27.82	2005	852	25.16	4718
1030	30.42	– 454	940	27.76	2062	850	25.10	4781
1028	30.36	– 400	938	27.70	2120	848	25.04	4844
1026	30.30	– 346	936	27.64	2178	846	24.98	4907
1024	30.24	– 292	934	27.58	2236	844	24.92	4970
1022	30.18	– 238	932	27.52	2294	842	24.86	5033
1020	30.12	– 184	930	27.46	2353	840	24.81	5097
1018	30.06	– 129	928	27.40	2412	838	24.75	5161
1016	30.00	– 74	926	27.34	2471	836	24.69	5225
1014	29.94	– 20	924	27.29	2530	834	24.63	5289
1012	29.88	34	922	27.23	2589	832	24.57	5353
1010	29.83	89	920	27.17	2647	830	24.51	5417
1008	29.77	144	918	27.11	2707	828	24.45	5481
1006	29.71	199	916	27.05	2767	826	24.39	5545
1004	29.65	254	914	26.99	2826	824	24.33	5610
1002	29.59	309	912	26.93	2885	822	24.27	5675
1000	29.53	364	910	26.87	2944	820	24.21	5740
998	29.47	419	908	26.81	3004	818	24.16	5805
996	29.41	475	906	26.75	3064	816	24.10	5870
994	29.35	530	904	26.70	3124	814	24.04	5935
992	29.29	586	902	26.64	3183	812	23.98	6000
990	29.23	641	900	26.58	3243	810	23.92	6065
988	29.18	697	898	26.52	3303	808	23.86	6131
986	29.12	753	896	26.46	3363	806	23.80	6197
984	29.06	809	894	26.40	3424	804	23.74	6263
982	29.00	865	892	26.34	3484	802	23.68	6329
980	28.94	921	890	26.28	3545	800	23.62	6394
978	28.88	977	888	26.22	3606	798	23.56	6461
976	28.82	1033	886	26.16	3667	796	23.51	6528
974	28.76	1089	884	26.10	3728	794	23.45	6595
972	28.70	1145	882	26.05	3789	792	23.39	6661
970	28.64	1202	880	25.99	3850	790	23.33	6727
968	28.59	1259	878	25.93	3911	788	23.27	6794
966	28.53	1316	876	25.87	3973	786	23.21	6861
964	28.47	1373	874	25.81	4034	784	23.15	6928
962	28.41	1430	872	25.75	4096	782	23.09	6995

WIND COMPONENTS (FOR TAKEOFF AND LANDING)

R

MULTIPLY	BY	TO GET
kt	1.852	km/h
kt	0.5144	m/s
m/s	3.6	km/h
m/s	1.9438	kt
km/h	0.5396	kt
km/h	0.2778	m/s

GIVEN	FIND
WIND DIRECTION RELATIVE TO RUNWAY HEADING=30 DEG WIND SPEED=45 KT	CROSS WIND COMPONENT=22.5 KT HEAD WIND COMPONENT=39.0 KT



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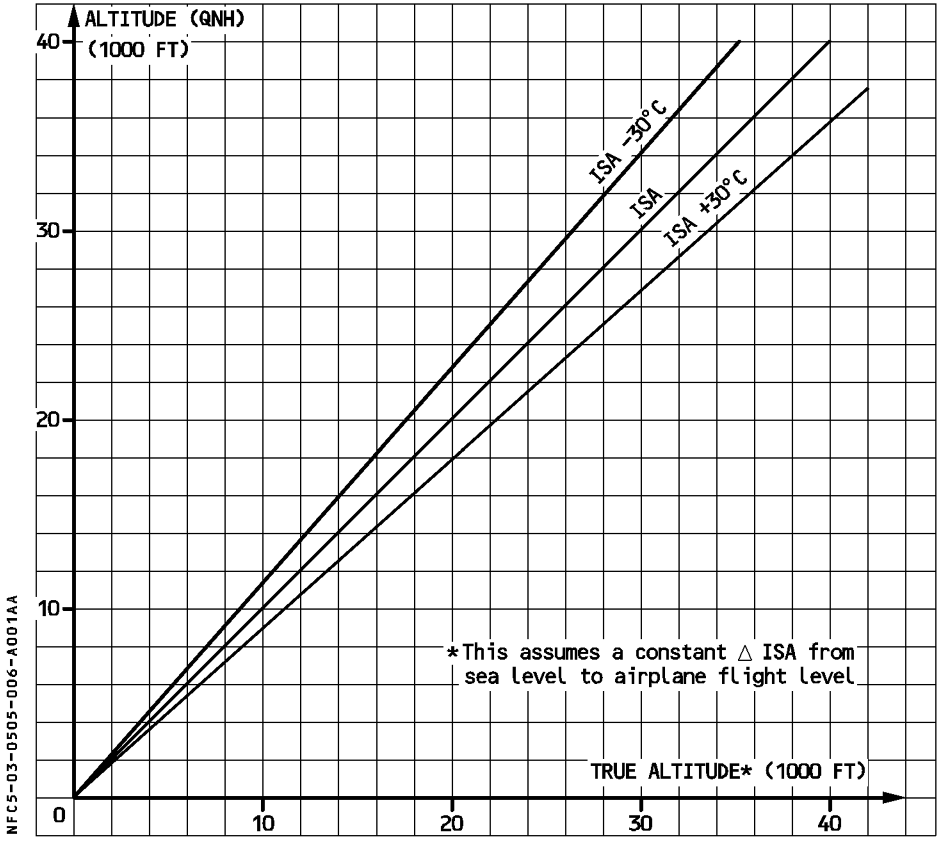
ALTITUDE TEMPERATURE CORRECTION

FOR HIGH ALTITUDE USE



FOR LOW ALTITUDE USE

QNH ALTITUDE MINUS TERRAIN ELEVATION (FT) →		ΔZ CORRECTION (FT) 500	1000	1500	2000	2500	3000
ΔISA	– 10 °C	– 17	– 34	– 51	– 68	– 85	– 102
	– 20 °C	– 35	– 70	– 105	– 140	– 175	– 210
	– 30 °C	– 52	– 104	– 156	– 208	– 260	– 312
	– 40 °C	– 70	– 140	– 210	– 280	– 350	– 420

TRUE ALTITUDE = QNH ALTITUDE + ΔZ
Note: A constant ΔISA from ground to airplane level has been assumed.

THRUST RATINGS

The thrust rating charts have been established for :

– **Maximum takeoff**
It is the maximum thrust certified for takeoff and is normally limited to five minutes. This time is extended to ten minutes for engine out contingency, as authorized by the approved AFM.

– **Maximum go around**
It is the maximum permissible thrust during go-around.

– **Flexible takeoff**
It is a reduced takeoff thrust as compared to the maximum permissible. The related N1 is calculated as a function of the flexible temperature entered in the FMGS MCDU. The flexible temperature is a function of the aircraft weight and environmental conditions. It guarantees that the regular performance requirements are met.

– **Maximum continuous**
It is the maximum thrust certified for continuous use. This rating should be used, at the pilot's discretion, only when required to ensure safe flight (engine failure).

– **Maximum climb**
It is the maximum thrust approved for normal climb.

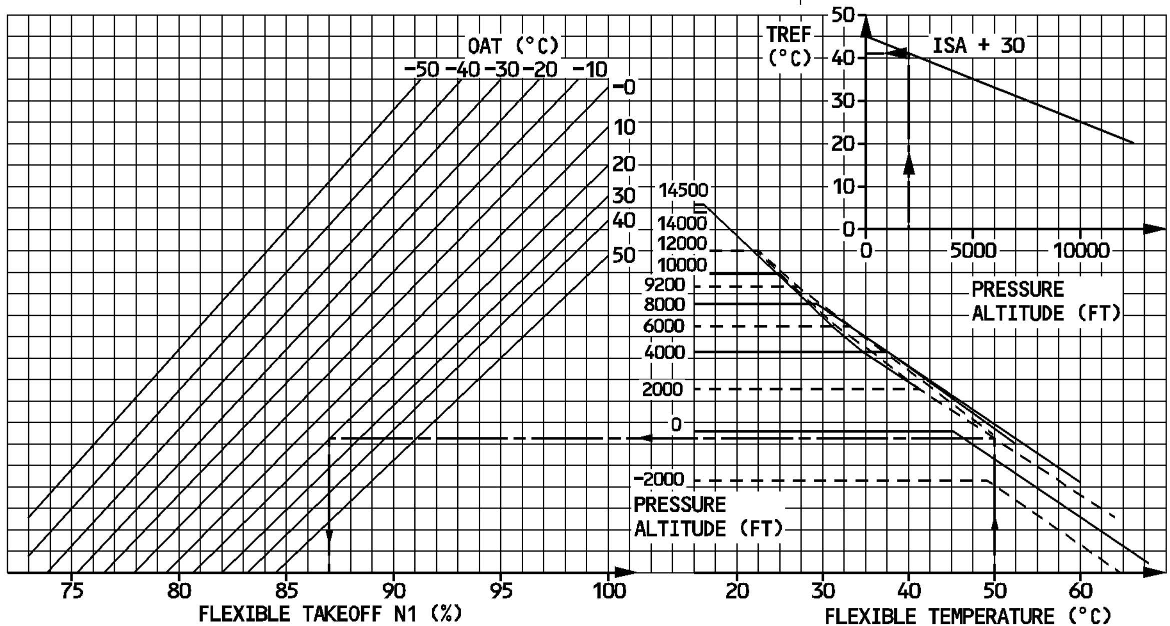
– **Maximum cruise**
It is the maximum thrust approved for normal cruise.
There is no thrust lever position corresponding to this thrust rating.
It is not displayed to the pilot, and the N1 limit which is displayed in cruise is the maximum climb N1.
The FMGS uses the maximum cruise N1 to compute the aircraft maximum speed.
In manual thrust setting, in cruise, the pilot should limit N1 to the maximum cruise N1 that is equal to the displayed maximum climb N1 minus 2.4 %.

FLEXIBLE TAKEOFF N1

NFC5-03-0506-002-A080AB

EXAMPLE : PRESS ALT : 2000 FT OAT=+20°C. FLX T=50°C.
- FLX TEMP 50°C > FLAT RATING TEMP(ISA+30=41°C)

PRESS ALT:2000 FT
OAT: 20°C
→ N1 FLEX = 87%



CFM56-5B6	N1 CORRECTIONS FOR AIR BLEED	
FLEX TAKEOFF N1 MACH = .000	AIR CONDITIONING ON	- .7
	ENGINE ANTI ICE ON	0
	ENGINE AND WING ANTI ICE ON	0

TAKEOFF

CFM56-5B6 TAKE OFF N1 NO AIR BLEED MACH=.000	N1 CORRECTIONS FOR AIR BLEED	OAT < ISA + 30	OAT ≥ ISA + 30
	AIR CONDITIONING ON	–.7	–.7
	ENGINE ANTI ICE ON	0.0	–1.4
	ENGINE ANTI ICE AND WING ANTI ICE ON	0.0	–2.1

OAT (°C)	PRESSURE ALTITUDE (FT)									
	–2000.	–1000.	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.
–54.0	73.7	74.7	75.8	76.7	77.6	78.7	79.3	79.8	80.4	80.8
–50.0	74.4	75.4	76.4	77.4	78.3	79.3	79.9	80.5	81.1	81.5
–46.0	75.0	76.1	77.1	78.0	79.0	80.0	80.6	81.2	81.8	82.2
–42.0	75.7	76.7	77.8	78.7	79.6	80.7	81.3	81.9	82.4	82.9
–38.0	76.3	77.4	78.4	79.4	80.3	81.4	82.0	82.6	83.1	83.6
–34.0	76.9	78.0	79.0	80.0	80.9	82.0	82.6	83.2	83.8	84.2
–30.0	77.5	78.6	79.7	80.6	81.6	82.7	83.3	83.9	84.4	84.9
–26.0	78.1	79.2	80.3	81.3	82.2	83.3	83.9	84.5	85.1	85.6
–22.0	78.8	79.9	80.9	81.9	82.8	84.0	84.6	85.2	85.7	86.2
–18.0	79.4	80.5	81.6	82.5	83.5	84.6	85.2	85.9	86.4	86.9
–14.0	80.0	81.1	82.2	83.2	84.1	85.3	85.9	86.5	87.0	87.5
–10.0	80.6	81.7	82.8	83.8	84.7	85.9	86.5	87.1	87.7	88.2
–6.0	81.2	82.3	83.4	84.4	85.3	86.5	87.1	87.7	88.3	88.8
–2.0	81.7	82.9	84.0	85.0	85.9	87.1	87.7	88.4	88.9	89.4
2.0	82.3	83.5	84.6	85.6	86.6	87.7	88.3	89.0	89.5	90.0
6.0	82.9	84.1	85.2	86.2	87.2	88.3	89.0	89.6	90.1	90.6
10.0	83.5	84.6	85.8	86.8	87.8	88.9	89.6	90.2	90.8	91.3
14.0	84.1	85.2	86.4	87.4	88.4	89.5	90.2	90.8	91.4	91.9
18.0	84.6	85.8	86.9	88.0	88.9	90.1	90.8	91.4	92.0	92.5
22.0	85.2	86.4	87.5	88.5	89.5	90.7	91.4	92.0	92.6	93.1
26.0	85.7	86.9	88.1	89.1	90.1	91.3	91.9	92.6	93.2	93.7
30.0	86.3	87.5	88.6	89.7	90.7	91.9	92.5	93.2	93.7	94.3
34.0	86.8	88.0	89.2	90.2	91.2	92.4	93.1	93.8	*94.1*	*94.0*
38.0	87.4	88.6	89.7	90.8	91.8	93.0	*93.4*	*93.5*	*93.5*	*93.4*
42.0	88.0	89.2	90.3	91.4	*92.1*	*92.8*	*92.9*	*93.0*	*92.9*	
46.0	88.5	89.7	*90.6*	*91.1*	*91.6*					
50.0	*88.7*	*89.4*	*90.0*	*90.6*	*91.1*					
54.0	*88.2*	*88.8*	*89.5*							

OAT < ISA + 30
OAT ≥ ISA + 30

LEFT INTENTIONALLY BLANK

GO AROUND

R

CFM56-5B6 GO AROUND N1 AIR CONDITIONING ON MACH=.225	N1 CORRECTIONS FOR AIR BLEED	OAT < ISA + 30	OAT ≥ ISA + 30
	AIR CONDITIONING OFF	.6	.6
	ENGINE ANTI ICE ON	0.0	–1.3
	ENGINE ANTI ICE AND WING ANTI ICE ON	0.0	–1.9

TAT (°C)	PRESSURE ALTITUDE (FT) –2000.	–1000.	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.
–54.0	74.7	75.6	76.5	77.2	77.8	78.3	79.1	79.8	80.4	80.9
–50.0	75.3	76.3	77.2	77.8	78.5	79.0	79.8	80.5	81.1	81.6
–46.0	76.0	76.9	77.8	78.5	79.2	79.7	80.4	81.2	81.8	82.3
–42.0	76.6	77.6	78.5	79.2	79.9	80.4	81.1	81.8	82.5	83.0
–38.0	77.3	78.2	79.1	79.8	80.5	81.0	81.8	82.5	83.1	83.7
–34.0	77.9	78.8	79.8	80.5	81.1	81.7	82.4	83.2	83.8	84.3
–30.0	78.5	79.5	80.4	81.1	81.8	82.3	83.1	83.8	84.5	85.0
–26.0	79.1	80.1	81.1	81.7	82.4	83.0	83.7	84.5	85.1	85.7
–22.0	79.8	80.7	81.7	82.4	83.1	83.6	84.4	85.1	85.8	86.3
–18.0	80.4	81.4	82.3	83.0	83.7	84.3	85.0	85.8	86.4	87.0
–14.0	81.0	82.0	83.0	83.7	84.4	84.9	85.7	86.4	87.1	87.6
–10.0	81.6	82.6	83.6	84.3	85.0	85.5	86.3	87.0	87.7	88.3
–6.0	82.2	83.2	84.2	84.9	85.6	86.1	86.9	87.7	88.3	88.9
–2.0	82.8	83.8	84.8	85.5	86.2	86.8	87.5	88.3	88.9	89.5
2.0	83.4	84.4	85.4	86.1	86.8	87.4	88.1	88.9	89.6	90.1
6.0	83.9	85.0	86.0	86.7	87.4	88.0	88.8	89.5	90.2	90.7
10.0	84.5	85.6	86.6	87.3	88.0	88.6	89.4	90.1	90.8	91.4
14.0	85.1	86.2	87.2	87.9	88.6	89.2	90.0	90.7	91.4	92.0
18.0	85.7	86.7	87.7	88.5	89.2	89.8	90.6	91.3	92.0	92.6
22.0	86.2	87.3	88.3	89.0	89.8	90.4	91.1	91.9	92.6	93.2
26.0	86.8	87.9	88.9	89.6	90.3	90.9	91.7	92.5	93.2	93.8
30.0	87.4	88.4	89.4	90.2	90.9	91.5	92.3	93.1	93.8	94.4
34.0	87.9	89.0	90.0	90.8	91.5	92.1	92.9	93.7	94.4	95.0
38.0	88.5	89.5	90.6	91.3	92.1	92.7	93.5	94.3	*94.4*	*94.4*
42.0	89.0	90.1	91.1	91.9	92.6	93.2	*93.6*	*93.8*	*93.8*	*93.7*
46.0	89.6	90.7	91.7	92.5	*92.7*	*92.8*	*93.1*	*93.2*	*93.1*	
50.0	*90.1*	*91.2*	*91.8*	*92.1*	*92.3*	*92.4*	*92.6*			
54.0	*90.2*	*90.7*	*91.3*	*91.6*	*91.8*					
58.0	*89.6*	*90.2*	*90.8*							
62.0	*89.0*									

OAT < ISA + 30

OAT ≥ ISA + 30

GO AROUND

R

CFM56-5B6	N1 CORRECTIONS FOR AIR BLEED	OAT < ISA + 30	OAT ≥ ISA + 30
GO AROUND N1 AIR CONDITIONING ON MACH=.225	AIR CONDITIONING OFF	.6	.6
	ENGINE ANTI ICE ON	0.0	–1.3
	ENGINE ANTI ICE AND WING ANTI ICE ON	0.0	–1.9

TAT (°C)	PRESSURE ALTITUDE (FT) 7000.	8000.	9000.	9200.	10000.	11000.	12000.	13000.	14000.	14500.
–54.0	80.9	81.5	82.0	82.1	82.5	83.0	83.6	84.1	84.6	84.8
–50.0	81.6	82.2	82.7	82.8	83.2	83.7	84.3	84.8	85.3	85.5
–46.0	82.3	82.9	83.4	83.5	83.9	84.5	85.0	85.5	86.0	86.3
–42.0	83.0	83.6	84.1	84.2	84.7	85.2	85.7	86.2	86.7	87.0
–38.0	83.7	84.2	84.8	84.9	85.3	85.8	86.4	86.9	87.4	87.7
–34.0	84.3	84.9	85.5	85.6	86.0	86.5	87.1	87.6	88.1	88.4
–30.0	85.0	85.6	86.1	86.2	86.7	87.2	87.7	88.3	88.8	89.0
–26.0	85.7	86.2	86.8	86.9	87.3	87.8	88.4	88.9	89.5	89.7
–22.0	86.3	86.9	87.5	87.6	88.0	88.5	89.1	89.6	90.1	90.4
–18.0	87.0	87.6	88.1	88.2	88.7	89.2	89.8	90.3	90.8	91.1
–14.0	87.6	88.2	88.8	88.9	89.3	89.9	90.4	91.0	91.5	91.8
–10.0	88.3	88.9	89.4	89.5	90.0	90.5	91.1	91.6	92.1	92.4
–6.0	88.9	89.5	90.0	90.2	90.6	91.1	91.7	92.3	92.8	93.0
–2.0	89.5	90.1	90.7	90.8	91.2	91.8	92.3	92.9	93.4	93.7
2.0	90.1	90.7	91.3	91.4	91.9	92.4	93.0	93.5	94.1	94.3
6.0	90.7	91.4	91.9	92.0	92.5	93.0	93.6	94.2	94.7	95.0
10.0	91.4	92.0	92.6	92.7	93.1	93.7	94.2	94.8	95.3	95.6
14.0	92.0	92.6	93.2	93.3	93.7	94.3	94.9	95.4	96.0	96.2
18.0	92.6	93.2	93.8	93.9	94.4	94.9	95.5	96.1	96.6	96.9
22.0	93.2	93.8	94.4	94.5	94.9	95.5	96.1	96.7	*96.6*	*96.5*
26.0	93.8	94.4	95.0	95.1	95.5	96.1	*96.1*	*96.0*	*95.8*	*95.8*
30.0	94.4	95.0	95.6	*95.6*	*95.5*	*95.4*	*95.3*	*95.2*	*95.1*	
34.0	*95.0*	*95.0*	*94.9*	*94.9*	*94.7*	*94.6*	*94.5*			
38.0	*94.4*	*94.2*	*94.1*	*94.1*	*93.9*					
42.0	*93.7*	*93.5*								
46.0										
50.0										
54.0										
58.0										
62.0										

OAT < ISA + 30

OAT ≥ ISA + 30

MAXIMUM CONTINUOUS

CFM56-5B5/B6 MAXIMUM CONTINUOUS N1 AIR CONDITIONING ON* IAS=230 KT	N1 CORRECTIONS FOR AIR BLEED	OAT > ISA + 10	OAT > ISA + 10
	AIR CONDITIONING OFF	.8	.8
	ENGINE ANTI ICE ON	0.0	–1.1
	ENGINE ANTI ICE AND WING ANTI ICE ON	0.0	–2.5

TAT (°C)	PRESSURE ALTITUDE (FT) –1000.	3000.	7000.	11000.	15000.	19000.	23000.	27000.	31000.	35000.	39000.
–54.0	73.4	76.1	78.4	80.4	81.8	81.4	82.2	83.2	84.3	85.1	84.1
–50.0	74.1	76.8	79.1	81.1	82.6	82.1	83.0	84.0	85.0	85.8	84.9
–46.0	74.7	77.4	79.8	81.8	83.3	82.8	83.7	84.7	85.7	86.6	85.6
–42.0	75.4	78.1	80.5	82.5	84.0	83.5	84.4	85.4	86.4	87.3	86.3
–38.0	76.0	78.7	81.1	83.1	84.6	84.2	85.0	86.1	87.1	88.0	87.0
–34.0	76.6	79.4	81.8	83.8	85.3	84.8	85.7	86.7	87.8	88.6	87.7
–30.0	77.2	80.0	82.4	84.5	86.0	85.5	86.4	87.4	88.5	89.3	88.3
–26.0	77.8	80.6	83.1	85.1	86.6	86.1	87.0	88.1	89.2	90.0	89.0
–22.0	78.5	81.3	83.7	85.8	87.3	86.8	87.7	88.7	89.8	*90.5*	89.7
–18.0	79.1	81.9	84.4	86.4	88.0	87.5	88.4	89.4	90.5	*90.3*	*89.6*
–14.0	79.7	82.5	85.0	87.1	88.6	88.1	89.0	90.1	*90.4*	*90.0*	*89.3*
–10.0	80.3	83.1	85.6	87.7	89.3	88.8	89.7	*90.3*	*90.1*	*89.6*	*89.0*
–6.0	80.8	83.7	86.2	88.3	89.9	89.4	*90.3*	*90.0*	*89.7*	*89.0*	*88.2*
–2.0	81.4	84.3	86.9	88.9	90.5	90.0	*90.0*	*89.7*	*89.0*	*88.4*	*87.5*
2.0	82.0	84.9	87.5	89.6	91.1	*90.2*	*89.7*	*89.0*	*88.4*	*87.7*	*86.9*
6.0	82.6	85.5	88.1	90.2	91.8	*89.9*	*89.3*	*88.4*	*87.8*	*87.0*	*86.3*
10.0	83.2	86.1	88.7	90.8	*91.5*	*89.5*	*88.6*	*87.8*	*87.2*	*86.2*	*85.7*
14.0	83.8	86.7	89.3	*91.2*	*91.1*	*89.0*	*87.9*	*87.1*	*86.5*		
18.0	84.3	87.3	89.9	*90.8*	*90.7*	*88.4*	*87.2*	*86.5*			
22.0	84.9	87.8	*90.0*	*90.4*	*90.3*	*87.6*	*86.5*				
26.0	85.4	88.4	*89.7*	*89.9*	*89.5*	*86.8*					
30.0	86.0	*88.5*	*89.5*	*89.3*	*88.8*	*86.0*					
34.0	*86.5*	*88.5*	*89.0*	*88.6*	*88.0*						
38.0	*86.7*	*88.4*	*88.4*	*87.9*							
42.0	*86.9*	*88.1*	*87.8*	*87.2*							
46.0	*87.0*	*87.5*	*87.1*								
50.0	*86.7*	*86.8*	*86.4*								
54.0	*86.0*	*86.2*									

OAT < ISA + 10

OAT ≥ ISA + 10

R * One engine inoperative - 1 pack operative on remaining engine.

MAXIMUM CLIMB

CFM56-5B5/B6	N1 CORRECTIONS FOR AIR BLEED	OAT < ISA + 10	OAT ≥ ISA + 10
MAXIMUM CLIMB N1 AIR CONDITIONING ON 250/300/.78	AIR CONDITIONING OFF	.8	.8
	ENGINE ANTI ICE ON	0.0	–.8
	ENGINE ANTI ICE AND WING ANTI ICE ON	0.0	–1.4

TAT (°C)	PRESSURE ALTITUDE (FT) –1000.	3000.	7000.	11000.	15000.	19000.	23000.	27000.	31000.	35000.	39000.
–54.0	73.4	75.4	77.0	77.8	78.8	79.8	80.7	81.5	82.5	83.9	83.9
–50.0	74.1	76.1	77.6	78.4	79.5	80.5	81.4	82.2	83.3	84.6	84.6
–46.0	74.7	76.7	78.3	79.1	80.2	81.2	82.1	82.9	84.0	85.3	85.3
–42.0	75.4	77.4	79.0	79.8	80.9	81.9	82.8	83.6	84.7	86.0	86.0
–38.0	76.0	78.0	79.6	80.5	81.5	82.5	83.5	84.3	85.3	86.7	86.7
–34.0	76.6	78.7	80.3	81.1	82.2	83.2	84.1	84.9	86.0	87.4	87.4
–30.0	77.2	79.3	80.9	81.7	82.8	83.8	84.8	85.6	86.7	88.1	88.1
–26.0	77.8	79.9	81.5	82.4	83.5	84.5	85.4	86.2	87.4	88.7	88.7
–22.0	78.4	80.5	82.2	83.0	84.1	85.1	86.1	86.9	88.0	89.4	89.4
–18.0	79.1	81.2	82.8	83.7	84.8	85.8	86.7	87.6	88.7	90.1	*89.9*
–14.0	79.7	81.8	83.5	84.3	85.4	86.4	87.4	88.2	89.4	*90.3*	*89.6*
–10.0	80.3	82.4	84.1	84.9	86.0	87.1	88.0	88.9	90.0	*90.1*	*89.4*
–6.0	80.8	83.0	84.7	85.5	86.6	87.7	88.7	89.5	*90.3*	*90.0*	*88.8*
–2.0	81.4	83.6	85.3	86.1	87.2	88.3	89.3	90.1	*90.1*	*89.5*	*88.0*
2.0	82.0	84.2	85.9	86.7	87.9	88.9	89.9	*90.1*	*90.0*	*88.8*	*87.4*
6.0	82.6	84.8	86.5	87.3	88.5	89.5	*90.0*	*89.9*	*89.6*	*88.2*	*86.8*
10.0	83.2	85.4	87.1	87.9	89.1	*89.8*	*89.8*	*89.7*	*89.0*	*87.5*	*86.2*
14.0	83.7	85.9	87.7	88.6	89.7	*89.6*	*89.7*	*89.2*	*88.4*	*86.8*	*85.6*
18.0	84.3	86.5	88.2	89.1	*89.4*	*89.3*	*89.2*	*88.6*	*87.7*		
22.0	84.9	87.1	*88.7*	*89.2*	*89.0*	*89.0*	*88.6*	*87.9*	*87.0*		
26.0	85.4	87.6	*88.3*	*88.9*	*88.7*	*88.5*	*88.0*	*87.2*	*86.3*		
30.0	86.0	*87.8*	*87.9*	*88.5*	*88.2*	*87.8*	*87.2*	*86.6*			
34.0	86.5	*87.3*	*87.3*	*87.8*	*87.5*	*87.1*	*86.5*				
38.0	*86.4*	*86.8*	*86.6*	*87.1*	*86.8*	*86.4*					
42.0	*85.9*	*86.1*	*85.9*	*86.4*	*86.0*						
46.0	*85.3*	*85.4*	*85.2*	*85.7*	*85.3*						
50.0	*84.5*	*84.7*	*84.4*	*85.0*							
54.0	*83.7*	*83.9*									

OAT < ISA + 10
OAT ≥ ISA + 10

MAXIMUM CRUISE

CFM56-5B5/B6	N1 CORRECTIONS FOR AIR BLEED	OAT < ISA + 10	OAT ≥ ISA + 10
MAXIMUM CRUISE N1 AIR CONDITIONING ON **250/300/.78**	AIR CONDITIONING OFF	.8	.8
	ENGINE ANTI ICE ON	0.0	–.8
	ENGINE ANTI ICE AND WING ANTI ICE ON	0.0	–1.4

TAT (°C)	PRESSURE ALTITUDE (FT) –1000.	3000.	7000.	11000.	15000.	19000.	23000.	27000.	31000.	35000.	39000.
–54.0	71.0	73.0	74.6	75.4	76.4	77.4	78.3	79.1	80.1	81.5	81.5
–50.0	71.7	73.7	75.2	76.0	77.1	78.1	79.0	79.8	80.9	82.2	82.2
–46.0	72.3	74.3	75.9	76.7	77.8	78.8	79.7	80.5	81.6	82.9	82.9
–42.0	73.0	75.0	76.6	77.4	78.5	79.5	80.4	81.2	82.3	83.6	83.6
–38.0	73.6	75.6	77.2	78.1	79.1	80.1	81.1	81.9	82.9	84.3	84.3
–34.0	74.2	76.3	77.9	78.7	79.8	80.8	81.7	82.5	83.6	85.0	85.0
–30.0	74.8	76.9	78.5	79.3	80.4	81.4	82.4	83.2	84.3	85.7	85.7
–26.0	75.4	77.5	79.1	80.0	81.1	82.1	83.0	83.8	85.0	86.3	86.3
–22.0	76.0	78.1	79.8	80.6	81.7	82.7	83.7	84.5	85.6	87.0	87.0
–18.0	76.7	78.8	80.4	81.3	82.4	83.4	84.3	85.2	86.3	87.7	*87.5*
–14.0	77.3	79.4	81.1	81.9	83.0	84.0	85.0	85.8	87.0	*87.9*	*87.2*
–10.0	77.9	80.0	81.7	82.5	83.6	84.7	85.6	86.5	87.6	*87.7*	*87.0*
–6.0	78.4	80.6	82.3	83.1	84.2	85.3	86.3	87.1	*87.9*	*87.6*	*86.4*
–2.0	79.0	81.2	82.9	83.7	84.8	85.9	86.9	87.7	*87.7*	*87.1*	*85.6*
2.0	79.6	81.8	83.5	84.3	85.5	86.5	87.5	*87.7*	*87.6*	*86.4*	*85.0*
6.0	80.2	82.4	84.1	84.9	86.1	87.1	*87.6*	*87.5*	*87.2*	*85.8*	*84.4*
10.0	80.8	83.0	84.7	85.5	86.7	*87.4*	*87.4*	*87.3*	*86.6*	*85.1*	*83.8*
14.0	81.3	83.5	85.3	86.2	87.3	*87.2*	*87.3*	*86.8*	*86.0*	*84.4*	*83.2*
18.0	81.9	84.1	85.8	86.7	*87.0*	*86.9*	*86.8*	*86.2*	*85.3*		
22.0	82.5	84.7	*86.3*	*86.8*	*86.6*	*86.6*	*86.2*	*85.5*	*84.6*		
26.0	83.0	85.2	*85.9*	*86.5*	*86.3*	*86.1*	*85.6*	*84.8*	*83.9*		
30.0	83.6	*85.4*	*85.5*	*86.1*	*85.8*	*85.4*	*84.8*	*84.2*			
34.0	84.1	*84.9*	*84.9*	*85.4*	*85.1*	*84.7*	*84.1*				
38.0	*84.0*	*84.4*	*84.2*	*84.7*	*84.4*	*84.0*					
42.0	*83.5*	*83.7*	*83.5*	*84.0*	*83.6*						
46.0	*82.9*	*83.0*	*82.8*	*83.3*	*82.9*						
50.0	*82.1*	*82.3*	*82.0*	*82.6*							
54.0	*81.3*	*81.5*									

OAT < ISA + 10
OAT ≥ ISA + 10

LEFT INTENTIONALLY BLANK

GENERAL

Climb tables are established at MAX CLIMB THRUST with air conditioning in normal mode and anti ice OFF.
The climb speed profile is :
– 250 kt from 1500 feet up to FL100
– acceleration from 250 kt to 300 kt
– climb at 300 kt then M.78 up to selected altitude.
All charts are established with a center of gravity corresponding to 33%.

R

CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST	ISA	**FROM BRAKE RELEASE**
NORMAL AIR CONDITIONING	CG=33.0%	**TIME (MIN)** **FUEL (KG)**
ANTI-ICING OFF		**DISTANCE (NM)** **TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)													
	50		**52**		**54**		**56**		**58**		**60**		**62**	
390	17	1235	18	1302	19	1373	20	1449	21	1531	23	1620	24	1721
	108	385	114	385	121	386	129	387	138	389	147	390	158	392
370	15	1160	16	1220	17	1282	18	1347	19	1416	20	1489	21	1566
	95	378	101	378	106	379	112	380	118	381	125	382	132	382
350	14	1095	15	1150	15	1207	16	1267	17	1328	18	1393	19	1460
	86	371	90	372	95	372	100	373	105	374	111	374	116	375
330	13	1036	13	1087	14	1140	15	1195	15	1251	16	1310	17	1371
	77	364	81	365	86	365	90	366	94	366	99	367	104	367
310	12	978	12	1025	13	1074	14	1125	14	1177	15	1231	16	1287
	70	356	73	357	77	357	81	358	85	358	89	359	93	359
290	11	915	11	959	12	1005	12	1051	13	1099	13	1149	14	1200
	62	346	65	347	68	347	71	348	75	348	78	349	82	349
270	10	839	10	879	10	920	11	962	11	1005	12	1050	12	1096
	53	333	56	334	58	334	61	335	64	335	67	335	70	336
250	9	770	9	806	9	843	10	881	10	920	11	960	11	1002
	46	321	48	321	50	322	52	322	55	322	57	323	60	323
240	8	737	8	771	9	806	9	843	10	880	10	918	10	957
	42	314	44	315	46	315	48	316	51	316	53	316	55	317
220	7	674	8	705	8	737	8	770	9	804	9	839	9	874
	36	302	38	303	40	303	41	303	43	304	45	304	47	304
200	6	615	7	643	7	672	7	702	8	732	8	764	8	796
	31	289	32	290	34	290	35	291	37	291	39	291	40	291
180	6	559	6	584	6	610	6	637	7	665	7	693	7	722
	26	277	28	277	29	277	30	278	31	278	33	278	34	278
160	5	505	5	528	6	551	6	575	6	600	6	626	7	651
	22	263	23	264	24	264	25	264	26	265	28	265	29	265
140	4	453	5	474	5	495	5	517	5	539	6	561	6	585
	19	249	19	250	20	250	21	250	22	251	23	251	24	251
120	4	404	4	422	4	441	4	460	5	480	5	500	5	521
	15	234	16	234	17	235	17	235	18	235	19	236	20	236
100	3	323	3	337	3	352	4	368	4	384	4	400	4	417
	11	206	11	207	12	207	12	208	13	208	13	208	14	208
50	2	211	2	220	2	230	2	240	2	250	2	260	3	271
	6	168	6	169	6	169	6	170	7	170	7	170	7	170
15	1	132	1	138	1	144	1	150	2	156	2	163	2	170
	3	119	3	120	3	120	3	120	3	120	3	121	3	121

LOW AIR CONDITIONING	HIGH AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.5 %	ΔFUEL = + 0.5 %	ΔFUEL = + 2 %	ΔFUEL = + 5 %

R

CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST	ISA	**FROM BRAKE RELEASE**
NORMAL AIR CONDITIONING	CG=33.0%	**TIME (MIN)** **FUEL (KG)**
ANTI-ICING OFF		**DISTANCE (NM)** **TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)													
	64		**66**		**68**		**70**		**72**		**74**		**76**	
390	26	1835												
	172	394												
370	22	1650	23	1740	25	1840	27	1952	29	2081				
	141	384	150	385	160	387	172	389	186	391				
350	20	1531	21	1606	22	1686	23	1773	24	1867	26	1970	27	2086
	123	376	129	377	137	378	145	379	153	381	163	383	175	385
330	18	1435	19	1502	20	1571	20	1645	22	1724	23	1808	24	1899
	109	368	115	369	120	370	127	371	133	372	141	373	149	375
310	16	1346	17	1406	18	1469	19	1534	19	1604	20	1677	21	1755
	97	360	102	360	107	361	112	362	117	363	123	364	130	365
290	15	1254	15	1308	16	1365	17	1424	17	1487	18	1552	19	1620
	86	350	90	350	94	351	98	352	103	352	108	353	113	354
270	13	1143	14	1192	14	1242	15	1295	15	1349	16	1406	17	1465
	73	336	76	337	80	337	83	338	87	339	91	339	95	340
250	12	1044	12	1088	13	1133	13	1180	14	1228	14	1278	15	1330
	62	323	65	324	68	324	71	325	74	326	77	326	80	327
240	11	998	11	1039	12	1082	12	1126	13	1171	13	1219	14	1268
	58	317	60	317	63	318	65	318	68	319	71	320	74	320
220	10	910	10	948	10	986	11	1025	11	1066	12	1108	12	1152
	49	304	51	305	53	305	56	306	58	306	60	307	63	308
200	9	828	9	862	9	896	10	932	10	968	10	1006	11	1045
	42	292	44	292	45	293	47	293	49	294	51	294	53	295
180	8	751	8	781	8	812	9	844	9	877	9	911	10	946
	35	279	37	279	38	279	40	280	42	281	43	281	45	282
160	7	678	7	705	7	733	8	762	8	791	8	821	8	852
	30	265	31	266	32	266	34	267	35	267	36	268	38	269
140	6	609	6	633	6	658	7	683	7	709	7	736	7	764
	25	251	26	252	27	252	28	253	29	253	30	254	32	255
120	5	542	5	563	6	586	6	608	6	631	6	655	7	680
	21	236	21	236	22	237	23	238	24	238	25	239	26	240
100	4	434	4	451	4	469	5	487	5	505	5	525	5	544
	14	209	15	209	16	210	16	211	17	211	17	212	18	213
50	3	282	3	293	3	305	3	316	3	328	3	340	3	352
	8	171	8	171	8	172	8	173	9	174	9	174	9	176
15	2	177	2	184	2	191	2	198	2	205	2	212	2	219
	3	121	4	122	4	122	4	123	4	124	4	125	4	126

LOW AIR CONDITIONING	**HIGH AIR CONDITIONING**	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.5 %	ΔFUEL = + 0.5 %	ΔFUEL = + 2 %	ΔFUEL = + 5 %

R

CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST	ISA+10	FROM BRAKE RELEASE	
NORMAL AIR CONDITIONING	CG=33.0%	TIME (MIN)	FUEL (KG)
ANTI-ICING OFF		DISTANCE (NM)	TAS (KT)

FL	WEIGHT AT BRAKE RELEASE (1000KG)													
	50		52		54		56		58		60		62	
390	17	1296	18	1367	19	1441	21	1521	22	1608	23	1702	25	1808
	114	394	120	395	128	396	136	397	145	398	155	399	167	401
370	16	1217	16	1280	17	1345	18	1414	19	1486	20	1563	21	1645
	100	387	106	387	112	388	118	389	125	390	132	391	139	392
350	14	1148	15	1206	16	1266	17	1329	17	1394	18	1462	19	1533
	90	380	95	381	100	381	105	382	111	383	116	383	123	384
330	13	1086	14	1139	14	1195	15	1252	16	1312	17	1374	17	1438
	81	373	86	374	90	374	94	375	99	375	104	376	109	376
310	12	1024	13	1074	13	1125	14	1179	15	1234	15	1291	16	1350
	73	365	77	365	81	366	85	366	89	367	93	368	98	368
290	11	958	12	1004	12	1051	13	1101	13	1151	14	1203	14	1257
	65	355	68	355	72	356	75	356	79	357	82	357	86	358
270	10	877	10	919	11	962	11	1006	12	1052	12	1098	13	1147
	56	342	58	342	61	343	64	343	67	343	70	344	73	344
250	9	804	9	842	10	880	10	920	10	961	11	1004	11	1047
	48	329	50	329	52	330	55	330	57	330	60	331	63	331
240	8	769	9	805	9	842	9	880	10	919	10	959	11	1000
	44	322	46	323	48	323	51	324	53	324	55	324	58	325
220	7	703	8	736	8	769	8	804	9	839	9	875	9	912
	38	310	40	310	42	311	43	311	45	311	47	312	49	312
200	7	641	7	671	7	701	7	732	8	764	8	796	8	830
	32	297	34	298	35	298	37	298	39	299	40	299	42	299
180	6	582	6	608	6	636	7	664	7	693	7	722	7	752
	27	284	29	284	30	285	31	285	33	286	34	286	36	286
160	5	525	5	549	6	574	6	599	6	625	6	652	7	679
	23	270	24	271	25	271	26	272	28	272	29	272	30	272
140	5	471	5	493	5	515	5	538	5	561	6	585	6	609
	19	256	20	257	21	257	22	258	23	258	24	258	25	258
120	4	419	4	439	4	458	5	478	5	499	5	520	5	542
	16	241	17	242	18	242	18	242	19	243	20	243	21	243
100	3	335	3	350	3	366	4	382	4	399	4	416	4	433
	11	213	12	214	12	214	13	215	13	215	14	216	14	216
50	2	218	2	228	2	238	2	248	2	259	2	270	3	281
	6	176	6	177	6	177	7	178	7	178	7	178	8	179
15	1	136	1	142	1	148	1	155	2	161	2	168	2	175
	3	128	3	128	3	128	3	129	3	129	3	130	4	130

LOW AIR CONDITIONING	HIGH AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.5 %	ΔFUEL = + 0.5 %	ΔFUEL = + 2 %	ΔFUEL = + 5 %

R

CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST	ISA+10	**FROM BRAKE RELEASE**
NORMAL AIR CONDITIONING	CG=33.0%	**TIME (MIN)** **FUEL (KG)**
ANTI-ICING OFF		**DISTANCE (NM)** **TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG) 64	66	68	70	72	74	76
390	27 1929 181 403						
370	23 1733 148 393	24 1828 157 394	25 1934 168 396	27 2052 181 398			
350	20 1608 129 385	21 1687 136 386	22 1771 144 387	23 1862 152 389	25 1962 162 390	26 2071 172 392	28 2194 184 394
330	18 1506 115 377	19 1576 121 378	20 1650 127 379	21 1728 133 380	22 1811 140 381	23 1900 148 383	24 1996 157 384
310	17 1411 102 369	17 1474 107 369	18 1541 112 370	19 1610 118 371	20 1684 124 372	21 1761 130 373	22 1844 136 374
290	15 1313 90 358	16 1371 94 359	16 1431 99 360	17 1493 103 360	18 1559 108 361	19 1628 113 362	20 1700 119 363
270	13 1196 77 345	14 1248 80 345	14 1301 83 346	15 1356 87 346	16 1413 91 347	16 1473 95 348	17 1536 99 349
250	12 1091 65 331	12 1137 68 332	13 1185 71 332	13 1234 74 333	14 1285 77 334	14 1337 81 335	15 1393 84 335
240	11 1042 60 325	12 1086 63 325	12 1131 66 326	13 1177 68 327	13 1225 71 327	14 1275 74 328	14 1327 77 329
220	10 950 51 312	10 990 54 313	11 1030 56 313	11 1071 58 314	12 1114 61 314	12 1159 63 315	12 1205 66 316
200	9 864 44 299	9 900 46 300	9 936 48 300	10 973 49 301	10 1012 51 302	11 1051 54 302	11 1093 56 303
180	8 783 37 286	8 815 39 287	8 847 40 287	9 881 42 288	9 915 44 288	9 951 45 289	10 988 47 290
160	7 707 31 273	7 735 33 273	7 764 34 274	8 794 35 274	8 825 37 275	8 857 38 276	9 890 40 277
140	6 634 26 259	6 659 27 259	7 685 28 260	7 712 29 260	7 740 31 261	7 768 32 262	8 798 33 263
120	5 564 22 243	6 587 22 244	6 610 23 245	6 634 24 245	6 658 25 246	6 684 26 247	7 710 27 248
100	4 451 15 216	4 469 16 217	5 488 16 218	5 507 17 218	5 527 18 219	5 547 18 220	5 568 19 221
50	3 293 8 179	3 305 8 180	3 316 9 180	3 329 9 182	3 341 9 183	3 354 10 184	3 367 10 185
15	2 183 4 130	2 190 4 131	2 198 4 132	2 205 4 133	2 213 4 134	2 221 4 136	2 229 5 137

LOW AIR CONDITIONING	HIGH AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.5 %	ΔFUEL = + 0.5 %	ΔFUEL = + 2 %	ΔFUEL = + 5 %

R

CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST	ISA+15	FROM BRAKE RELEASE
NORMAL AIR CONDITIONING	CG=33.0%	**TIME (MIN)** **FUEL (KG)**
ANTI-ICING OFF		**DISTANCE (NM)** **TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)													
	50		**52**		**54**		**56**		**58**		**60**		**62**	
390	20	1405	21	1484	22	1570	24	1662	25	1764	27	1879		
	131	401	140	402	149	403	159	404	170	406	184	408		
370	18	1313	19	1384	20	1457	21	1535	22	1617	23	1705	25	1800
	115	394	122	395	129	396	137	396	145	397	154	398	163	400
350	16	1237	17	1302	18	1368	19	1438	20	1512	21	1589	22	1670
	103	387	109	388	115	389	121	389	128	390	135	391	143	392
330	15	1167	15	1227	16	1288	17	1352	18	1419	19	1489	20	1562
	93	380	98	381	103	381	109	382	114	383	120	383	127	384
310	13	1098	14	1153	15	1209	16	1268	16	1329	17	1393	18	1459
	83	372	88	372	92	373	97	374	102	374	107	375	113	375
290	12	1023	13	1073	13	1125	14	1179	15	1235	15	1293	16	1352
	74	361	78	362	81	363	85	363	90	364	94	364	99	365
270	11	933	11	978	12	1024	12	1073	13	1122	14	1174	14	1226
	63	348	66	348	69	349	72	349	76	350	80	350	83	351
250	10	851	10	892	11	934	11	977	12	1022	12	1068	13	1115
	54	335	56	335	59	336	62	336	65	336	68	337	71	337
240	9	813	9	852	10	892	10	933	11	975	11	1018	12	1063
	50	328	52	329	54	329	57	329	60	330	62	330	65	331
220	8	741	8	776	9	812	9	849	10	887	10	926	10	966
	42	315	44	316	46	316	49	317	51	317	53	317	55	317
200	7	673	7	705	8	737	8	770	9	805	9	840	9	875
	36	302	38	303	39	303	41	303	43	304	45	304	47	304
180	6	609	7	638	7	667	7	697	8	727	8	759	8	791
	30	289	32	289	33	290	35	290	36	290	38	291	40	291
160	6	549	6	574	6	600	6	627	7	654	7	682	7	711
	25	275	27	275	28	276	29	276	30	276	32	277	33	277
140	5	491	5	514	5	537	6	561	6	585	6	610	6	636
	21	260	22	261	23	261	24	261	25	262	26	262	28	262
120	4	436	4	456	5	476	5	498	5	519	5	542	6	564
	17	245	18	245	19	245	20	246	21	246	22	246	23	247
100	3	346	3	362	4	379	4	396	4	413	4	431	4	449
	12	216	13	217	13	217	14	218	14	218	15	218	16	219
50	2	225	2	235	2	245	2	256	3	267	3	279	3	291
	6	178	7	178	7	179	7	179	8	180	8	180	8	181
15	1	139	1	146	1	152	2	159	2	166	2	173	2	180
	3	127	3	128	3	128	3	128	3	129	4	129	4	130

LOW AIR CONDITIONING	HIGH AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.5 %	ΔFUEL = + 0.5 %	ΔFUEL = + 2 %	ΔFUEL = + 5 %

R

CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST	ISA+15	**FROM BRAKE RELEASE**
NORMAL AIR CONDITIONING	CG=33.0%	**TIME (MIN)** **FUEL (KG)**
ANTI-ICING OFF		**DISTANCE (NM)** **TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)													
	64		**66**		**68**		**70**		**72**		**74**		**76**	
390														
370	26	1904	28	2019	30	2149								
	174	401	187	403	201	405								
350	23	1756	24	1848	26	1948	27	2057	29	2179	31	2316	33	2476
	151	393	160	394	169	395	180	397	193	399	207	401	225	403
330	21	1638	22	1719	23	1804	24	1895	26	1994	27	2101	29	2219
	133	385	141	386	148	387	156	388	166	389	176	391	187	393
310	19	1528	20	1600	21	1676	22	1756	23	1841	24	1933	25	2030
	118	376	124	377	131	378	137	379	145	380	152	381	161	382
290	17	1415	18	1479	19	1547	19	1618	20	1693	21	1772	22	1856
	103	365	108	366	114	367	119	368	125	369	131	370	138	371
270	15	1281	16	1338	16	1397	17	1459	18	1523	19	1591	19	1662
	87	351	91	352	95	352	100	353	104	354	109	355	115	356
250	13	1163	14	1214	14	1266	15	1320	16	1377	16	1436	17	1498
	74	338	77	338	81	339	84	339	88	340	92	341	96	341
240	12	1109	13	1157	13	1206	14	1257	15	1310	15	1365	16	1423
	68	331	71	331	74	332	77	333	81	333	84	334	88	335
220	11	1007	11	1050	12	1094	12	1139	13	1186	13	1235	14	1286
	58	318	60	318	63	319	66	319	68	320	71	321	74	321
200	10	912	10	950	10	990	11	1030	11	1072	12	1116	12	1161
	49	305	51	305	53	306	55	306	58	307	60	307	63	308
180	8	824	9	858	9	893	10	929	10	967	10	1005	11	1046
	41	291	43	291	45	292	47	292	49	293	50	294	53	294
160	7	741	8	771	8	803	8	835	9	868	9	903	9	938
	35	277	36	278	37	278	39	279	41	279	42	280	44	281
140	7	663	7	690	7	718	7	747	8	776	8	807	8	838
	29	263	30	263	31	264	32	264	34	265	35	265	37	266
120	6	588	6	612	6	637	6	662	7	689	7	716	7	744
	24	247	25	247	26	248	27	249	28	249	29	250	30	251
100	4	468	5	487	5	507	5	527	5	548	5	570	6	592
	16	219	17	220	18	220	18	221	19	222	20	223	21	224
50	3	303	3	315	3	328	3	341	3	354	3	368	3	382
	9	181	9	182	9	182	10	183	10	184	10	186	11	187
15	2	188	2	195	2	203	2	211	2	219	2	228	2	236
	4	130	4	131	4	132	4	133	5	134	5	135	5	137

LOW AIR CONDITIONING	**HIGH AIR CONDITIONING**	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.5 %	ΔFUEL = + 0.5 %	ΔFUEL = + 2 %	ΔFUEL = + 5 %

R

CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+20 CG=33.0%	**FROM BRAKE RELEASE** **TIME (MIN)** **FUEL (KG)** **DISTANCE (NM)** **TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)													
	50		**52**		**54**		**56**		**58**		**60**		**62**	
390	23	1550	24	1644	26	1746	28	1860						
	156	409	166	410	178	411	192	413						
370	20	1440	21	1521	23	1606	24	1697	26	1794	27	1899	29	2016
	135	401	144	402	152	403	162	404	172	405	184	406	197	408
350	18	1352	19	1425	21	1502	22	1583	23	1668	24	1758	26	1855
	121	394	128	395	135	396	143	397	151	398	161	399	170	400
330	17	1272	18	1339	19	1409	20	1482	21	1559	22	1640	23	1725
	109	387	115	388	121	388	128	389	135	390	142	391	150	392
310	15	1192	16	1253	17	1317	18	1384	19	1454	20	1526	21	1603
	97	379	102	379	108	380	113	380	119	381	126	382	133	383
290	14	1104	15	1160	15	1218	16	1279	17	1341	18	1406	19	1475
	85	368	89	368	94	369	99	369	104	370	109	371	115	371
270	12	1000	13	1050	13	1101	14	1155	15	1210	15	1267	16	1326
	72	353	75	354	79	354	83	355	87	355	91	356	96	356
250	11	909	11	953	12	999	12	1046	13	1095	14	1146	14	1198
	61	339	64	340	67	340	70	341	74	341	77	342	81	342
240	10	866	11	908	11	952	12	996	12	1043	13	1090	13	1139
	56	333	59	333	62	334	65	334	68	334	71	335	74	335
220	9	786	9	824	10	863	10	903	11	944	11	987	12	1030
	47	319	50	320	52	320	55	320	57	321	60	321	63	322
200	8	712	8	745	9	780	9	816	9	853	10	890	10	929
	40	306	42	306	44	306	46	307	48	307	50	307	53	308
180	7	641	7	672	8	703	8	735	8	768	9	801	9	836
	34	292	35	292	37	292	39	293	40	293	42	293	44	293
160	6	576	6	603	7	631	7	659	7	688	8	718	8	749
	28	277	29	277	31	278	32	278	34	278	35	279	37	279
140	5	514	6	538	6	562	6	588	6	614	7	641	7	668
	23	262	24	262	26	263	27	263	28	263	29	264	30	264
120	5	454	5	476	5	497	5	520	6	543	6	567	6	591
	19	246	20	246	21	246	22	247	23	247	24	247	25	248
100	4	360	4	377	4	394	4	412	4	430	4	449	5	468
	13	216	14	216	14	217	15	217	16	218	16	218	17	218
50	2	233	2	243	3	255	3	266	3	278	3	290	3	302
	7	176	7	176	7	177	8	177	8	178	8	178	9	178
15	1	144	2	150	2	157	2	164	2	172	2	179	2	187
	3	123	3	123	3	124	3	124	4	124	4	125	4	125

LOW AIR CONDITIONING	**HIGH AIR CONDITIONING**	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.5 %	ΔFUEL = + 0.5 %	ΔFUEL = + 2 %	ΔFUEL = + 5 %

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CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+20 CG=33.0%	**FROM BRAKE RELEASE** **TIME (MIN)** **FUEL (KG)** **DISTANCE (NM)** **TAS (KT)**

FL	64	66	68	70	72	74	76
	WEIGHT AT BRAKE RELEASE (1000KG)						
390							
370	31 2145 212 409						
350	27 1959 181 401	29 2071 193 402	31 2195 206 404	33 2335 222 406	35 2496 240 408		
330	24 1815 159 393	26 1912 168 394	27 2015 178 395	29 2127 189 397	30 2250 202 398	32 2389 216 400	35 2544 233 402
310	22 1683 140 384	23 1768 147 385	24 1858 156 386	26 1954 164 387	27 2058 174 388	28 2171 185 389	30 2294 197 391
290	19 1546 121 372	20 1620 127 373	21 1699 134 374	23 1781 141 375	24 1870 148 376	25 1966 157 377	26 2067 166 378
270	17 1387 101 357	18 1451 105 357	19 1519 111 358	19 1589 116 359	20 1663 122 360	21 1742 128 361	22 1825 135 362
250	15 1252 84 343	15 1308 88 343	16 1367 92 344	17 1428 97 344	18 1492 101 345	18 1559 106 346	19 1630 111 346
240	14 1190 78 336	14 1243 81 336	15 1298 85 337	16 1355 89 337	16 1415 93 338	17 1478 97 339	18 1544 102 339
220	12 1075 65 322	13 1122 68 322	13 1171 71 323	14 1221 75 323	14 1274 78 324	15 1329 81 325	16 1386 85 325
200	11 969 55 308	11 1011 57 308	12 1054 60 309	12 1099 62 309	13 1145 65 310	13 1193 68 310	14 1244 71 311
180	9 872 46 294	10 908 48 294	10 947 50 295	11 986 52 295	11 1027 54 296	11 1070 57 296	12 1114 59 297
160	8 781 38 279	9 814 40 280	9 848 42 280	9 883 43 280	10 919 45 281	10 957 47 281	10 996 49 282
140	7 696 32 264	7 725 33 265	8 756 34 265	8 787 36 265	8 819 37 266	9 852 39 266	9 887 40 267
120	6 616 26 248	7 642 27 248	7 668 28 249	7 696 29 249	7 724 31 250	8 754 32 250	8 784 33 251
100	5 488 18 219	5 509 19 219	5 530 19 220	5 552 20 220	6 574 21 221	6 598 22 222	6 622 23 222
50	3 315 9 179	3 328 10 179	3 341 10 180	3 355 10 181	4 370 11 182	4 384 11 182	4 399 12 183
15	2 195 4 126	2 203 4 127	2 211 4 127	2 220 5 128	2 229 5 129	2 238 5 130	2 247 5 131

LOW AIR CONDITIONING	**HIGH AIR CONDITIONING**	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.5 %	ΔFUEL = + 0.5 %	ΔFUEL = + 2 %	ΔFUEL = + 5 %

GENERAL

Cruise tables are established :
- for ISA, ISA + 10, ISA + 15 and ISA + 20
- with normal air conditioning and anti ice OFF
- from FL290 to FL390 at M.78
- from FL100 to FL390 at long range speed.
- with a 33 % center of gravity.

OPTIMUM MACH NUMBER

Seven tables give the optimum Mach number versus cost index, altitude and wind, as calculated by the FMGC.

COST INDEX = 0 (MAXIMUM RANGE)

WEIGHT 1000kg	WIND (kt)	FL 290	FL 310	FL 330	FL 350	FL 370	FL 390
50	100.	.581	.606	.633	.659	.689	.727
	50.	.594	.620	.648	.672	.705	.742
	0.	.612	.637	.668	.688	.726	.760
	–50.	.629	.657	.685	.715	.747	.771
	–100.	.652	.683	.709	.750	.773	.783
55	100.	.607	.634	.659	.689	.727	.754
	50.	.621	.649	.672	.705	.742	.764
	0.	.639	.669	.689	.725	.759	.777
	–50.	.658	.686	.715	.747	.771	.781
	–100.	.684	.709	.750	.773	.783	.785
60	100.	.633	.658	.686	.723	.753	.767
	50.	.648	.671	.702	.738	.763	.773
	0.	.668	.688	.722	.756	.776	.780
	–50.	.685	.713	.744	.769	.781	.783
	–100.	.708	.746	.771	.782	.785	.785
65	100.	.655	.683	.717	.748	.766	
	50.	.668	.698	.733	.760	.772	
	0.	.685	.717	.752	.774	.780	
	–50.	.709	.739	.766	.779	.783	
	–100.	.741	.768	.781	.785	.785	
70	100.	.677	.709	.743	.764		
	50.	.692	.726	.755	.771		
	0.	.710	.746	.770	.779		
	–50.	.733	.761	.777	.783		
	–100.	.764	.780	.785	.785		
75	100.	.700	.737	.759	.769		
	50.	.718	.750	.767	.775		
	0.	.739	.766	.778	.781		
	–50.	.757	.775	.782	.783		
	–100.	.778	.784	.785	.784		

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COST INDEX = 10 kg/min

WEIGHT 1000kg	WIND (kt)	FL 290	FL 310	FL 330	FL 350	FL 370	FL 390
50	100.	.616	.643	.674	.699	.735	.765
	50.	.630	.659	.688	.721	.753	.775
	0.	.646	.678	.706	.748	.773	.783
	–50.	.672	.699	.746	.775	.782	.786
	–100.	.710	.749	.778	.783	.786	.789
55	100.	.641	.672	.695	.732	.763	.778
	50.	.657	.686	.716	.749	.773	.782
	0.	.676	.703	.743	.771	.783	.785
	–50.	.697	.739	.771	.782	.786	.787
	–100.	.740	.777	.782	.786	.788	.790
60	100.	.669	.690	.725	.759	.777	.781
	50.	.682	.710	.743	.769	.781	.783
	0.	.699	.735	.764	.781	.785	.785
	–50.	.729	.764	.780	.785	.787	.786
	–100.	.771	.782	.785	.788	.789	.789
65	100.	.685	.717	.752	.774	.780	
	50.	.703	.735	.764	.779	.783	
	0.	.726	.757	.777	.784	.785	
	–50.	.756	.776	.784	.786	.786	
	–100.	.779	.784	.787	.789	.789	
70	100.	.708	.744	.769	.779		
	50.	.726	.757	.775	.782		
	0.	.749	.772	.783	.785		
	–50.	.771	.782	.786	.786		
	–100.	.783	.786	.788	.789		
75	100.	.734	.763	.777	.780		
	50.	.750	.772	.781	.782		
	0.	.767	.780	.784	.784		
	–50.	.781	.785	.786	.784		
	–100.	.785	.788	.788	.787		

COST INDEX = 20 kg/min

WEIGHT 1000kg	WIND (kt)	FL 290	FL 310	FL 330	FL 350	FL 370	FL 390
50	100.	.643	.675	.704	.746	.773	.783
	50.	.660	.693	.733	.770	.782	.786
	0.	.689	.716	.766	.781	.785	.788
	–50.	.721	.761	.781	.785	.788	.791
	–100.	.771	.786	.788	.790	.792	.794
55	100.	.671	.699	.738	.768	.782	.785
	50.	.689	.721	.761	.779	.785	.786
	0.	.706	.760	.778	.784	.787	.789
	–50.	.756	.779	.784	.787	.790	.792
	–100.	.780	.786	.788	.791	.794	.794
60	100.	.693	.728	.759	.779	.785	.785
	50.	.710	.752	.775	.784	.786	.785
	0.	.749	.775	.783	.786	.788	.787
	–50.	.777	.783	.786	.789	.791	.790
	–100.	.784	.787	.790	.792	.794	.793
65	100.	.718	.750	.773	.783	.785	
	50.	.740	.769	.782	.785	.785	
	0.	.768	.781	.785	.787	.787	
	–50.	.781	.785	.788	.790	.790	
	–100.	.786	.789	.791	.793	.793	
70	100.	.739	.766	.780	.784		
	50.	.761	.780	.785	.785		
	0.	.777	.784	.786	.787		
	–50.	.784	.787	.789	.789		
	–100.	.787	.790	.792	.793		
75	100.	.759	.776	.783	.783		
	50.	.775	.784	.785	.784		
	0.	.783	.786	.786	.785		
	–50.	.785	.788	.789	.788		
	–100.	.789	.791	.792	.790		

R

COST INDEX = 40 kg/min

WEIGHT 1000kg	WIND (kt)	FL 290	FL 310	FL 330	FL 350	FL 370	FL 390
50	**100.**	.709	.754	.779	.785	.788	.791
	50.	.740	.772	.785	.788	.791	.794
	0.	.780	.787	.789	.792	.794	.795
	–50.	.790	.792	.794	.795	.796	.798
	–100.	.795	.796	.798	.799	.799	.800
55	**100.**	.734	.778	.783	.787	.789	.791
	50.	.764	.782	.786	.789	.792	.794
	0.	.783	.787	.790	.793	.795	.795
	–50.	.790	.792	.794	.795	.797	.798
	–100.	.795	.796	.798	.798	.799	.800
60	**100.**	.765	.781	.785	.788	.790	.789
	50.	.779	.784	.788	.790	.792	.792
	0.	.785	.788	.791	.794	.795	.794
	–50.	.790	.792	.794	.796	.797	.796
	–100.	.795	.796	.797	.798	.799	.798
65	**100.**	.776	.783	.787	.789	.789	
	50.	.783	.786	.789	.791	.791	
	0.	.786	.789	.792	.794	.793	
	–50.	.790	.793	.795	.796	.796	
	–100.	.795	.796	.797	.798	.798	
70	**100.**	.781	.785	.788	.788		
	50.	.784	.788	.790	.790		
	0.	.787	.790	.792	.793		
	–50.	.791	.793	.795	.795		
	–100.	.794	.796	.797	.798		
75	**100.**	.784	.787	.787	.786		
	50.	.786	.789	.790	.788		
	0.	.789	.791	.792	.790		
	–50.	.792	.794	.795	.790		
	–100.	.795	.796	.797	.790		

COST INDEX = 60 kg/min

WEIGHT 1000kg	WIND (kt)	FL 290	FL 310	FL 330	FL 350	FL 370	FL 390
50	**100.**	.785	.788	.790	.793	.794	.796
	50.	.790	.792	.794	.795	.796	.798
	0.	.794	.795	.797	.799	.799	.800
	–50.	.797	.799	.800	.800	.800	.800
	–100.	.800	.800	.800	.800	.800	.800
55	**100.**	.785	.788	.791	.793	.795	.796
	50.	.790	.792	.794	.795	.797	.798
	0.	.793	.795	.797	.797	.799	.800
	–50.	.797	.799	.800	.800	.800	.800
	–100.	.800	.800	.800	.800	.800	.800
60	**100.**	.786	.788	.791	.794	.795	.794
	50.	.790	.792	.794	.796	.797	.796
	0.	.793	.795	.796	.798	.799	.798
	–50.	.797	.799	.799	.800	.800	.798
	–100.	.800	.800	.800	.800	.800	.798
65	**100.**	.786	.789	.792	.794	.794	
	50.	.790	.792	.794	.796	.795	
	0.	.793	.795	.796	.798	.797	
	–50.	.797	.798	.798	.800	.800	
	–100.	.800	.800	.800	.800	.800	
70	**100.**	.787	.790	.793	.793		
	50.	.790	.793	.795	.795		
	0.	.793	.795	.797	.797		
	–50.	.796	.797	.799	.799		
	–100.	.800	.800	.800	.800		
75	**100.**	.789	.791	.792	.790		
	50.	.791	.794	.794	.790		
	0.	.794	.796	.796	.790		
	–50.	.796	.798	.798	.790		
	–100.	.799	.800	.800	.790		

R

COST INDEX = 80 kg/min							
		FLIGHT LEVEL					
WEIGHT/WIND 1000kg	(kt)	290	310	330	350	370	390
50	100.	.793	.795	.797	.798	.799	.800
	50.	.796	.798	.800	.800	.800	.800
	0.	.799	.800	.800	.800	.800	.800
	–50.	.800	.800	.800	.800	.800	.800
	–100.	.800	.800	.800	.800	.800	.800
55	100.	.793	.795	.796	.797	.799	.799
	50.	.796	.798	.799	.799	.800	.800
	0.	.799	.800	.800	.800	.800	.800
	–50.	.800	.800	.800	.800	.800	.800
	–100.	.800	.800	.800	.800	.800	.800
60	100.	.793	.794	.796	.797	.799	.798
	50.	.796	.797	.798	.799	.800	.798
	0.	.799	.800	.800	.800	.800	.798
	–50.	.800	.800	.800	.800	.800	.798
	–100.	.800	.800	.800	.800	.800	.798
65	100.	.792	.794	.796	.797	.797	
	50.	.795	.796	.798	.799	.799	
	0.	.799	.799	.800	.800	.800	
	–50.	.800	.800	.800	.800	.800	
	–100.	.800	.800	.800	.800	.800	
70	100.	.793	.794	.796	.796		
	50.	.795	.796	.798	.798		
	0.	.798	.798	.800	.800		
	–50.	.800	.800	.800	.800		
	–100.	.800	.800	.800	.800		
75	100.	.793	.795	.796	.790		
	50.	.795	.797	.797	.790		
	0.	.797	.799	.799	.790		
	–50.	.799	.800	.800	.790		
	–100.	.800	.800	.800	.790		

COST INDEX = 100 kg/min							
		FLIGHT LEVEL					
WEIGHT/WIND 1000kg	(kt)	290	310	330	350	370	390
50	100.	.797	.800	.800	.800	.800	.800
	50.	.800	.800	.800	.800	.800	.800
	0.	.800	.800	.800	.800	.800	.800
	–50.	.800	.800	.800	.800	.800	.800
	–100.	.800	.800	.800	.800	.800	.800
55	100.	.797	.800	.800	.800	.800	.800
	50.	.800	.800	.800	.800	.800	.800
	0.	.800	.800	.800	.800	.800	.800
	–50.	.800	.800	.800	.800	.800	.800
	–100.	.800	.800	.800	.800	.800	.800
60	100.	.797	.799	.799	.800	.800	.798
	50.	.800	.800	.800	.800	.800	.798
	0.	.800	.800	.800	.800	.800	.798
	–50.	.800	.800	.800	.800	.800	.798
	–100.	.800	.800	.800	.800	.800	.798
65	100.	.797	.798	.799	.800	.800	
	50.	.800	.800	.800	.800	.800	
	0.	.800	.800	.800	.800	.800	
	–50.	.800	.800	.800	.800	.800	
	–100.	.800	.800	.800	.800	.800	
70	100.	.796	.797	.799	.799		
	50.	.799	.799	.800	.800		
	0.	.800	.800	.800	.800		
	–50.	.800	.800	.800	.800		
	–100.	.800	.800	.800	.800		
75	100.	.796	.798	.798	.790		
	50.	.797	.799	.800	.790		
	0.	.800	.800	.800	.790		
	–50.	.800	.800	.800	.790		
	–100.	.800	.800	.800	.790		

OPTIMUM AND MAXIMUM ALTITUDES

DEFINITIONS

· Optimum altitude : The altitude at which the airplane covers the maximum distance per kilogram (pound) of fuel (best specific range). It depends on the actual weight and deviation from ISA.
· Maximum altitude is defined as the lower of :
 – maximum altitude at maximum cruise thrust in level flight and
 – maximum altitude at maximum climb thrust with 300 feet/minute vertical speed.

Note : Definition of the maximum altitude in the FMGC is different (Refer to FCOM 4).

CRUISE LEVEL CHARTS

These charts have been established for a center of gravity at 33 % MAC.
Maximum and optimum altitudes are given for different temperatures at long range speed and M.78.

Note : The n = 1.3 g (1.4 g) curve indicates the buffet margin.

R **OPTIMUM WEIGHT FOR 4000 FEET STEP CLIMB**

R

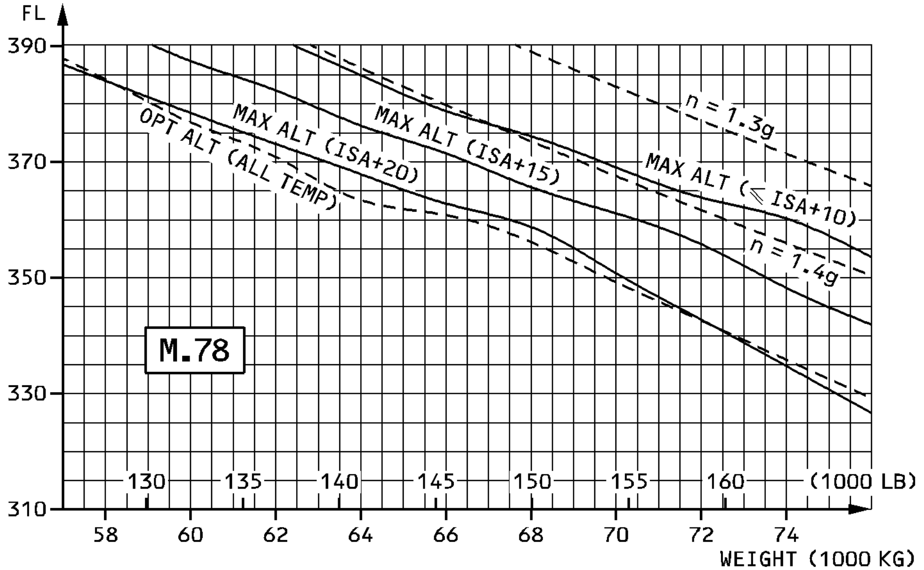
STEP CLIMB FROM/TO	WEIGHT (1000 kg/1000 lb)					
	≤ ISA + 10		ISA + 15		ISA + 20	
	LR	M.78	LR	M.78	LR	M.78
310/350	76/167	76/167	74/163	74/163	70/154	70/154
330/370	70/154	70/154	67/147	67/147	63/138	63/138
350/390	62/136	62/136	59/130	59/130	56/123	56/123

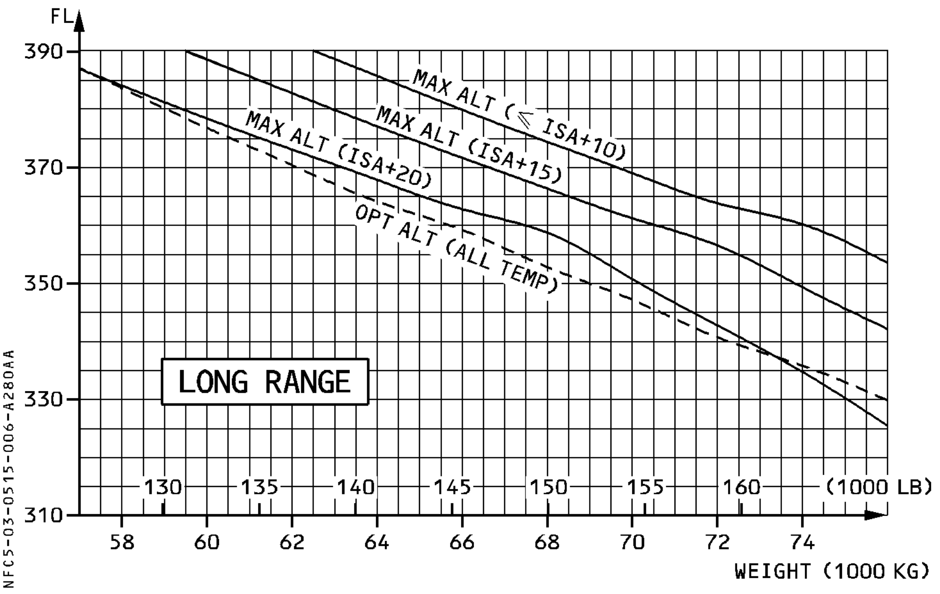
BLEED CORRECTIONS

R

CORRECTIONS	ENGINE ANTI ICE	TOTAL ANTI ICE
ISA	Max Alt. : – 200 ft Opt Alt. : – 300 ft	Max Alt. : – 400 ft Opt Alt. : – 300 ft
ISA + 10	Max Alt. : – 1200 ft Opt Alt. : – 200 ft	Max Alt. : – 2300 ft Opt Alt. : – 300 ft
ISA + 15	Max Alt. : – 1400 ft Opt Alt. : – 400 ft	Max. Alt. : – 3200 ft Opt Alt. – 1600 ft
ISA + 20	Max Alt. : – 3000 ft Opt Alt. : – 3000 ft	Max Alt. : – 5500 ft Opt Alt. : – 5000 ft

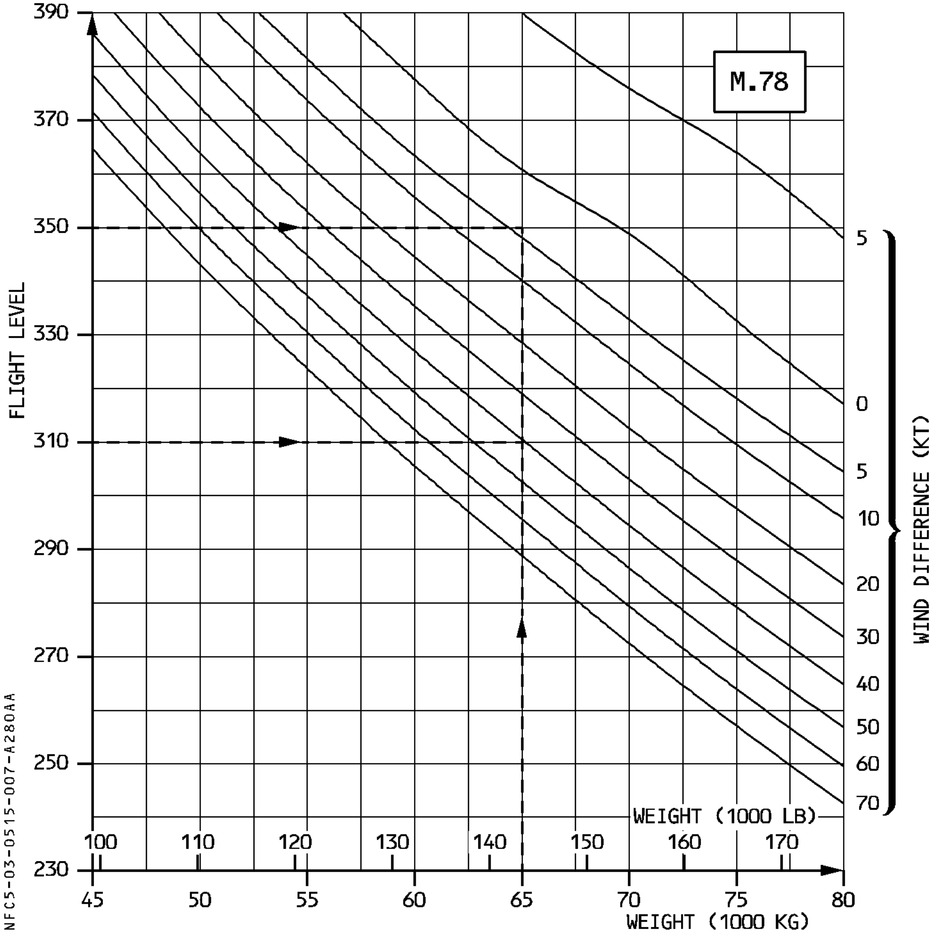
R


FL
390
370
350
330
310
MAX ALT (ISA+20)
OPT ALT (ALL TEMP)
MAX ALT (ISA+15)
n = 1.3g
MAX ALT (≤ ISA+10)
n = 1.4g
M.78
130
135
140
145
150
155
160
(1000 LB)
58
60
62
64
66
68
70
72
74
WEIGHT (1000 KG)


FL
390
370
350
330
310
MAX ALT (≤ ISA+10)
MAX ALT (ISA+15)
MAX ALT (ISA+20)
OPT ALT (ALL TEMP)
LONG RANGE
130
135
140
145
150
155
160
(1000 LB)
58
60
62
64
66
68
70
72
74
WEIGHT (1000 KG)
NFC5-03-0515-006-A280AA

WIND ALTITUDE TRADE FOR CONSTANT SPECIFIC RANGE

R



GIVEN : Weight : 65000 kg (143 300 lb)
R Wind at FL350 : 10 kt head
R FIND : Minimum wind difference to descend to FL310 : (40 – 4) = 36 kt
R RESULTS : Descent to FL310 may be considered provided the tail wind at this
R altitude is more than (36 – 10) = 26 kt.

OPTIMUM ALTITUDE ON SHORT STAGE

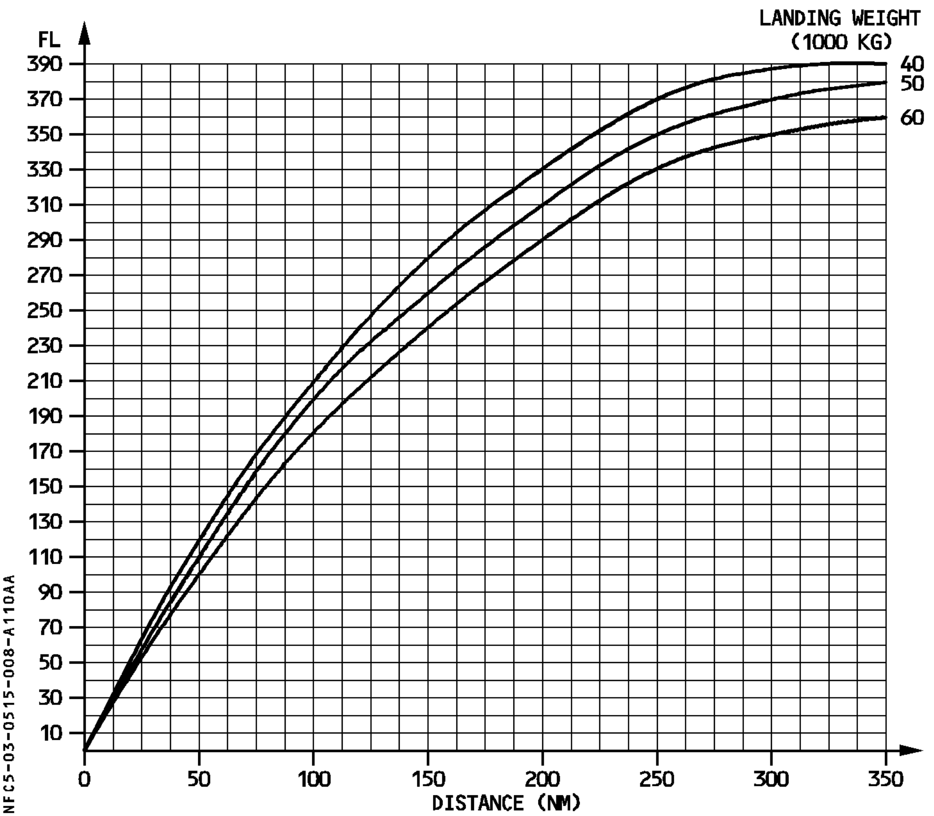
According to the air distance (from brake release point to landing), the cruise flight level is limited by the distance required to perform climb and descent. The graph determines the optimum altitude.

It includes the following profiles:

- Takeoff
- Climb: 250KT/300KT/M.78
- Long range cruise (during at least 5 minutes)
- Descent: M.78/300KT/250KT
- Approach and landing

and it is established for:

- ISA
- CG = 33 %
- Normal air conditioning
- Anti ice OFF



R

CRUISE - M.78

MAX. CRUISE THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=33.0%	N1 (%) KG/H/ENG NM/1000KG	MACH IAS (KT) TAS (KT)

WEIGHT (1000KG)	FL290		FL310		FL330		FL350		FL370		FL390	
50	80.3	.780	80.2	.780	80.0	.780	80.0	.780	80.5	.780	81.7	.780
	1305	302	1209	289	1124	277	1050	264	990	252	948	241
	176.9	462	189.2	458	201.7	454	214.0	450	225.8	447	235.9	447
52	80.5	.780	80.3	.780	80.2	.780	80.3	.780	80.9	.780	82.2	.780
	1314	302	1219	289	1136	277	1063	264	1007	252	970	241
	175.7	462	187.7	458	199.6	454	211.4	450	222.2	447	230.6	447
54	80.7	.780	80.5	.780	80.5	.780	80.6	.780	81.3	.780	82.7	.780
	1322	302	1230	289	1149	277	1078	264	1025	252	994	241
	174.5	462	186.1	458	197.3	454	208.5	450	218.3	447	225.0	447
56	80.8	.780	80.7	.780	80.7	.780	80.9	.780	81.8	.780	83.2	.780
	1332	302	1242	289	1163	277	1094	264	1045	252	1023	241
	173.2	462	184.3	458	195.1	454	205.5	450	214.1	447	218.8	447
58	81.0	.780	80.9	.780	81.0	.780	81.3	.780	82.2	.780	83.8	.780
	1343	302	1254	289	1176	277	1111	264	1068	252	1055	241
	171.9	462	182.5	458	192.8	454	202.4	450	209.5	447	211.9	447
60	81.2	.780	81.2	.780	81.3	.780	81.7	.780	82.7	.780	84.4	.780
	1354	302	1268	289	1192	277	1129	264	1093	252	1090	241
	170.5	462	180.5	458	190.3	454	199.1	450	204.7	447	205.3	447
62	81.4	.780	81.4	.780	81.6	.780	82.1	.780	83.2	.780	85.1	.780
	1366	302	1281	289	1208	277	1150	264	1121	252	1126	241
	169.0	462	178.7	458	187.8	454	195.4	450	199.6	447	198.7	447
64	81.6	.780	81.6	.780	81.9	.780	82.6	.780	83.7	.780	85.9	.780
	1379	302	1295	289	1225	277	1174	264	1154	252	1163	241
	167.4	462	176.7	458	185.1	454	191.5	450	193.8	447	192.3	447
66	81.8	.780	81.9	.780	82.3	.780	83.0	.780	84.3	.780		
	1392	302	1311	289	1244	277	1199	264	1188	252		
	165.8	462	174.6	458	182.3	454	187.6	450	188.3	447		
68	82.0	.780	82.2	.780	82.7	.780	83.4	.780	84.9	.780		
	1406	302	1327	289	1265	277	1226	264	1224	252		
	164.2	462	172.4	458	179.3	454	183.4	450	182.8	447		
70	82.2	.780	82.5	.780	83.2	.780	83.9	.780	85.6	.780		
	1420	302	1344	289	1289	277	1259	264	1261	252		
	162.6	462	170.2	458	176.0	454	178.6	450	177.4	447		
72	82.5	.780	82.8	.780	83.5	.780	84.5	.780	86.3	.780		
	1436	302	1363	289	1313	277	1293	264	1299	252		
	160.8	462	167.9	458	172.7	454	173.9	450	172.2	447		
74	82.7	.780	83.2	.780	83.9	.780	85.0	.780				
	1452	302	1384	289	1340	277	1328	264				
	158.9	462	165.4	458	169.3	454	169.3	450				
76	83.0	.780	83.6	.780	84.4	.780	85.6	.780				
	1469	302	1406	289	1371	277	1365	264				
	157.1	462	162.7	458	165.5	454	164.7	450				

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = –0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

CRUISE - M.78

MAX. CRUISE THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+10 CG=33.0%	**N1 (%)** **KG/H/ENG** **NM/1000KG**	**MACH** **IAS (KT)** **TAS (KT)**

WEIGHT (1000KG)	FL290		FL310		FL330		FL350		FL370		FL390	
50	82.1	.780	81.9	.780	81.8	.780	81.8	.780	82.4	.780	83.5	.780
	1339	302	1242	289	1155	277	1079	264	1018	252	975	241
	176.1	472	188.3	468	200.8	464	213.1	460	224.8	458	234.8	458
52	82.3	.780	82.1	.780	82.0	.780	82.1	.780	82.7	.780	84.0	.780
	1348	302	1252	289	1167	277	1092	264	1034	252	997	241
	174.9	472	186.7	468	198.7	464	210.5	460	221.2	458	229.6	458
54	82.5	.780	82.3	.780	82.3	.780	82.4	.780	83.2	.780	84.5	.780
	1358	302	1263	289	1180	277	1108	264	1053	252	1022	241
	173.7	472	185.1	468	196.4	464	207.6	460	217.3	458	223.9	458
56	82.6	.780	82.5	.780	82.6	.780	82.8	.780	83.6	.780	85.1	.780
	1368	302	1275	289	1194	277	1124	264	1074	252	1051	241
	172.4	472	183.4	468	194.2	464	204.5	460	213.1	458	217.6	458
58	82.8	.780	82.7	.780	82.8	.780	83.1	.780	84.1	.780	85.7	.780
	1378	302	1288	289	1208	277	1141	264	1097	252	1085	241
	171.1	472	181.5	468	192.0	464	201.4	460	208.6	458	210.8	458
60	83.0	.780	83.0	.780	83.1	.780	83.5	.780	84.6	.780	86.4	.780
	1390	302	1302	289	1224	277	1160	264	1123	252	1120	241
	169.7	472	179.6	468	189.4	464	198.1	460	203.8	458	204.2	458
62	83.1	.780	83.2	.780	83.4	.780	84.0	.780	85.1	.780	87.1	.780
	1402	302	1315	289	1241	277	1182	264	1152	252	1158	241
	168.2	472	177.8	468	186.9	464	194.5	460	198.6	458	197.6	458
64	83.4	.780	83.5	.780	83.8	.780	84.4	.780	85.6	.780	87.8	.780
	1416	302	1330	289	1258	277	1206	264	1186	252	1196	241
	166.6	472	175.8	468	184.3	464	190.7	460	192.8	458	191.3	458
66	83.6	.780	83.7	.780	84.1	.780	84.8	.780	86.2	.780		
	1430	302	1346	289	1278	277	1231	264	1222	252		
	164.9	472	173.7	468	181.5	464	186.7	460	187.3	458		
68	83.8	.780	84.0	.780	84.6	.780	85.3	.780	86.8	.780		
	1443	302	1363	289	1299	277	1260	264	1258	252		
	163.4	472	171.5	468	178.4	464	182.5	460	181.8	458		
70	84.0	.780	84.3	.780	85.0	.780	85.8	.780	87.5	.780		
	1458	302	1381	289	1323	277	1294	264	1297	252		
	161.7	472	169.3	468	175.2	464	177.7	460	176.4	458		
72	84.3	.780	84.7	.780	85.4	.780	86.3	.780	88.2	.780		
	1474	302	1400	289	1349	277	1329	264	1336	252		
	159.9	472	167.0	468	171.9	464	173.0	460	171.3	458		
74	84.5	.780	85.0	.780	85.8	.780	86.9	.780				
	1491	302	1422	289	1376	277	1365	264				
	158.1	472	164.5	468	168.5	464	168.4	460				
76	84.8	.780	85.4	.780	86.2	.780	87.5	.780				
	1509	302	1445	289	1408	277	1403	264				
	156.3	472	161.9	468	164.6	464	163.8	460				

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = –0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

CRUISE - M.78

MAX. CRUISE THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+15 CG=33.0%	**N1 (%)** **KG/H/ENG** **NM/1000KG**	**MACH** **IAS (KT)** **TAS (KT)**

WEIGHT (1000KG)	**FL290**		**FL310**		**FL330**		**FL350**		**FL370**		**FL390**	
50	83.0	.780	82.8	.780	82.7	.780	82.8	.780	83.3	.780	84.5	.780
	1357	302	1258	289	1170	277	1093	264	1031	252	988	241
	175.6	476	187.8	473	200.3	469	212.5	465	224.3	463	234.2	463
52	83.2	.780	83.0	.780	82.9	.780	83.0	.780	83.7	.780	85.0	.780
	1366	302	1269	289	1182	277	1107	264	1048	252	1010	241
	174.4	476	186.2	473	198.2	469	210.0	465	220.7	463	229.0	463
54	83.3	.780	83.2	.780	83.2	.780	83.4	.780	84.1	.780	85.5	.780
	1376	302	1280	289	1196	277	1122	264	1067	252	1036	241
	173.2	476	184.6	473	195.9	469	207.0	465	216.8	463	223.3	463
56	83.5	.780	83.4	.780	83.5	.780	83.7	.780	84.6	.780	86.0	.780
	1386	302	1292	289	1210	277	1139	264	1088	252	1066	241
	171.9	476	182.9	473	193.7	469	204.0	465	212.6	463	217.0	463
58	83.6	.780	83.6	.780	83.7	.780	84.1	.780	85.0	.780	86.6	.780
	1396	302	1305	289	1224	277	1157	264	1112	252	1100	241
	170.6	476	181.0	473	191.5	469	200.9	465	208.1	463	210.2	463
60	83.8	.780	83.9	.780	84.0	.780	84.5	.780	85.5	.780	87.3	.780
	1408	302	1319	289	1240	277	1176	264	1138	252	1136	241
	169.2	476	179.1	473	188.9	469	197.6	465	203.3	463	203.6	463
62	84.0	.780	84.1	.780	84.3	.780	84.9	.780	86.0	.780		
	1421	302	1333	289	1257	277	1198	264	1168	252		
	167.7	476	177.3	473	186.4	469	194.0	465	198.0	463		
64	84.2	.780	84.3	.780	84.7	.780	85.3	.780	86.6	.780		
	1434	302	1348	289	1275	277	1222	264	1203	252		
	166.1	476	175.3	473	183.8	469	190.2	465	192.3	463		
66	84.5	.780	84.6	.780	85.1	.780	85.8	.780	87.2	.780		
	1448	302	1364	289	1295	277	1248	264	1238	252		
	164.5	476	173.2	473	181.0	469	186.2	465	186.8	463		
68	84.7	.780	84.9	.780	85.5	.780	86.2	.780	87.8	.780		
	1462	302	1381	289	1317	277	1277	264	1276	252		
	162.9	476	171.0	473	178.0	469	181.9	465	181.3	463		
70	84.9	.780	85.2	.780	85.9	.780	86.7	.780				
	1477	302	1399	289	1341	277	1312	264				
	161.3	476	168.8	473	174.7	469	177.2	465				
72	85.2	.780	85.6	.780	86.3	.780	87.3	.780				
	1494	302	1419	289	1367	277	1347	264				
	159.5	476	166.5	473	171.4	469	172.5	465				
74	85.4	.780	85.9	.780	86.7	.780	87.8	.780				
	1511	302	1441	289	1395	277	1384	264				
	157.7	476	164.0	473	168.0	469	167.9	465				
76	85.7	.780	86.3	.780	87.1	.780						
	1529	302	1464	289	1428	277						
	155.8	476	161.4	473	164.1	469						

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = –0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

CRUISE - M.78

MAX. CRUISE THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+20 CG=33.0%	**N1 (%)** **KG/H/ENG** **NM/1000KG**	**MACH** **IAS (KT)** **TAS (KT)**

WEIGHT (1000KG)	**FL290**		**FL310**		**FL330**		**FL350**		**FL370**		**FL390**	
50	83.8	.780	83.7	.780	83.6	.780	83.7	.780	84.2	.780	85.4	.780
	1374	302	1275	289	1185	277	1108	264	1045	252	1001	241
	175.1	481	187.2	477	199.8	474	211.9	470	223.7	468	233.5	468
52	84.0	.780	83.9	.780	83.8	.780	83.9	.780	84.6	.780	85.9	.780
	1384	302	1286	289	1198	277	1122	264	1062	252	1024	241
	173.9	481	185.7	477	197.7	474	209.4	470	220.1	468	228.3	468
54	84.2	.780	84.1	.780	84.1	.780	84.3	.780	85.0	.780	86.4	.780
	1394	302	1297	289	1212	277	1138	264	1081	252	1050	241
	172.7	481	184.1	477	195.4	474	206.4	470	216.2	468	222.7	468
56	84.3	.780	84.3	.780	84.3	.780	84.6	.780	85.5	.780	86.9	.780
	1404	302	1309	289	1226	277	1154	264	1103	252	1081	241
	171.4	481	182.4	477	193.2	474	203.4	470	212.0	468	216.3	468
58	84.5	.780	84.5	.780	84.6	.780	85.0	.780	85.9	.780		
	1415	302	1322	289	1240	277	1172	264	1127	252		
	170.1	481	180.5	477	190.9	474	200.3	470	207.5	468		
60	84.7	.780	84.7	.780	84.9	.780	85.4	.780	86.4	.780		
	1427	302	1337	289	1257	277	1192	264	1153	252		
	168.7	481	178.6	477	188.4	474	197.0	470	202.8	468		
62	84.9	.780	85.0	.780	85.2	.780	85.8	.780	86.9	.780		
	1439	302	1350	289	1274	277	1214	264	1184	252		
	167.2	481	176.8	477	185.9	474	193.4	470	197.4	468		
64	85.1	.780	85.2	.780	85.6	.780	86.2	.780	87.5	.780		
	1453	302	1366	289	1292	277	1239	264	1219	252		
	165.6	481	174.8	477	183.2	474	189.6	470	191.8	468		
66	85.3	.780	85.5	.780	86.0	.780	86.7	.780				
	1468	302	1382	289	1312	277	1265	264				
	164.0	481	172.7	477	180.5	474	185.7	470				
68	85.5	.780	85.8	.780	86.4	.780	87.1	.780				
	1482	302	1400	289	1335	277	1295	264				
	162.4	481	170.6	477	177.4	474	181.3	470				
70	85.8	.780	86.1	.780	86.8	.780	87.7	.780				
	1497	302	1418	289	1359	277	1330	264				
	160.8	481	168.4	477	174.2	474	176.6	470				
72	86.0	.780	86.5	.780	87.2	.780						
	1514	302	1438	289	1385	277						
	159.0	481	166.0	477	170.9	474						
74	86.3	.780	86.8	.780	87.6	.780						
	1531	302	1460	289	1413	277						
	157.2	481	163.5	477	167.5	474						
76	86.6	.780	87.2	.780	88.0	.780						
	1549	302	1484	289	1447	277						
	155.3	481	160.9	477	163.6	474						

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = –0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%

N1 (%) — MACH
KG/H/ENG — IAS (KT)
NM/1000KG — TAS (KT)

WEIGHT (1000KG)	FL100		FL150		FL200		FL230		FL250		FL270	
50	58.2	.439	63.8	.515	67.4	.559	70.6	.609	72.2	.634	73.5	.654
	1108	243	1144	260	1087	256	1091	263	1072	263	1042	261
	126.5	280	141.0	323	158.0	344	169.4	370	178.1	382	187.3	390
52	60.7	.473	64.6	.522	68.8	.577	71.6	.622	73.0	.643	74.4	.663
	1216	261	1177	263	1140	264	1129	269	1101	267	1073	265
	124.0	302	139.1	327	155.4	354	167.2	377	175.7	387	184.5	396
54	62.7	.498	65.5	.532	69.9	.590	72.4	.631	73.8	.651	75.2	.671
	1305	276	1214	268	1183	271	1161	273	1130	271	1101	268
	121.8	318	137.2	333	153.3	363	165.1	383	173.5	392	182.1	401
56	63.6	.507	66.5	.541	70.7	.600	73.2	.640	74.6	.660	75.7	.676
	1346	281	1252	273	1216	275	1191	277	1162	275	1123	270
	120.3	324	135.3	339	151.5	368	163.0	388	171.1	398	179.7	403
58	64.4	.515	67.4	.549	71.9	.617	74.0	.647	75.3	.668	76.1	.677
	1381	285	1288	277	1265	283	1219	280	1189	278	1140	271
	119.0	329	133.5	344	149.8	379	161.1	393	168.9	402	177.3	404
60	65.1	.522	68.2	.556	72.7	.626	74.7	.655	76.0	.674	76.4	.677
	1416	289	1321	281	1299	288	1250	284	1216	281	1155	271
	117.7	333	131.9	348	148.0	385	159.1	398	166.9	406	175.1	404
62	65.9	.529	69.0	.565	73.4	.634	75.4	.663	76.4	.677	77.0	.683
	1450	293	1357	285	1331	292	1281	288	1236	282	1183	273
	116.4	338	130.3	354	146.4	390	157.1	403	164.9	408	172.3	408
64	66.6	.535	69.8	.575	74.1	.642	76.0	.669	76.8	.678	77.7	.691
	1482	297	1398	291	1362	295	1308	291	1253	283	1217	277
	115.2	341	128.8	360	144.7	394	155.4	406	162.9	408	169.5	413
66	67.2	.540	70.7	.585	74.8	.648	76.7	.676	77.1	.679	78.4	.700
	1511	299	1440	296	1390	299	1336	294	1269	283	1253	280
	114.0	345	127.4	367	143.2	398	153.6	410	160.9	409	166.7	418
68	67.8	.545	71.5	.595	75.4	.654	77.0	.678	77.6	.684	79.1	.709
	1541	302	1480	301	1418	301	1355	295	1298	285	1290	284
	112.9	348	126.0	373	141.7	402	151.9	412	158.6	412	164.0	423
70	68.4	.549	72.4	.606	76.0	.661	77.4	.680	78.2	.691	79.8	.718
	1568	305	1522	307	1450	305	1373	295	1332	289	1329	288
	111.8	351	124.8	380	140.1	406	150.2	412	156.2	416	161.3	429
72	68.9	.553	73.3	.619	76.6	.667	77.7	.680	78.9	.699	80.5	.726
	1595	307	1567	313	1477	308	1388	295	1368	292	1365	292
	110.7	353	123.6	387	138.7	410	148.6	413	153.8	421	158.8	433
74	69.5	.557	74.0	.627	77.1	.673	78.1	.684	79.5	.708	81.0	.733
	1622	309	1605	318	1506	310	1416	297	1407	296	1399	295
	109.7	356	122.4	393	137.3	413	146.6	415	151.5	426	156.3	438
76	70.1	.564	74.6	.634	77.7	.678	78.7	.691	80.2	.717	81.5	.740
	1659	313	1637	321	1533	313	1451	301	1446	300	1435	298
	108.6	360	121.3	397	135.9	417	144.5	419	149.2	432	153.9	442

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = –0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%

N1 (%) / **KG/H/ENG** / **NM/1000KG** — **MACH** / **IAS (KT)** / **TAS (KT)**

WEIGHT (1000KG)	FL290		FL310		FL330		FL350		FL370		FL390	
50	74.9	.673	75.3	.676	76.6	.698	78.2	.726	79.6	.752	81.6	.778
	1012	258	960	248	946	245	941	245	939	242	946	240
	196.8	398	206.8	397	214.6	406	222.4	419	229.7	431	236.0	446
52	75.3	.676	76.0	.684	77.5	.710	78.9	.736	80.4	.764	82.3	.782
	1031	259	989	251	983	250	976	248	977	247	975	242
	194.0	400	202.9	401	210.2	413	217.5	424	224.2	438	230.0	449
54	75.7	.676	76.8	.693	78.5	.723	79.6	.748	81.1	.775	82.8	.785
	1047	259	1023	255	1021	254	1013	252	1015	251	1006	243
	191.3	400	198.9	407	205.9	420	212.7	431	218.9	444	223.8	450
56	76.2	.680	77.6	.703	79.1	.731	80.2	.757	81.8	.781	83.4	.785
	1068	260	1058	258	1054	258	1047	256	1048	253	1035	243
	188.3	402	195.0	413	201.7	425	208.2	436	213.8	448	217.4	450
58	76.9	.689	78.5	.715	79.8	.741	81.0	.769	82.4	.784	84.0	.786
	1103	264	1096	263	1089	261	1088	260	1076	254	1071	243
	184.8	408	191.3	419	197.7	431	203.6	443	208.8	449	210.5	451
60	77.7	.698	79.3	.725	80.4	.750	81.6	.778	82.9	.786	84.7	.786
	1137	268	1133	267	1125	265	1126	264	1108	255	1106	243
	181.5	413	187.8	426	193.8	436	199.2	449	203.5	451	203.8	451
62	78.4	.707	79.9	.734	81.0	.759	82.2	.782	83.4	.786	85.4	.786
	1174	272	1168	270	1161	268	1156	265	1137	255	1144	243
	178.3	419	184.3	430	190.0	441	195.0	451	198.2	451	197.1	451
64	79.2	.719	80.5	.742	81.6	.770	82.7	.784	84.0	.786	86.1	.785
	1214	276	1204	274	1203	273	1184	266	1172	255	1180	243
	175.2	425	180.9	436	186.1	448	190.8	452	192.4	451	190.9	450
66	80.0	.727	81.0	.750	82.3	.779	83.2	.786	84.6	.786		
	1249	280	1240	277	1241	276	1215	267	1207	255		
	172.2	430	177.6	440	182.5	453	186.5	453	186.9	451		
68	80.5	.734	81.6	.759	82.8	.782	83.7	.786	85.2	.787		
	1284	283	1277	281	1271	277	1245	267	1245	255		
	169.3	435	174.4	445	178.9	455	182.0	453	181.3	451		
70	81.0	.742	82.2	.770	83.3	.784	84.2	.786	85.9	.787		
	1319	286	1319	285	1300	278	1278	267	1286	255		
	166.5	439	171.2	452	175.4	456	177.3	453	175.7	452		
72	81.5	.750	82.8	.778	83.7	.785	84.7	.786	86.3	.781		
	1355	289	1358	288	1330	279	1312	267	1304	253		
	163.7	444	168.0	456	171.8	457	172.7	453	171.9	448		
74	82.0	.756	83.3	.782	84.2	.787	85.3	.787				
	1390	292	1389	290	1362	280	1350	267				
	161.0	448	165.1	459	168.1	458	167.9	453				
76	82.6	.766	83.8	.784	84.6	.786	85.9	.787				
	1433	296	1419	291	1391	279	1389	267				
	158.3	454	162.1	460	164.3	457	163.3	454				

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = −0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+10
CG=33.0%

N1 (%) **MACH**
KG/H/ENG **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL200		FL230		FL250		FL270	
50	59.4	.439	65.7	.524	69.1	.563	71.7	.601	73.5	.629	75.0	.650
	1136	243	1193	264	1117	258	1097	260	1085	261	1058	259
	125.7	286	140.2	335	157.8	353	169.6	372	178.3	387	187.3	396
52	62.4	.480	66.6	.532	70.1	.575	73.0	.618	74.3	.639	75.9	.661
	1265	265	1227	268	1158	263	1144	267	1116	265	1092	264
	123.2	312	138.4	340	155.6	360	167.4	383	175.8	392	184.5	403
54	64.7	.508	67.4	.539	71.2	.588	73.8	.628	75.2	.647	76.7	.668
	1364	281	1258	272	1200	270	1177	272	1146	269	1120	267
	121.0	330	136.7	344	153.4	368	165.2	389	173.5	398	182.0	407
56	65.5	.515	68.1	.544	72.0	.597	74.6	.637	76.1	.658	77.3	.673
	1398	285	1286	275	1233	274	1209	276	1182	274	1143	269
	119.8	335	135.1	347	151.6	374	163.0	394	171.0	404	179.5	410
58	66.2	.521	68.8	.550	73.1	.611	75.4	.644	76.8	.666	77.6	.675
	1429	289	1315	277	1279	281	1238	279	1212	277	1161	270
	118.6	339	133.5	351	149.8	383	161.1	399	168.8	409	177.1	411
60	66.8	.526	69.5	.554	74.0	.623	76.2	.652	77.5	.672	78.0	.676
	1457	292	1341	280	1317	286	1270	283	1239	280	1178	270
	117.4	342	131.9	354	148.1	390	159.0	404	166.7	413	174.8	412
62	67.3	.531	70.3	.563	74.7	.630	76.9	.661	78.0	.675	78.6	.681
	1483	294	1379	285	1348	290	1303	287	1260	281	1207	272
	116.3	345	130.4	360	146.4	395	157.0	409	164.6	415	172.0	415
64	67.9	.535	71.1	.573	75.4	.638	77.5	.667	78.3	.676	79.3	.690
	1509	296	1420	290	1380	293	1331	290	1277	282	1243	276
	115.2	348	128.9	366	144.7	399	155.2	413	162.6	415	169.1	420
66	68.5	.539	72.0	.583	76.2	.645	78.2	.673	78.7	.677	80.0	.697
	1536	299	1462	295	1412	297	1360	293	1296	282	1278	279
	114.1	350	127.4	373	143.1	404	153.4	417	160.6	416	166.3	425
68	69.0	.543	72.8	.593	76.8	.651	78.6	.676	79.2	.682	80.7	.706
	1564	301	1502	300	1441	300	1380	294	1325	285	1316	283
	112.9	353	126.0	378	141.6	408	151.6	419	158.2	419	163.5	430
70	69.6	.548	73.5	.600	77.5	.659	78.9	.677	79.9	.690	81.4	.716
	1592	304	1535	304	1477	304	1398	294	1361	288	1356	287
	111.8	356	124.8	383	139.9	413	149.9	419	155.7	424	160.9	436
72	70.2	.552	74.6	.614	78.1	.665	79.2	.678	80.5	.697	82.1	.724
	1620	306	1587	311	1505	307	1415	294	1397	291	1394	291
	110.7	359	123.6	392	138.4	417	148.2	420	153.3	428	158.3	441
74	70.8	.556	75.3	.624	78.6	.671	79.7	.682	81.1	.705	82.7	.731
	1647	308	1627	316	1534	309	1444	296	1434	295	1431	294
	109.7	361	122.3	398	137.0	420	146.2	422	151.0	433	155.8	446
76	71.4	.563	75.9	.630	79.2	.676	80.3	.689	81.8	.714	83.2	.738
	1685	312	1660	319	1561	312	1480	300	1474	299	1468	297
	108.6	366	121.2	402	135.6	423	144.1	427	148.8	439	153.3	450

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = −0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF							ISA+10 CG=33.0%		N1 (%) KG/H/ENG NM/1000KG		MACH IAS (KT) TAS (KT)	
WEIGHT (1000KG)	FL290		FL310		FL330		FL350		FL370		FL390	
50	76.4	.671	76.9	.674	78.3	.696	79.9	.724	81.4	.750	83.5	.777
	1031	257	978	247	965	244	961	244	961	242	970	240
	196.7	406	206.6	404	214.3	414	222.0	427	229.1	440	235.1	456
52	76.9	.673	77.6	.682	79.2	.708	80.6	.734	82.2	.762	84.1	.782
	1050	258	1009	250	1002	249	997	247	999	246	1002	242
	193.8	407	202.6	409	209.8	421	217.0	433	223.6	447	229.1	459
54	77.3	.674	78.5	.692	80.2	.721	81.3	.745	83.0	.773	84.7	.785
	1066	258	1045	254	1042	254	1036	252	1039	250	1034	243
	191.1	407	198.5	415	205.5	428	212.1	439	218.2	453	222.8	461
56	77.8	.678	79.3	.703	80.9	.729	82.0	.755	83.7	.780	85.3	.785
	1090	260	1082	258	1078	257	1072	255	1075	253	1063	243
	188.0	410	194.6	421	201.2	434	207.6	445	213.0	458	216.4	460
58	78.6	.686	80.2	.714	81.5	.739	82.8	.767	84.2	.783	85.9	.786
	1124	263	1121	263	1115	261	1114	260	1104	253	1100	243
	184.6	415	190.9	428	197.1	440	202.9	452	208.0	459	209.4	461
60	79.3	.695	81.0	.724	82.1	.749	83.4	.777	84.8	.786	86.6	.786
	1160	267	1159	267	1153	265	1154	263	1137	255	1137	243
	181.2	420	187.3	434	193.1	445	198.4	458	202.7	461	202.8	461
62	80.1	.705	81.6	.732	82.8	.758	84.1	.781	85.3	.785	87.3	.786
	1197	271	1194	270	1190	268	1186	265	1166	254	1177	243
	177.9	426	183.7	439	189.3	451	194.2	461	197.4	460	196.0	461
64	80.9	.716	82.2	.741	83.4	.769	84.5	.783	85.9	.786	88.0	.785
	1238	275	1232	273	1232	272	1215	266	1203	255	1211	243
	174.8	433	180.2	444	185.4	457	190.0	462	191.6	461	190.1	460
66	81.6	.725	82.8	.749	84.1	.777	85.1	.786	86.5	.786		
	1275	279	1269	277	1272	276	1248	267	1240	255		
	171.7	438	177.0	449	181.7	462	185.6	463	186.0	461		
68	82.2	.732	83.3	.758	84.6	.781	85.5	.786	87.1	.786		
	1311	282	1308	280	1304	277	1278	267	1279	255		
	168.7	443	173.7	454	178.2	465	181.2	463	180.4	461		
70	82.8	.741	84.0	.768	85.1	.783	86.0	.786	87.9	.787		
	1351	286	1350	284	1333	278	1313	267	1321	255		
	165.8	448	170.5	460	174.7	466	176.4	463	174.8	462		
72	83.3	.749	84.6	.777	85.5	.785	86.6	.786	88.2	.781		
	1389	289	1392	288	1364	279	1349	267	1338	253		
	163.0	453	167.3	466	171.0	467	171.8	463	171.2	458		
74	83.8	.756	85.1	.781	86.0	.786	87.2	.787				
	1426	292	1425	290	1397	279	1388	267				
	160.3	457	164.3	468	167.4	468	167.0	464				
76	84.4	.766	85.6	.783	86.4	.786	87.8	.787				
	1470	296	1455	290	1428	279	1428	267				
	157.5	463	161.3	469	163.5	467	162.4	464				

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = –0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+15 CG=33.0%	**N1 (%)** **KG/H/ENG** **NM/1000KG**	**MACH** **IAS (KT)** **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL200		FL230		FL250		FL270	
50	59.9	.439	66.6	.527	69.7	.561	72.3	.599	74.2	.628	75.7	.649
	1150	243	1212	266	1125	257	1104	259	1092	260	1067	259
	125.3	288	140.0	339	157.9	355	169.7	375	178.3	390	187.3	400
52	63.7	.489	67.3	.533	70.8	.574	73.6	.616	75.0	.637	76.7	.660
	1306	271	1240	269	1166	263	1151	266	1124	265	1102	263
	122.8	321	138.4	343	155.6	363	167.4	385	175.8	395	184.4	406
54	65.6	.511	68.0	.538	71.9	.587	74.4	.625	75.9	.645	77.4	.667
	1386	283	1267	271	1210	269	1184	270	1154	268	1130	266
	120.9	335	136.7	347	153.4	371	165.2	391	173.5	400	181.8	411
56	66.2	.516	68.7	.543	72.7	.596	75.2	.634	76.8	.656	78.0	.672
	1415	286	1295	274	1243	273	1216	275	1190	273	1154	268
	119.7	339	135.1	350	151.6	377	163.1	397	170.9	407	179.3	414
58	66.8	.521	69.4	.549	73.7	.609	76.1	.643	77.6	.664	78.4	.674
	1442	289	1324	277	1286	280	1249	278	1222	276	1172	269
	118.6	342	133.5	354	149.8	385	161.0	402	168.6	412	176.9	415
60	67.3	.525	70.1	.554	74.7	.620	76.9	.651	78.3	.671	78.8	.675
	1466	291	1352	279	1326	285	1281	282	1251	280	1190	270
	117.4	344	131.9	357	148.0	392	158.9	407	166.5	417	174.6	415
62	67.9	.529	70.9	.562	75.4	.629	77.6	.660	78.7	.674	79.4	.680
	1492	293	1390	284	1359	289	1315	286	1272	281	1219	272
	116.3	347	130.4	362	146.3	398	156.8	413	164.4	418	171.8	419
64	68.5	.534	71.8	.572	76.1	.636	78.3	.666	79.1	.675	80.1	.688
	1520	296	1431	289	1392	293	1345	289	1289	281	1255	275
	115.2	350	128.8	369	144.6	403	155.0	417	162.4	419	168.8	424
66	69.1	.538	72.7	.583	76.8	.643	78.9	.672	79.5	.676	80.8	.696
	1547	298	1474	295	1423	296	1373	292	1308	282	1292	279
	114.1	353	127.3	375	143.0	407	153.2	421	160.4	420	166.0	429
68	69.6	.543	73.5	.592	77.5	.650	79.3	.675	80.0	.682	81.5	.705
	1576	301	1514	299	1453	299	1393	293	1339	284	1330	283
	112.9	356	125.9	381	141.5	411	151.4	422	158.0	423	163.2	434
70	70.2	.547	74.2	.599	78.2	.658	79.7	.676	80.7	.689	82.2	.715
	1604	303	1547	303	1490	303	1411	293	1376	288	1371	287
	111.8	359	124.7	386	139.7	416	149.7	423	155.5	428	160.5	440
72	70.8	.551	75.2	.612	78.8	.664	80.0	.676	81.3	.697	83.0	.724
	1633	306	1598	310	1519	306	1429	294	1412	291	1411	291
	110.7	362	123.5	395	138.3	420	148.0	423	153.0	432	157.9	446
74	71.4	.555	76.0	.622	79.4	.670	80.5	.681	82.0	.704	83.5	.731
	1661	308	1638	315	1549	309	1458	296	1450	294	1448	294
	109.6	364	122.3	401	136.8	424	146.0	426	150.7	437	155.4	450
76	72.0	.562	76.5	.628	79.9	.675	81.1	.688	82.6	.713	84.0	.738
	1698	312	1671	318	1577	311	1495	299	1491	298	1486	297
	108.5	369	121.1	405	135.4	427	143.9	430	148.4	443	152.9	454

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = –0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+15 CG=33.0%	**N1 (%)** **KG/H/ENG** **NM/1000KG**	**MACH** **IAS (KT)** **TAS (KT)**

WEIGHT (1000KG)	**FL290**		**FL310**		**FL330**		**FL350**		**FL370**		**FL390**	
50	77.2	.670	77.7	.673	79.1	.695	80.8	.723	82.3	.750	84.4	.776
	1042	256	987	246	975	244	972	243	973	242	981	240
	196.5	409	206.4	408	214.2	417	221.7	431	228.6	445	234.6	460
52	77.7	.673	78.5	.681	80.1	.707	81.5	.733	83.1	.762	85.0	.782
	1061	257	1020	250	1013	248	1008	247	1013	246	1014	242
	193.6	411	202.3	413	209.6	425	216.7	437	223.1	452	228.5	464
54	78.1	.673	79.3	.691	81.0	.719	82.2	.745	83.9	.773	85.6	.785
	1077	258	1056	254	1053	253	1048	251	1053	250	1047	243
	190.9	411	198.3	419	205.2	432	211.7	444	217.7	458	222.2	465
56	78.6	.678	80.1	.701	81.7	.729	82.9	.754	84.6	.780	86.2	.784
	1102	259	1092	257	1090	257	1085	255	1089	253	1078	243
	187.8	414	194.3	425	200.9	438	207.2	449	212.5	463	215.8	465
58	79.4	.687	81.0	.713	82.4	.739	83.6	.766	85.1	.783	86.9	.785
	1138	263	1133	262	1128	261	1127	259	1118	253	1115	243
	184.2	419	190.6	432	196.7	444	202.5	456	207.5	464	208.9	466
60	80.2	.695	81.9	.723	83.0	.748	84.3	.776	85.7	.786	87.5	.786
	1174	267	1172	266	1167	264	1167	263	1153	255	1152	243
	180.9	425	186.9	438	192.7	450	198.0	462	202.2	466	202.2	466
62	80.9	.703	82.4	.731	83.7	.758	85.0	.781	86.2	.785		
	1209	270	1207	269	1205	268	1201	265	1182	254		
	177.6	430	183.4	443	188.9	455	193.8	465	196.9	465		
64	81.7	.714	83.1	.741	84.3	.769	85.4	.783	86.8	.785		
	1249	274	1248	273	1248	272	1230	266	1219	254		
	174.5	436	179.8	449	185.0	462	189.6	467	191.1	466		
66	82.5	.724	83.6	.749	85.0	.778	86.0	.786	87.4	.786		
	1289	278	1285	277	1289	276	1264	267	1256	255		
	171.4	442	176.6	454	181.3	467	185.2	468	185.5	466		
68	83.0	.731	84.2	.757	85.5	.781	86.4	.785	88.0	.785		
	1326	282	1323	280	1321	277	1294	266	1292	254		
	168.4	447	173.4	459	177.7	469	180.8	468	180.2	465		
70	83.6	.740	84.8	.767	86.0	.783	87.0	.786	88.1	.761		
	1366	285	1367	284	1351	278	1330	267	1279	246		
	165.4	452	170.1	465	174.2	471	176.0	468	176.3	451		
72	84.1	.748	85.4	.776	86.5	.785	87.5	.786				
	1405	289	1408	287	1383	279	1367	267				
	162.6	457	166.9	470	170.6	472	171.3	468				
74	84.7	.755	86.0	.781	86.9	.787	88.1	.786				
	1442	292	1443	289	1416	279	1407	267				
	160.0	461	163.9	473	166.8	473	166.6	469				
76	85.2	.765	86.4	.783	87.4	.786	88.3	.773				
	1486	296	1473	290	1448	279	1408	262				
	157.2	467	161.0	474	163.0	472	163.6	461				

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = –0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+20
CG=33.0%

N1 (%) **MACH**
KG/H/ENG **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	**FL100**		**FL150**		**FL200**		**FL230**		**FL250**		**FL270**	
50	60.7	.442	67.2	.527	70.3	.560	73.0	.598	74.8	.626	76.4	.647
	1170	244	1223	266	1133	256	1113	258	1100	260	1075	258
	124.9	292	140.0	343	157.9	358	169.6	378	178.2	392	187.2	402
52	65.2	.500	67.9	.532	71.4	.573	74.2	.614	75.7	.635	77.4	.659
	1352	277	1250	268	1175	262	1157	265	1132	264	1112	263
	122.4	331	138.4	346	155.6	366	167.4	387	175.8	398	184.2	410
54	66.3	.512	68.6	.537	72.5	.586	75.0	.623	76.6	.644	78.2	.667
	1401	283	1277	271	1219	268	1190	269	1163	267	1141	266
	120.8	339	136.8	349	153.4	374	165.2	393	173.4	403	181.6	415
56	66.8	.516	69.3	.542	73.3	.594	75.9	.632	77.5	.654	78.8	.671
	1426	286	1304	274	1252	273	1225	274	1200	272	1165	268
	119.7	341	135.2	353	151.6	380	163.0	399	170.8	410	179.1	417
58	67.3	.520	70.0	.548	74.3	.607	76.7	.640	78.3	.663	79.2	.672
	1449	288	1333	276	1294	279	1256	277	1232	276	1183	269
	118.6	344	133.5	356	149.8	387	160.9	404	168.5	415	176.7	418
60	67.8	.523	70.7	.553	75.3	.619	77.5	.649	79.0	.670	79.6	.673
	1473	290	1361	279	1335	284	1290	281	1262	279	1201	269
	117.5	346	131.9	359	148.0	395	158.8	410	166.3	420	174.3	419
62	68.5	.529	71.5	.561	76.0	.627	78.4	.659	79.5	.672	80.2	.679
	1503	293	1400	283	1368	288	1327	286	1283	280	1231	271
	116.3	350	130.4	365	146.2	400	156.7	416	164.2	421	171.5	422
64	69.1	.533	72.4	.571	76.8	.634	79.1	.666	79.9	.674	80.9	.687
	1531	295	1442	289	1401	292	1358	289	1302	281	1268	275
	115.2	353	128.8	371	144.5	405	154.8	420	162.2	422	168.5	427
66	69.6	.537	73.3	.582	77.5	.642	79.7	.671	80.2	.675	81.6	.695
	1558	298	1486	294	1433	295	1386	292	1320	281	1305	278
	114.0	355	127.3	378	142.9	410	153.0	424	160.1	423	165.7	432
68	70.2	.541	74.1	.591	78.2	.648	80.1	.674	80.8	.681	82.3	.704
	1587	300	1526	299	1464	298	1407	293	1352	284	1344	282
	112.9	358	125.9	384	141.3	414	151.2	425	157.7	427	162.9	438
70	70.8	.546	74.8	.598	78.9	.657	80.4	.675	81.5	.688	83.1	.714
	1616	303	1559	303	1502	303	1425	293	1390	287	1385	286
	111.8	361	124.6	389	139.6	419	149.5	426	155.2	431	160.2	444
72	71.4	.550	75.7	.610	79.5	.663	80.8	.676	82.1	.696	83.8	.723
	1645	305	1606	309	1533	306	1444	294	1427	291	1426	290
	110.7	364	123.4	396	138.1	423	147.7	427	152.7	436	157.6	450
74	72.0	.554	76.6	.619	80.1	.668	81.3	.680	82.8	.704	84.4	.730
	1673	307	1648	314	1562	308	1474	296	1467	294	1465	293
	109.6	367	122.2	403	136.6	427	145.7	430	150.4	441	155.0	454
76	72.7	.561	77.2	.626	80.7	.674	81.9	.687	83.5	.713	84.9	.737
	1712	311	1683	318	1591	311	1512	299	1508	298	1503	297
	108.5	371	121.0	407	135.2	430	143.5	434	148.1	447	152.5	459

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = –0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+20
CG=33.0%

N1 (%) / **MACH**
KG/H/ENG / **IAS (KT)**
NM/1000KG / **TAS (KT)**

WEIGHT (1000KG)	FL290		FL310		FL330		FL350		FL370		FL390	
50	78.0	.669	78.5	.672	79.9	.694	81.6	.723	83.2	.750	85.3	.775
	1051	256	997	246	985	244	984	243	985	242	993	239
	196.4	413	206.2	411	213.9	421	221.3	435	228.1	449	234.0	465
52	78.4	.671	79.3	.680	80.8	.704	82.4	.733	84.0	.761	85.9	.781
	1070	257	1030	249	1022	248	1021	247	1025	246	1027	242
	193.5	414	202.1	416	209.3	428	216.2	441	222.5	456	228.0	468
54	78.9	.672	80.1	.690	81.8	.717	83.1	.745	84.8	.773	86.5	.785
	1088	257	1066	253	1063	252	1061	251	1067	250	1061	243
	190.6	415	198.0	422	204.8	436	211.2	448	217.1	463	221.6	470
56	79.4	.676	80.9	.700	82.5	.727	83.8	.754	85.5	.780	87.1	.784
	1113	259	1104	257	1101	256	1099	255	1103	253	1092	242
	187.5	417	194.0	428	200.5	442	206.7	454	212.0	468	215.2	470
58	80.2	.686	81.8	.711	83.2	.738	84.5	.765	86.0	.783	87.3	.768
	1150	263	1143	261	1141	260	1141	259	1133	253	1096	237
	184.0	423	190.3	435	196.2	448	202.0	461	207.0	469	210.2	460
60	81.0	.694	82.7	.722	83.9	.748	85.2	.775	86.6	.786	87.4	.724
	1187	266	1184	266	1181	264	1181	263	1168	255	1080	222
	180.5	428	186.6	442	192.2	454	197.6	467	201.7	471	201.0	434
62	81.7	.703	83.3	.731	84.5	.757	85.9	.781	87.1	.785		
	1224	270	1222	269	1220	268	1216	265	1198	254		
	177.3	434	183.0	447	188.4	460	193.3	470	196.3	470		
64	82.5	.714	83.9	.741	85.2	.768	86.3	.783	87.7	.785		
	1265	274	1263	273	1264	272	1246	265	1235	254		
	174.1	440	179.4	453	184.5	466	189.1	471	190.6	471		
66	83.3	.723	84.5	.749	85.9	.777	86.9	.786	87.8	.765		
	1305	278	1301	277	1304	275	1281	267	1226	247		
	171.0	446	176.1	458	180.8	471	184.7	473	186.9	458		
68	83.9	.731	85.1	.757	86.4	.781	87.3	.785				
	1342	281	1340	280	1337	277	1311	266				
	168.0	451	172.9	463	177.3	474	180.2	473				
70	84.4	.739	85.7	.767	86.9	.783	87.9	.785				
	1382	285	1383	284	1368	278	1348	266				
	165.0	456	169.6	469	173.7	475	175.5	473				
72	85.0	.748	86.3	.775	87.3	.785	88.0	.773				
	1422	288	1424	287	1401	279	1351	262				
	162.2	461	166.5	474	170.1	477	172.2	465				
74	85.5	.755	86.8	.780	87.8	.786	88.1	.742				
	1459	291	1461	289	1435	279	1336	250				
	159.5	466	163.5	478	166.4	477	167.2	447				
76	86.1	.764	87.3	.782	88.0	.780						
	1504	295	1492	290	1448	277						
	156.7	471	160.5	479	163.6	474						

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = –0.6 %	ΔFUEL = +2.5 %	ΔFUEL = +4.5 %

GENERAL

The following in cruise quick check tables allow the flight crew to determine the fuel consumption and the time required to cover a given air distance from any moment in cruise
R to landing.

These tables are established for :

– Cruise Mach number : M.78/LR
– Descent profile : M.78/300KT/250KT
– Approach and landing : 110 kg or 240 lb – 6 minute IMC
– ISA
– CG = 33 %
– Normal air conditioning
– Anti ice OFF

Note : *1. In the tables, the asterisk "*" means that a step climb of 4000 feet has been made to reach the corresponding flight level.*
2. The flight level shown on the top of each column is the final flight level.
3. For each degree celsius above ISA apply a fuel correction of
0.005 (kg/°C/NM) × ΔISA (°C) × Air Distance (NM)
or 0.011 (lb/°C/NM) × ΔISA (°C) × Air Distance (NM)

CORRECTION FOR DEVIATION FROM REFERENCE WEIGHT

The in cruise quick check tables are based on a reference initial weight.
The fuel consumption must be corrected when the actual weight is different from the reference initial weight.
If it is lower (or greater) than the reference weight, subtract (or add) the value given in the correction part of the table per 1000 kg or 1000 lb below (or above) the reference weight.

EXAMPLE

In-cruise quick check with cruise at M.78
FL370
Actual cruise weight : 55000 kg
Remaining ground distance : 800 NM
ISA + 10
Average wind during flight : – 40 kt (head wind)

- Evaluation of air distance to be covered
  - Using the "Ground Distance/Air Distance" conversion table (see 3.05.50 P2), the corresponding air distance is : 880 NM
- Determination of the fuel consumption and time for the reference initial weight in cruise.
  - Enter table on 3.05.20 page 4 with an air distance of 880 NM and FL370 for ISA.
R Fuel consumption : 4022 kg
Time needed : 2 h 07 min
- Correction due to real in cruise weight of 55000 kg
R △ fuel consumption : – 40 kg per 1000 kg below reference
R △ fuel : – 40 × (60 – 55) = – 200 kg
- Temperature correction :
△ fuel consumption : + 0.005 kg per 1° above ISA and per 1 NM Air distance
△ fuel : + 0.005 × 10 × 880 = 44 kg

Result :
R Fuel : 4022 – 200 + 44 = 3866 kg
Time : 2 h 07 min

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
100	376 0.22	350 0.22	325 0.22	303 0.22	281 0.22		0	0	0
125	523 0.26	488 0.26	457 0.26	429 0.26	403 0.26	381 0.26	0	0	0
150	670 0.29	627 0.29	589 0.29	555 0.29	526 0.29	503 0.29	0	0	0
175	816 0.32	766 0.32	720 0.32	680 0.32	648 0.32	624 0.32	0	1	1
200	963 0.35	904 0.35	851 0.36	806 0.36	770 0.36	746 0.36	1	1	3
225	1110 0.39	1043 0.39	983 0.39	931 0.39	891 0.39	867 0.39	2	2	4
250	1256 0.42	1181 0.42	1114 0.42	1057 0.42	1013 0.43	988 0.43	1	3	6
275	1403 0.45	1319 0.45	1245 0.46	1182 0.46	1134 0.46	1108 0.46	2	4	7
300	1549 0.48	1457 0.49	1376 0.49	1307 0.49	1256 0.49	1229 0.49	2	5	9
325	1696 0.52	1595 0.52	1507 0.52	1432 0.52	1377 0.53	1349 0.53	3	6	10
350	1842 0.55	1733 0.55	1637 0.55	1556 0.56	1497 0.56	1469 0.56	4	7	12
375	1988 0.58	1871 0.58	1768 0.59	1681 0.59	1618 0.59	1589 0.59	4	8	13
400	2134 1.01	2009 1.02	1898 1.02	1806 1.02	1739 1.03	1708 1.03	5	9	15
425	2280 1.05	2146 1.05	2029 1.05	1930 1.06	1859 1.06	1827 1.06	6	10	16
450	2426 1.08	2284 1.08	2159 1.09	2054 1.09	1979 1.09	1946 1.09	6	11	17
475	2572 1.11	2421 1.11	2289 1.12	2178 1.12	2099 1.13	2065 1.13	7	12	19
500	2717 1.14	2559 1.15	2419 1.15	2302 1.16	2219 1.16	2184 1.16	7	13	20
525	2863 1.18	2696 1.18	2549 1.19	2426 1.19	2339 1.19	2302 1.19	8	14	21
550	3009 1.21	2833 1.21	2679 1.22	2550 1.22	2459 1.23	2420 1.23	9	15	23
575	3154 1.24	2970 1.25	2808 1.25	2673 1.26	2578 1.26	2538 1.26	9	15	24
600	3299 1.27	3107 1.28	2938 1.28	2797 1.29	2697 1.29	2656 1.29	10	16	26
625	3445 1.31	3244 1.31	3067 1.32	2920 1.32	2816 1.33	2774 1.33	11	17	27
650	3590 1.34	3381 1.34	3197 1.35	3043 1.36	2935 1.36	2891 1.36	11	18	28
675	3735 1.37	3517 1.38	3326 1.38	3167 1.39	3054 1.39	3008 1.39	12	19	29
700	3880 1.40	3654 1.41	3455 1.42	3290 1.42	3172 1.43	3125 1.43	12	20	31
725	4025 1.43	3790 1.44	3584 1.45	3412 1.46	3291 1.46	3242 1.46	13	21	32

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	290	**310**	**330**	**350**	**370**	**390**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**
725	4025 1.43	3790 1.44	3584 1.45	3412 1.46	3291 1.46	3242 1.46	13	21	32
750	4170 1.47	3927 1.48	3713 1.48	3535 1.49	3409 1.50	3358 1.50	14	22	33
775	4315 1.50	4063 1.51	3842 1.52	3658 1.52	3527 1.53	3474 1.53	14	23	35
800	4460 1.53	4199 1.54	3971 1.55	3780 1.56	3645 1.56	3590 1.56	15	23	36
825	4604 1.56	4335 1.57	4099 1.58	3903 1.59	3763 2.00	3706 2.00	15	24	37
850	4749 2.00	4471 2.01	4228 2.01	4025 2.02	3881 2.03	3822 2.03	16	25	38
875	4893 2.03	4607 2.04	4356 2.05	4147 2.06	3998 2.06	3937 2.06	16	26	40
900	5038 2.06	4743 2.07	4485 2.08	4269 2.09	4116 2.10	4053 2.10	17	27	41
925	5182 2.09	4879 2.10	4613 2.11	4391 2.12	4233 2.13	4168 2.13	18	28	42
950	5327 2.13	5015 2.14	4741 2.15	4513 2.16	4350 2.16	4283 2.16	18	28	43
975	5471 2.16	5150 2.17	4869 2.18	4635 2.19	4467 2.20	4397 2.20	19	29	44
1000	5615 2.19	5286 2.20	4997 2.21	4756 2.22	4584 2.23	4512 2.23	19	30	46
1025	5759 2.22	5421 2.23	5126 2.25	4878 2.26	4700 2.26	4626 2.26	20	31	47
1050	5903 2.26	5557 2.27	5253 2.28	4999 2.29	4817 2.30	4740 2.30	20	32	48
1075	6047 2.29	5692 2.30	5381 2.31	5121 2.32	4933 2.33	4854 2.33	21	32	55
1100	6191 2.32	5827 2.33	5509 2.35	5242 2.36	5050 2.36	4968 2.36	22	33	56
1125	6335 2.35	5962 2.37	5637 2.38	5363 2.39	5166 2.40	5081 2.40	22	34	58
1150	6479 2.39	6097 2.40	5764 2.41	5485 2.42	5282 2.43	5194 2.43	23	35	59
1175	6622 2.42	6232 2.43	5892 2.44	5606 2.46	5398 2.46	5308 2.46	23	36	60
1200	6766 2.45	6367 2.46	6019 2.48	5726 2.49	5514 2.50	5420 2.50	24	36	61
1225	6910 2.48	6502 2.50	6147 2.51	5847 2.52	5630 2.53	5533 2.53	24	37	63
1250	7053 2.52	6637 2.53	6274 2.54	5968 2.56	5745 2.57	5646 2.57	25	38	64
1275	7196 2.55	6771 2.56	6401 2.58	6088 2.59	5861 3.00	5758 3.00	25	39	65
1300	7340 2.58	6906 2.59	6528 3.01	6209 3.02	5976 3.03	5870 3.03	26	39	66
1325	7483 3.01	7040 3.03	6655 3.04	6329 3.06	6091 3.07	5982 3.07	26	40	68
1350	7626 3.05	7174 3.06	6782 3.08	6449 3.09	6206 3.10	6094 3.10	27	41	69

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.6 %	△FUEL = + 3 %	△FUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
1350	7626 3.05	7174 3.06	6782 3.08	6449 3.09	6206 3.10	6094 3.10	27	41	69
1375	7769 3.08	7308 3.09	6909 3.11	6570 3.12	6321 3.13	6205 3.13	27	42	70
1400	7912 3.11	7443 3.13	7036 3.14	6690 3.16	6435 3.17	6317 3.17	28	42	71
1425	8055 3.14	7577 3.16	7162 3.17	6809 3.19	6550 3.20	6428 3.20	29	43	73
1450	8197 3.18	7711 3.19	7289 3.21	6929 3.22	6664 3.23	6539 3.23	29	44	74
1475	8340 3.21	7844 3.22	7415 3.24	7049 3.26	6779 3.27	6650 3.27	30	45	75
1500	8483 3.24	7978 3.26	7542 3.27	7169 3.29	6893 3.30	6760 3.30	30	45	76
1525	8625 3.27	8112 3.29	7668 3.31	7288 3.32	7007 3.33	6871 3.33	31	46	77
1550	8768 3.31	8245 3.32	7794 3.34	7407 3.36	7121 3.37	6981 3.37	31	47	78
1575	8910 3.34	8379 3.35	7920 3.37	7527 3.39	7235 3.40	7091 3.40	32	47	80
1600	9053 3.37	8512 3.39	8046 3.41	7646 3.42	7348 3.43	7201 3.43	32	48	81
1625	9195 3.40	8646 3.42	8172 3.44	7765 3.46	7462 3.47	7311 3.47	33	49	82
1650	9337 3.44	8779 3.45	8298 3.47	7884 3.49	7575 3.50	7420 3.50	33	50	83
1675	9479 3.47	8912 3.49	8423 3.50	8003 3.52	7688 3.53	7530 3.53	34	50	84
1700	9621 3.50	9045 3.52	8549 3.54	8121 3.56	7802 3.57	7639 3.57	34	51	85
1725	9763 3.53	9178 3.55	8675 3.57	8240 3.59	7915 4.00	7748 4.00	34	52	86
1750	9905 3.56	9311 3.58	8800 4.00	8359 4.02	8027 4.03	7857 4.03	35	52	87
1775	10047 4.00	9444 4.02	8925 4.04	8477 4.06	8140 4.07	7966 4.07	35	53	89
1800	10189 4.03	9577 4.05	9051 4.07	8595 4.09	8253 4.10	8074 4.10	36	54	90
1825	10330 4.06	9709 4.08	9176 4.10	8714 4.12	8365 4.14	8183 4.14	36	54	91
1850	10472 4.09	9842 4.11	9301 4.14	8832 4.16	8478 4.17	8291 4.17	37	55	92
1875	10614 4.13	9974 4.15	9426 4.17	8950 4.19	8590 4.20	8399 4.20	37	56	93
1900	10756 4.16	10107 4.18	9551 4.20	9068 4.22	8702 4.24	8507 4.24	38	56	94
1925	10897 4.19	10239 4.21	9676 4.23	9186 4.26	8814 4.27	8614 4.27	38	57	95
1950	11039 4.22	10371 4.25	9801 4.27	9303 4.29	8926 4.30	8722 4.30	39	58	96
1975	11180 4.26	10504 4.28	9925 4.30	9421 4.32	9037 4.34	8829 4.34	39	58	97

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
1975	11180 4.26	10504 4.28	9925 4.30	9421 4.32	9037 4.34	8829 4.34	39	58	97
2000	11322 4.29	10636 4.31	10050 4.33	9539 4.36	9149 4.37	8936 4.37	40	59	98
2025	11463 4.32	10769 4.34	10174 4.37	9656 4.39	9260 4.40	9044 4.40	40	60	99
2050	11604 4.35	10901 4.38	10299 4.40	9773 4.42	9372 4.44	9150 4.44	40	60	100
2075	11746 4.39	11033 4.41	10423 4.43	9891 4.46	9483 4.47	9257 4.47	41	61	101
2100	11887 4.42	11165 4.44	10547 4.47	10008 4.49	9594 4.50	9364 4.50	41	62	102
2125	12028 4.45	11297 4.47	10671 4.50	10125 4.52	9705 4.54	9470 4.54	42	62	103
2150	12169 4.48	11429 4.51	10795 4.53	10242 4.56	9816 4.57	9576 4.57	42	63	104
2175	12310 4.52	11561 4.54	10919 4.56	10359 4.59	9927 5.00	9682 5.00	43	64	105
2200	12451 4.55	11693 4.57	11043 5.00	10475 5.02	10037 5.04	9788 5.04	43	64	106
2225	12592 4.58	11824 5.01	11166 5.03	10592 5.06	10148 5.07	9894 5.07	43	65	107
2250	12733 5.01	11956 5.04	11290 5.06	10709 5.09	10258 5.10	10000 5.10	44	65	108
2275	12873 5.05	12088 5.07	11414 5.10	10826 5.12	10368 5.14	10105 5.14	44	66	109
2300	13014 5.08	12219 5.10	11537 5.13	10942 5.16	10479 5.17	10210 5.17	45	67	110
2325	13155 5.11	12351 5.14	11660 5.16	11058 5.19	10590 5.21	10315 5.21	45	67	111
2350	13295 5.14	12482 5.17	11784 5.20	11175 5.22	10700 5.24	10421 5.24	46	68	111
2375	13436 5.18	12614 5.20	11907 5.23	11291 5.26	10811 5.27	10527 5.27	46	68	112
2400	13576 5.21	12745 5.23	12030 5.26	11407 5.29	10921 5.31	10632 5.31	46	69	113
2425	13716 5.24	12876 5.27	12153 5.30	11523 5.32	11032 5.34	10738 5.34	47	69	114
2450	13857 5.27	13007 5.30	12276 5.33	11639 5.36	11142 5.37	10844 5.37	47	70	115
2475	13997 5.31	13138 5.33	12399 5.36	11755 5.39	11252 5.41	10949 5.41	48	71	116
2500	14137 5.34	13269 5.37	12522 5.39	11871 5.42	11362 5.44	11054 5.44	48	71	117
2525	14277 5.37	13400 5.40	12645 5.43	11987 5.46	11472 5.47	11159 5.47	48	72	118
2550	14417 5.40	13531 5.43	12767 5.46	12102 5.49	11581 5.51	11264 5.51	49	72	119
2575	14557 5.43	13661 5.46	12890 5.49	12218 5.52	11691 5.54	11369 5.54	49	73	119
2600	14697 5.47	13792 5.50	13012 5.53	12333 5.56	11801 5.57	11474 5.57	50	73	120

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
2600	14697 5.47	13792 5.50	13012 5.53	12333 5.56	11801 5.57	11474 5.57	50	73	120
2625	14837 5.50	13923 5.53	13135 5.56	12449 5.59	11910 6.01	11579 6.01	50	74	121
2650	14976 5.53	14053 5.56	13257 5.59	12564 6.02	12020 6.04	11683 6.04	51	75	122
2675	15116 5.56	14184 5.59	13379 6.03	12679 6.06	12129 6.07	11788 6.07	51	75	123
2700	15255 6.00	14314 6.03	13501 6.06	12794 6.09	12238 6.11	11892 6.11	51	76	124
2725	15395 6.03	14444 6.06	13623 6.09	12909 6.12	12347 6.14	11996 6.14	52	76	124
2750	15534 6.06	14574 6.09	13745 6.12	13024 6.16	12456 6.17	12100 6.17	52	77	125
2775	15674 6.09	14705 6.13	13867 6.16	13139 6.19	12565 6.21	12204 6.21	52	77	126
2800	15813 6.13	14835 6.16	13989 6.19	13254 6.22	12674 6.24	12308 6.24	53	78	127
2825	15952 6.16	14965 6.19	14111 6.22	13368 6.26	12783 6.27	12411 6.28	53	79	128
2850	16092 6.19	15095 6.22	14232 6.26	13483 6.29	12891 6.31	12515 6.31	54	79	128
2875	16231 6.22	15224 6.26	14354 6.29	13597 6.32	13000 6.34	12618 6.34	54	80	129
2900	16370 6.26	15354 6.29	14475 6.32	13712 6.36	13108 6.38	12722 6.38	54	80	130
2925	16509 6.29	15484 6.32	14597 6.36	13826 6.39	13216 6.41	12825 6.41	55	81	131
2950	16649 6.32	15613 6.35	14718 6.39	13940 6.42	13324 6.44	12928 6.44	55	81	132
2975	16788 6.35	15743 6.39	14839 6.42	14054 6.46	13433 6.48	13031 6.48	55	82	132
3000	16927 6.39	15873 6.42	14960 6.45	14168 6.49	13541 6.51	13133 6.51	56	82	133
3025	17065 6.42	16002 6.45	15081 6.49	14282 6.52	13648 6.54	13236 6.54	56	83	134
3050	17204 6.45	16132 6.49	15202 6.52	14396 6.56	13756 6.58	13339 6.58	57	83	135
3075	17343 6.48	16261 6.52	15323 6.55	14510 6.59	13864 7.01	13441 7.01	57	84	135
3100	17482 6.52	16391 6.55	15444 6.59	14624 7.02	13972 7.04	13543 7.04	57	84	136

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 100	150	200	230	250	270	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL150	FL200 FL230	FL250 FL270
100	829 0.24	648 0.24	533 0.23	472 0.23	435 0.23	400 0.23	2	0	0
125	1041 0.29	837 0.29	701 0.27	629 0.27	584 0.27	543 0.27	3	0	0
150	1252 0.33	1026 0.33	870 0.31	786 0.31	734 0.30	686 0.30	4	1	0
175	1463 0.38	1214 0.37	1038 0.35	943 0.34	884 0.34	828 0.34	5	2	1
200	1673 0.43	1403 0.42	1207 0.39	1099 0.38	1033 0.38	971 0.38	7	3	2
225	1884 0.47	1591 0.46	1375 0.43	1256 0.42	1182 0.42	1113 0.41	8	4	3
250	2094 0.52	1779 0.50	1543 0.47	1412 0.46	1331 0.45	1255 0.45	9	5	4
275	2304 0.56	1966 0.55	1710 0.51	1568 0.50	1480 0.49	1397 0.49	11	6	5
300	2514 1.01	2154 0.59	1878 0.55	1724 0.53	1629 0.53	1539 0.53	12	7	6
325	2723 1.06	2341 1.04	2045 0.59	1880 0.57	1778 0.56	1681 0.56	13	8	7
350	2932 1.10	2528 1.08	2212 1.03	2036 1.01	1926 1.00	1823 1.00	14	9	8
375	3141 1.15	2715 1.12	2379 1.07	2191 1.05	2074 1.04	1964 1.04	16	10	9
400	3350 1.20	2901 1.17	2546 1.11	2347 1.09	2223 1.08	2106 1.08	17	11	10
425	3558 1.24	3088 1.21	2713 1.15	2502 1.13	2371 1.11	2247 1.11	18	12	11
450	3767 1.29	3274 1.26	2879 1.19	2657 1.16	2519 1.15	2388 1.15	19	13	12
475	3975 1.34	3460 1.30	3046 1.23	2812 1.20	2667 1.19	2529 1.19	21	14	13
500	4182 1.38	3646 1.34	3212 1.27	2967 1.24	2814 1.23	2670 1.22	22	15	14
525	4390 1.43	3831 1.39	3378 1.31	3121 1.28	2962 1.27	2811 1.26	23	16	15
550	4597 1.48	4017 1.43	3544 1.35	3276 1.32	3109 1.30	2951 1.30	25	17	16
575	4804 1.52	4202 1.48	3709 1.39	3430 1.36	3257 1.34	3092 1.34	26	18	17
600	5011 1.57	4387 1.52	3875 1.43	3584 1.40	3404 1.38	3232 1.37	27	19	18
625	5217 2.02	4571 1.57	4040 1.47	3738 1.43	3551 1.42	3372 1.41	29	20	19
650	5424 2.06	4756 2.01	4206 1.52	3892 1.47	3698 1.45	3512 1.45	30	21	20
675	5630 2.11	4940 2.06	4371 1.56	4046 1.51	3845 1.49	3652 1.48	31	22	21
700	5835 2.16	5124 2.10	4536 2.00	4200 1.55	3992 1.53	3792 1.52	33	23	22
725	6041 2.21	5307 2.14	4700 2.04	4353 1.59	4138 1.57	3932 1.56	34	24	23

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 100	150	200	230	250	270	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL150	FL200 FL230	FL250 FL270
725	6041 2.21	5307 2.14	4700 2.04	4353 1.59	4138 1.57	3932 1.56	34	24	23
750	6246 2.25	5491 2.19	4865 2.08	4507 2.03	4285 2.00	4071 2.00	35	25	24
775	6451 2.30	5674 2.23	5030 2.12	4660 2.07	4431 2.04	4211 2.03	37	26	25
800	6656 2.35	5857 2.28	5194 2.16	4813 2.11	4578 2.08	4350 2.07	38	27	26
825	6861 2.40	6040 2.32	5358 2.20	4966 2.15	4724 2.12	4490 2.11	39	28	27
850	7065 2.45	6222 2.37	5523 2.24	5119 2.18	4869 2.16	4629 2.15	41	29	28
875	7269 2.49	6405 2.42	5686 2.29	5272 2.22	5015 2.19	4768 2.18	42	30	29
900	7473 2.54	6587 2.46	5850 2.33	5424 2.26	5161 2.23	4907 2.22	43	31	30
925	7677 2.59	6769 2.51	6014 2.37	5577 2.30	5306 2.27	5045 2.26	45	32	30
950	7880 3.04	6951 2.55	6178 2.41	5729 2.34	5451 2.31	5184 2.29	46	33	31
975	8083 3.09	7132 3.00	6341 2.45	5882 2.38	5597 2.35	5323 2.33	48	34	32
1000	8286 3.13	7313 3.04	6504 2.49	6034 2.42	5742 2.39	5461 2.37	49	35	33
1025	8489 3.18	7494 3.09	6667 2.54	6186 2.46	5886 2.42	5599 2.41	50	36	34
1050	8691 3.23	7675 3.13	6830 2.58	6338 2.50	6031 2.46	5737 2.44	52	37	35
1075	8894 3.28	7856 3.18	6993 3.02	6489 2.54	6176 2.50	5875 2.48	53	38	36
1100	9096 3.33	8036 3.23	7156 3.06	6641 2.58	6320 2.54	6013 2.52	54	39	37
1125	9297 3.38	8216 3.27	7318 3.10	6792 3.01	6465 2.58	6151 2.56	56	40	38
1150	9499 3.43	8396 3.32	7480 3.15	6944 3.05	6609 3.02	6289 2.59	57	41	39
1175	9700 3.48	8576 3.36	7643 3.19	7095 3.09	6753 3.05	6426 3.03	59	42	40
1200	9901 3.53	8756 3.41	7805 3.23	7246 3.13	6897 3.09	6563 3.07	60	43	41
1225	10102 3.57	8935 3.46	7967 3.27	7397 3.17	7041 3.13	6701 3.11	61	44	42
1250	10302 4.02	9114 3.50	8128 3.31	7548 3.21	7184 3.17	6838 3.14	63	45	42
1275	10501 4.08	9293 3.55	8290 3.36	7698 3.25	7328 3.21	6975 3.18	64	46	43
1300	10699 4.13	9472 3.59	8451 3.40	7849 3.29	7471 3.25	7112 3.22	66	47	44
1325	10897 4.18	9651 4.04	8613 3.44	7999 3.33	7615 3.29	7248 3.26	67	48	45
1350	11094 4.23	9829 4.09	8774 3.48	8150 3.37	7758 3.32	7385 3.29	68	50	46

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	100	**150**	**200**	**230**	**250**	**270**	**FL100 FL150**	**FL200 FL230**	**FL250 FL270**
1350	11094 4.23	9829 4.09	8774 3.48	8150 3.37	7758 3.32	7385 3.29	68	50	46
1375	11291 4.28	10007 4.13	8935 3.53	8300 3.41	7901 3.36	7522 3.33	70	51	47
1400	11488 4.34	10185 4.18	9096 3.57	8450 3.45	8044 3.40	7658 3.37	71	52	48
1425	11685 4.39	10363 4.23	9257 4.01	8600 3.49	8186 3.44	7794 3.41	73	53	49
1450	11881 4.44	10540 4.27	9417 4.06	8749 3.53	8329 3.48	7931 3.44	74	54	50
1475	12078 4.50	10717 4.32	9578 4.10	8899 3.57	8472 3.52	8067 3.48	75	55	51
1500	12273 4.55	10894 4.37	9738 4.14	9048 4.01	8614 3.56	8203 3.52	77	56	52
1525	12469 5.00	11070 4.41	9898 4.18	9198 4.05	8756 4.00	8338 3.56	78	57	52
1550	12664 5.06	11247 4.46	10058 4.23	9347 4.09	8898 4.03	8474 3.59	80	58	53
1575	12859 5.11	11423 4.51	10218 4.27	9496 4.13	9040 4.07	8610 4.03	81	59	54
1600	13054 5.16	11599 4.56	10377 4.31	9645 4.17	9182 4.11	8745 4.07	83	60	55
1625	13248 5.22	11775 5.00	10536 4.36	9794 4.21	9324 4.15	8880 4.11	84	61	56
1650	13442 5.27	11951 5.05	10695 4.40	9943 4.25	9466 4.19	9016 4.15	85	63	57
1675	13636 5.33	12126 5.10	10853 4.44	10091 4.29	9607 4.23	9151 4.18	87	64	58
1700	13830 5.38	12302 5.14	11011 4.49	10240 4.33	9748 4.27	9286 4.22	88	65	59
1725	14023 5.44	12477 5.19	11170 4.53	10388 4.37	9890 4.31	9421 4.26	90	66	60
1750	14216 5.49	12652 5.24	11327 4.58	10536 4.41	10031 4.35	9555 4.30	91	67	60
1775	14409 5.55	12826 5.29	11485 5.02	10684 4.45	10172 4.39	9690 4.33	93	68	61
1800	14602 6.00	13001 5.34	11643 5.06	10831 4.49	10313 4.43	9825 4.37	94	69	62
1825	14794 6.06	13175 5.38	11801 5.11	10979 4.53	10453 4.46	9959 4.41	96	70	63
1850	14986 6.11	13349 5.43	11958 5.15	11126 4.57	10594 4.50	10093 4.45	97	71	64
1875	15178 6.17	13523 5.48	12115 5.20	11273 5.01	10734 4.54	10228 4.48	98	72	65
1900	15369 6.23	13697 5.53	12272 5.24	11420 5.05	10874 4.58	10362 4.52	100	74	66
1925	15560 6.28	13870 5.57	12429 5.28	11567 5.09	11014 5.02	10495 4.56	101	75	67
1950	15751 6.34	14043 6.02	12586 5.33	11714 5.13	11154 5.06	10629 5.00	103	76	67
1975	15942 6.40	14217 6.07	12742 5.37	11860 5.17	11293 5.10	10763 5.04	105	77	68

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 100	150	200	230	250	270	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL150	FL200 FL230	FL250 FL270
1975	15942 6.40	14217 6.07	12742 5.37	11860 5.17	11293 5.10	10763 5.04	105	77	68
2000	16128 6.46	14389 6.12	12899 5.42	12007 5.21	11433 5.14	10896 5.08	106	78	69
2025	16314 6.52	14562 6.17	13055 5.46	12153 5.25	11572 5.18	11029 5.11	108	79	70
2050	16500 6.58	14735 6.22	13211 5.51	12300 5.29	11712 5.22	11162 5.15	109	80	71
2075	16685 7.04	14907 6.26	13367 5.55	12446 5.33	11851 5.26	11295 5.19	111	81	72
2100	16870 7.11	15079 6.31	13523 6.00	12592 5.38	11990 5.30	11428 5.23	113	83	73
2125	17055 7.17	15251 6.36	13678 6.04	12738 5.42	12129 5.34	11561 5.27	114	84	73
2150	17239 7.23	15423 6.41	13834 6.09	12883 5.46	12268 5.38	11694 5.31	116	85	74
2175	17423 7.30	15594 6.46	13989 6.13	13029 5.50	12407 5.42	11827 5.35	117	86	75
2200	17607 7.36	15766 6.51	14144 6.18	13174 5.54	12546 5.46	11959 5.39	119	87	76
2225	17791 7.42	15937 6.56	14299 6.22	13320 5.58	12684 5.50	12092 5.42	121	88	77
2250	17974 7.49	16107 7.00	14454 6.27	13465 6.02	12822 5.54	12224 5.46	122	89	78
2275	18157 7.55	16277 7.05	14609 6.31	13610 6.06	12961 5.58	12356 5.50	124	91	79
2300	18339 8.02	16447 7.10	14764 6.36	13755 6.10	13099 6.02	12488 5.54	125	92	79
2325	18521 8.09	16617 7.15	14918 6.40	13900 6.15	13237 6.06	12620 5.58	127	93	80
2350	18703 8.15	16787 7.20	15072 6.45	14045 6.19	13375 6.10	12752 6.02	129	94	81
2375	18885 8.22	16956 7.25	15226 6.49	14189 6.23	13512 6.14	12884 6.06	130	95	82
2400	19066 8.28	17125 7.30	15380 6.54	14334 6.27	13650 6.18	13016 6.10	132	96	83
2425	19247 8.35	17294 7.35	15534 6.58	14478 6.31	13788 6.22	13147 6.14	134	98	84
2450	19428 8.42	17463 7.40	15688 7.03	14622 6.35	13925 6.26	13279 6.17	135	99	84
2475	19608 8.49	17631 7.45	15841 7.08	14766 6.39	14062 6.30	13410 6.21	137	100	85
2500	19788 8.56	17800 7.50	15995 7.12	14910 6.43	14199 6.34	13541 6.25	138	101	86
2525	19968 9.02	17968 7.54	16146 7.17	15054 6.48	14336 6.38	13672 6.29	140	102	87
2550	20147 9.09	18136 7.59	16297 7.22	15198 6.52	14473 6.43	13803 6.33	142	104	88
2575	20326 9.16	18304 8.04	16448 7.26	15341 6.56	14610 6.47	13934 6.37	143	105	89
2600	20505 9.23	18471 8.09	16598 7.31	15485 7.00	14747 6.51	14065 6.41	145	106	90

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 100	FLIGHT LEVEL 150	FLIGHT LEVEL 200	FLIGHT LEVEL 230	FLIGHT LEVEL 250	FLIGHT LEVEL 270	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL150	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL200 FL230	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL250 FL270
2600	20505 9.23	18471 8.09	16598 7.31	15485 7.00	14747 6.51	14065 6.41	145	106	90
2625	20684 9.30	18639 8.14	16749 7.36	15628 7.04	14883 6.55	14195 6.45	146	107	91
2650	20862 9.37	18806 8.19	16899 7.41	15771 7.09	15020 6.59	14326 6.49	148	108	92
2675	21040 9.44	18973 8.24	17049 7.46	15914 7.13	15156 7.03	14456 6.53	150	109	93
2700	21218 9.52	19140 8.29	17199 7.50	16057 7.17	15292 7.07	14587 6.57	151	111	94
2725	21395 9.59	19306 8.34	17349 7.55	16199 7.21	15428 7.11	14717 7.01	153	112	95
2750	21572 10.06	19473 8.39	17498 8.00	16341 7.26	15564 7.15	14847 7.05	155	113	96
2775	21748 10.12	19639 8.44	17648 8.05	16483 7.30	15700 7.19	14977 7.08	156	114	97
2800	21923 10.19	19805 8.49	17797 8.10	16625 7.35	15836 7.23	15107 7.12	158	115	98
2825	22098 10.25	19971 8.54	17946 8.15	16766 7.39	15971 7.27	15237 7.16	159	117	99
2850	22273 10.31	20137 8.59	18095 8.20	16908 7.44	16107 7.31	15366 7.20	161	118	100
2875	22447 10.37	20303 9.04	18244 8.25	17049 7.48	16242 7.36	15496 7.24	163	119	101
2900	22621 10.44	20468 9.09	18392 8.30	17190 7.52	16377 7.40	15625 7.28	164	120	102
2925	22795 10.50	20633 9.14	18540 8.34	17331 7.57	16512 7.44	15755 7.32	166	121	102
2950	22968 10.56	20798 9.19	18689 8.39	17472 8.01	16647 7.48	15884 7.36	168	123	103
2975	23142 11.02	20963 9.24	18837 8.44	17613 8.06	16782 7.52	16013 7.40	170	124	104
3000	23314 11.09	21128 9.29	18984 8.49	17754 8.10	16916 7.56	16142 7.44	171	125	105
3025	23487 11.15	21293 9.34	19132 8.54	17895 8.15	17051 8.00	16270 7.48	173	126	106
3050	23659 11.21	21457 9.40	19280 8.59	18035 8.19	17185 8.04	16398 7.52	175	127	107
3075	23831 11.28	21621 9.45	19427 9.04	18175 8.24	17319 8.09	16526 7.56	176	128	108
3100	24003 11.34	21785 9.50	19574 9.09	18315 8.29	17454 8.13	16655 8.00	178	130	109

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	290	**310**	**330**	**350**	**370**	**390**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**
100	369 0.23	346 0.23	324 0.22	303 0.22	281 0.22		0	0	0
125	507 0.26	479 0.26	453 0.26	428 0.26	404 0.26	381 0.26	0	0	0
150	644 0.30	612 0.30	582 0.29	554 0.29	527 0.29	504 0.29	0	0	0
175	782 0.34	745 0.33	711 0.33	679 0.32	649 0.32	626 0.32	1	1	2
200	919 0.37	877 0.37	839 0.36	804 0.36	771 0.36	748 0.36	3	3	3
225	1056 0.41	1010 0.40	968 0.40	929 0.39	893 0.39	870 0.39	4	4	5
250	1193 0.45	1142 0.44	1096 0.43	1054 0.43	1015 0.42	991 0.42	5	6	7
275	1329 0.48	1274 0.47	1224 0.47	1179 0.46	1137 0.46	1113 0.46	6	7	8
300	1466 0.52	1406 0.51	1352 0.50	1303 0.49	1259 0.49	1234 0.49	7	8	10
325	1602 0.56	1538 0.55	1480 0.54	1427 0.53	1380 0.52	1355 0.52	9	10	11
350	1738 0.59	1669 0.58	1607 0.57	1551 0.56	1501 0.56	1475 0.56	10	11	13
375	1874 1.03	1801 1.02	1734 1.01	1675 0.59	1622 0.59	1595 0.59	11	12	15
400	2010 1.07	1932 1.05	1862 1.04	1799 1.03	1743 1.02	1716 1.02	12	13	16
425	2145 1.11	2063 1.09	1989 1.08	1923 1.06	1863 1.06	1835 1.06	13	15	18
450	2281 1.14	2194 1.13	2116 1.11	2046 1.10	1984 1.09	1955 1.09	14	16	19
475	2416 1.18	2325 1.16	2243 1.15	2169 1.13	2104 1.12	2074 1.12	16	17	21
500	2551 1.22	2456 1.20	2369 1.18	2293 1.16	2224 1.16	2194 1.16	17	19	22
525	2686 1.25	2587 1.23	2496 1.22	2415 1.20	2344 1.19	2313 1.19	18	20	24
550	2821 1.29	2717 1.27	2622 1.25	2538 1.23	2464 1.23	2431 1.22	19	21	25
575	2955 1.33	2847 1.31	2748 1.29	2661 1.27	2583 1.26	2550 1.26	20	23	27
600	3090 1.37	2977 1.34	2874 1.32	2783 1.30	2702 1.29	2668 1.29	21	24	28
625	3224 1.40	3107 1.38	3000 1.36	2906 1.33	2822 1.33	2786 1.32	22	25	30
650	3358 1.44	3237 1.41	3126 1.39	3028 1.37	2941 1.36	2904 1.36	23	26	31
675	3492 1.48	3366 1.45	3251 1.43	3150 1.40	3059 1.39	3022 1.39	25	28	33
700	3625 1.51	3496 1.49	3376 1.46	3271 1.44	3178 1.43	3139 1.42	26	29	34
725	3759 1.55	3625 1.52	3502 1.50	3393 1.47	3296 1.46	3256 1.46	27	30	36

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
725	3759 1.55	3625 1.52	3502 1.50	3393 1.47	3296 1.46	3256 1.46	27	30	36
750	3893 1.59	3754 1.56	3627 1.53	3514 1.50	3415 1.49	3373 1.49	28	32	37
775	4026 2.03	3883 2.00	3752 1.57	3636 1.54	3533 1.53	3490 1.52	29	33	39
800	4159 2.06	4012 2.03	3877 2.00	3757 1.57	3651 1.56	3606 1.56	30	34	40
825	4292 2.10	4141 2.07	4001 2.04	3878 2.01	3769 1.59	3723 1.59	31	35	42
850	4425 2.14	4270 2.10	4126 2.07	3999 2.04	3886 2.03	3839 2.02	32	37	43
875	4557 2.18	4398 2.14	4250 2.11	4120 2.08	4004 2.06	3955 2.06	33	38	44
900	4690 2.22	4527 2.18	4374 2.14	4240 2.11	4121 2.09	4071 2.09	34	39	46
925	4822 2.25	4655 2.21	4498 2.18	4361 2.14	4238 2.13	4186 2.12	36	40	47
950	4955 2.29	4783 2.25	4622 2.21	4481 2.18	4355 2.16	4302 2.16	37	42	49
975	5087 2.33	4910 2.29	4746 2.25	4601 2.21	4472 2.19	4417 2.19	38	43	50
1000	5219 2.37	5038 2.32	4869 2.29	4721 2.25	4589 2.23	4532 2.22	39	44	51
1025	5351 2.40	5165 2.36	4993 2.32	4841 2.28	4705 2.26	4646 2.26	40	45	53
1050	5483 2.44	5293 2.40	5116 2.36	4961 2.32	4821 2.30	4761 2.29	41	47	54
1075	5614 2.48	5420 2.43	5239 2.39	5080 2.35	4938 2.33	4875 2.32	42	48	56
1100	5746 2.52	5547 2.47	5362 2.43	5199 2.39	5054 2.36	4989 2.36	43	49	57
1125	5877 2.55	5673 2.51	5484 2.46	5318 2.42	5170 2.40	5103 2.39	44	50	58
1150	6008 2.59	5800 2.54	5607 2.50	5437 2.45	5286 2.43	5217 2.42	45	51	60
1175	6139 3.03	5926 2.58	5729 2.54	5556 2.49	5401 2.46	5331 2.46	46	53	61
1200	6270 3.07	6053 3.02	5851 2.57	5674 2.52	5517 2.50	5444 2.49	47	54	62
1225	6401 3.10	6179 3.06	5973 3.01	5793 2.56	5632 2.53	5557 2.52	48	55	64
1250	6531 3.14	6305 3.09	6095 3.04	5911 2.59	5747 2.57	5670 2.56	49	56	65
1275	6662 3.18	6431 3.13	6217 3.08	6029 3.03	5862 3.00	5783 2.59	50	58	66
1300	6792 3.22	6556 3.17	6338 3.11	6147 3.06	5977 3.03	5895 3.02	51	59	68
1325	6922 3.26	6682 3.20	6460 3.15	6265 3.10	6092 3.07	6008 3.06	52	60	69
1350	7052 3.29	6807 3.24	6581 3.19	6383 3.13	6207 3.10	6120 3.09	53	61	70

LOW AIR CONDITIONING	**LOW AIR CONDITIONING**	**TOTAL ANTI ICE ON**
∆FUEL = – 0.6 %	∆FUEL = + 3 %	∆FUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	290	**310**	**330**	**350**	**370**	**390**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**
1350	7052 3.29	6807 3.24	6581 3.19	6383 3.13	6207 3.10	6120 3.09	53	61	70
1375	7182 3.33	6933 3.28	6702 3.22	6500 3.17	6321 3.13	6232 3.12	54	62	71
1400	7312 3.37	7058 3.32	6823 3.26	6618 3.20	6435 3.17	6344 3.16	55	64	73
1425	7441 3.41	7183 3.35	6944 3.29	6735 3.24	6550 3.20	6455 3.19	57	65	74
1450	7570 3.45	7308 3.39	7065 3.33	6852 3.27	6664 3.24	6567 3.22	58	66	75
1475	7700 3.48	7432 3.43	7185 3.37	6969 3.31	6777 3.27	6678 3.26	59	67	77
1500	7829 3.52	7557 3.46	7305 3.40	7086 3.34	6891 3.30	6789 3.29	60	68	78
1525	7958 3.56	7681 3.50	7426 3.44	7203 3.38	7005 3.34	6900 3.32	61	69	79
1550	8087 4.00	7805 3.54	7546 3.47	7319 3.41	7118 3.37	7010 3.36	62	71	80
1575	8215 4.04	7930 3.58	7666 3.51	7435 3.45	7231 3.41	7121 3.39	63	72	89
1600	8344 4.07	8054 4.01	7785 3.55	7552 3.48	7344 3.44	7231 3.42	64	73	90
1625	8472 4.11	8177 4.05	7905 3.58	7668 3.52	7457 3.47	7341 3.46	65	74	91
1650	8601 4.15	8301 4.09	8025 4.02	7784 3.55	7570 3.51	7451 3.49	66	75	93
1675	8729 4.19	8425 4.13	8144 4.06	7899 3.59	7683 3.54	7561 3.52	67	76	94
1700	8857 4.23	8548 4.16	8263 4.09	8015 4.03	7795 3.57	7671 3.56	68	78	95
1725	8985 4.26	8671 4.20	8382 4.13	8131 4.06	7908 4.01	7780 3.59	69	79	97
1750	9112 4.30	8794 4.24	8501 4.16	8246 4.10	8020 4.04	7890 4.02	70	80	98
1775	9240 4.34	8917 4.28	8620 4.20	8361 4.13	8132 4.08	7999 4.06	71	81	99
1800	9368 4.38	9040 4.32	8739 4.24	8476 4.17	8244 4.11	8108 4.09	72	82	101
1825	9495 4.42	9163 4.35	8857 4.27	8591 4.20	8356 4.15	8216 4.12	73	83	102
1850	9622 4.46	9285 4.39	8975 4.31	8706 4.24	8467 4.18	8325 4.16	74	84	103
1875	9749 4.49	9408 4.43	9094 4.35	8821 4.27	8579 4.21	8433 4.19	75	86	104
1900	9876 4.53	9530 4.47	9212 4.38	8935 4.31	8690 4.25	8541 4.22	76	87	106
1925	10003 4.57	9652 4.50	9330 4.42	9049 4.34	8802 4.28	8650 4.26	76	88	107
1950	10130 5.01	9774 4.54	9447 4.46	9164 4.38	8913 4.32	8757 4.29	77	89	108
1975	10256 5.05	9896 4.58	9565 4.49	9278 4.42	9024 4.35	8865 4.32	78	90	110

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	290	**310**	**330**	**350**	**370**	**390**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**
1975	10256 5.05	9896 4.58	9565 4.49	9278 4.42	9024 4.35	8865 4.32	78	90	110
2000	10383 5.09	10018 5.02	9683 4.53	9392 4.45	9135 4.38	8973 4.36	79	91	111
2025	10510 5.12	10139 5.06	9800 4.57	9505 4.49	9245 4.42	9080 4.39	80	92	112
2050	10637 5.16	10261 5.10	9917 5.00	9619 4.52	9356 4.45	9187 4.42	81	93	113
2075	10764 5.20	10382 5.13	10034 5.04	9733 4.56	9466 4.49	9294 4.46	82	94	114
2100	10891 5.24	10503 5.17	10151 5.08	9846 5.00	9577 4.52	9401 4.49	83	96	116
2125	11017 5.27	10623 5.21	10268 5.11	9959 5.03	9687 4.55	9508 4.52	84	97	117
2150	11144 5.31	10744 5.25	10385 5.15	10072 5.07	9797 4.59	9615 4.56	85	98	118
2175	11270 5.35	10864 5.29	10502 5.19	10186 5.10	9907 5.02	9721 4.59	86	99	119
2200	11397 5.39	10984 5.32	10618 5.23	10298 5.14	10016 5.06	9827 5.02	87	100	121
2225	11523 5.43	11104 5.36	10735 5.26	10411 5.17	10126 5.09	9933 5.06	88	101	122
2250	11649 5.46	11224 5.40	10851 5.30	10523 5.21	10236 5.13	10039 5.09	89	102	123
2275	11775 5.50	11344 5.44	10967 5.34	10636 5.25	10345 5.16	10145 5.12	90	103	124
2300	11901 5.54	11463 5.48	11083 5.37	10748 5.28	10454 5.19	10251 5.16	91	104	125
2325	12027 5.58	11583 5.52	11199 5.41	10860 5.32	10563 5.23	10356 5.19	92	105	127
2350	12153 6.01	11702 5.56	11314 5.45	10972 5.35	10672 5.26	10462 5.22	93	106	128
2375	12279 6.05	11821 5.59	11430 5.49	11084 5.39	10781 5.30	10567 5.26	94	108	129
2400	12404 6.09	11940 6.03	11546 5.52	11195 5.43	10890 5.33	10673 5.29	95	109	130
2425	12530 6.13	12059 6.07	11661 5.56	11307 5.46	10998 5.37	10778 5.32	95	110	131
2450	12655 6.16	12178 6.11	11776 6.00	11418 5.50	11106 5.40	10883 5.36	96	111	132
2475	12780 6.20	12297 6.15	11891 6.03	11530 5.54	11215 5.44	10988 5.39	97	112	134
2500	12906 6.24	12415 6.19	12006 6.07	11641 5.57	11323 5.47	11093 5.42	98	113	135
2525	13031 6.28	12534 6.23	12121 6.11	11752 6.01	11431 5.51	11198 5.46	99	114	136
2550	13155 6.31	12652 6.26	12236 6.15	11863 6.04	11539 5.54	11302 5.49	100	115	137
2575	13280 6.35	12770 6.30	12351 6.18	11974 6.08	11647 5.58	11407 5.53	101	116	138
2600	13405 6.39	12888 6.34	12465 6.22	12084 6.12	11754 6.01	11511 5.56	102	117	139

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
2600	13405 6.39	12888 6.34	12465 6.22	12084 6.12	11754 6.01	11511 5.56	102	117	139
2625	13530 6.43	13006 6.38	12580 6.26	12195 6.15	11862 6.05	11615 5.59	103	118	140
2650	13654 6.47	13124 6.42	12694 6.30	12305 6.19	11969 6.08	11719 6.03	104	119	141
2675	13778 6.50	13241 6.46	12808 6.33	12416 6.23	12077 6.12	11823 6.06	104	120	143
2700	13903 6.54	13359 6.50	12922 6.37	12526 6.26	12184 6.15	11927 6.09	105	121	144
2725	14027 6.58	13476 6.54	13036 6.41	12636 6.30	12291 6.18	12031 6.13	106	122	145
2750	14151 7.02	13593 6.58	13150 6.45	12746 6.34	12398 6.22	12134 6.16	107	123	146
2775	14275 7.05	13710 7.02	13263 6.49	12856 6.37	12505 6.25	12238 6.19	108	124	147
2800	14399 7.09	13827 7.05	13377 6.52	12965 6.41	12612 6.29	12341 6.23	109	125	148
2825	14523 7.13	13944 7.09	13490 6.56	13075 6.45	12718 6.32	12444 6.26	110	126	149
2850	14646 7.17	14060 7.13	13603 7.00	13184 6.48	12825 6.36	12547 6.30	111	128	150
2875	14770 7.21	14177 7.17	13716 7.04	13294 6.52	12931 6.39	12650 6.33	111	129	151
2900	14893 7.24	14293 7.21	13829 7.07	13403 6.56	13037 6.43	12752 6.36	112	130	152
2925	15017 7.28	14410 7.25	13942 7.11	13512 6.59	13143 6.46	12855 6.40	113	131	154
2950	15140 7.32	14526 7.29	14055 7.15	13621 7.03	13249 6.50	12957 6.43	114	132	155
2975	15263 7.36	14642 7.33	14168 7.19	13730 7.07	13355 6.53	13060 6.46	115	133	156
3000	15386 7.39	14758 7.37	14280 7.23	13838 7.10	13461 6.57	13162 6.50	116	134	157
3025	15509 7.43	14873 7.41	14393 7.26	13947 7.14	13567 7.00	13264 6.53	117	135	158
3050	15632 7.47	14989 7.45	14505 7.30	14055 7.18	13672 7.04	13366 6.57	117	136	159
3075	15754 7.51	15105 7.49	14617 7.34	14164 7.21	13778 7.08	13467 7.00	118	137	160
3100	15877 7.54	15220 7.53	14729 7.38	14272 7.25	13883 7.11	13569 7.03	119	138	161

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.6 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

GENERAL

Holding tables contain information about the total fuel flow that allows the flight crew to plan holding and reserve fuel requirements.
They are established for flight in a race track holding pattern for two different configurations:
· clean configuration at 210 knots and green dot speed
· configuration 1 at 170 knots and S speed.
Green dot speed in clean configuration and S in CONF 1 are speeds between the minimum fuel speed and the minimum drag speed.
These charts are established with air conditioning in normal mode and the center of gravity at 33 %.

R

RACE TRACK HOLDING PATTERN - GREEN DOT SPEED

MAX. CRUISE THRUST LIMITS CLEAN CONFIGURATION NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=33.0%	**N1 (%)** **FF (KG/H/ENG)**

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL140	FL180	FL200	FL220	FL250
44	44.6 889	46.7 869	50.0 848	52.8 835	56.1 821	57.7 813	59.3 807	61.9 797
46	45.5 924	47.7 907	51.0 885	53.8 872	57.3 856	58.7 848	60.3 841	63.2 829
48	46.4 960	48.7 945	51.9 922	54.9 908	58.2 891	59.7 884	61.4 877	64.4 861
50	47.2 997	49.7 981	52.8 958	56.0 943	59.1 926	60.7 918	62.5 909	65.5 890
52	48.1 1035	50.4 1017	53.7 995	57.1 979	60.1 962	61.7 953	63.6 941	66.4 917
54	49.0 1074	51.2 1054	54.7 1033	58.1 1016	61.0 997	62.7 985	64.6 973	67.4 946
56	49.9 1110	52.0 1091	55.6 1069	58.9 1051	61.9 1030	63.7 1017	65.7 1002	68.3 974
58	50.7 1147	52.8 1127	56.5 1105	59.7 1086	62.8 1063	64.7 1048	66.6 1029	69.2 1004
60	51.3 1184	53.5 1163	57.5 1142	60.5 1122	63.8 1094	65.7 1079	67.4 1057	70.1 1034
62	52.0 1220	54.3 1201	58.5 1180	61.3 1156	64.7 1126	66.6 1107	68.3 1086	71.0 1065
64	52.7 1256	55.1 1239	59.3 1216	62.1 1189	65.7 1157	67.4 1134	69.1 1115	71.8 1097
66	53.4 1293	55.9 1278	60.0 1251	62.9 1222	66.6 1186	68.2 1163	70.0 1145	72.6 1130
68	54.2 1330	56.8 1315	60.7 1287	63.8 1255	67.4 1214	69.0 1192	70.8 1175	73.4 1164
70	54.9 1369	57.6 1353	61.4 1320	64.6 1287	68.1 1241	69.8 1222	71.5 1207	74.3 1199
72	55.6 1408	58.4 1391	62.1 1354	65.4 1319	68.9 1271	70.6 1252	72.3 1239	75.1 1234
74	56.3 1448	59.2 1429	62.8 1387	66.2 1348	69.6 1301	71.3 1282	73.0 1272	75.9 1272
76	57.1 1487	60.0 1467	63.5 1420	67.0 1378	70.3 1331	72.0 1314	73.7 1306	76.6 1311

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**	**PER 1° ABOVE ISA**	**STRAIGHT LINE**
ΔFF = – 0.3 %	ΔFF = + 6 %	ΔFF = + 10 %	ΔFF = + 0.3 %	ΔFF = – 5 %

R

RACE TRACK HOLDING PATTERN - 210KT

MAX. CRUISE THRUST LIMITS CLEAN CONFIGURATION NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=33.0%	**N1 (%)** **FF (KG/H/ENG)**

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL140	FL180	FL200	FL220	FL250
44	47.0 976	49.4 950	52.5 928	55.7 920	58.8 892	60.3 878	61.9 867	64.6 850
46	47.5 998	49.9 973	53.0 952	56.3 942	59.3 913	60.8 901	62.5 891	65.3 870
48	48.0 1022	50.4 997	53.6 977	57.0 966	59.9 937	61.5 926	63.2 913	65.9 890
50	48.6 1047	50.8 1023	54.2 1004	57.7 990	60.5 961	62.1 951	63.9 936	66.5 911
52	49.2 1073	51.4 1049	54.8 1032	58.3 1015	61.1 988	62.8 976	64.6 960	67.2 933
54	49.8 1100	51.9 1077	55.5 1062	58.9 1041	61.8 1015	63.5 1001	65.4 984	67.9 956
56	50.4 1129	52.5 1107	56.3 1090	59.5 1068	62.5 1043	64.3 1028	66.2 1008	68.6 981
58	51.0 1158	53.1 1137	57.0 1119	60.1 1096	63.2 1071	65.1 1054	66.9 1033	69.4 1007
60	51.5 1189	53.7 1169	57.7 1149	60.7 1125	64.0 1099	65.9 1080	67.6 1058	70.1 1034
62	52.1 1221	54.4 1202	58.5 1181	61.4 1157	64.7 1127	66.7 1107	68.3 1086	70.9 1063
64	52.7 1254	55.0 1236	59.2 1213	62.0 1188	65.6 1156	67.3 1134	69.0 1115	71.6 1095
66	53.3 1288	55.7 1272	59.8 1245	62.7 1220	66.4 1185	68.1 1164	69.8 1145	72.5 1128
68	53.9 1324	56.4 1305	60.4 1278	63.5 1253	67.2 1214	68.8 1195	70.6 1176	73.3 1163
70	54.5 1361	57.2 1341	61.0 1313	64.2 1285	67.9 1245	69.6 1226	71.4 1211	74.2 1199
72	55.2 1399	58.0 1377	61.7 1348	65.0 1318	68.6 1278	70.4 1259	72.2 1248	75.0 1237
74	55.9 1439	58.8 1416	62.4 1384	65.9 1351	69.4 1312	71.2 1294	73.0 1286	75.8 1280
76	56.6 1476	59.6 1455	63.1 1422	66.7 1385	70.2 1347	72.0 1333	73.9 1325	76.5 1314

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**	**PER 1° ABOVE ISA**	**STRAIGHT LINE**
ΔFF = – 0.3 %	ΔFF = + 6 %	ΔFF = + 10 %	ΔFF = + 0.3 %	ΔFF = – 5 %

R

RACE TRACK HOLDING PATTERN - S SPEED

MAX. CRUISE THRUST LIMITS
CONFIGURATION 1
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%

N1 (%)
FF (KG/H/ENG)

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL120	FL140	FL160	FL180	FL200
44	45.5 913	47.7 891	50.9 873	52.2 866	53.7 860	55.4 854	57.1 848	58.5 840
46	46.4 948	48.7 929	51.8 912	53.3 905	54.8 899	56.6 892	58.1 885	59.5 877
48	47.3 985	49.7 968	52.8 951	54.3 945	56.0 938	57.7 931	59.0 922	60.6 916
50	48.3 1023	50.5 1008	53.8 991	55.4 984	57.1 977	58.6 968	60.0 959	61.7 953
52	49.2 1062	51.3 1048	54.8 1031	56.4 1023	58.1 1015	59.5 1005	61.0 998	62.7 987
54	50.1 1102	52.1 1088	55.8 1070	57.5 1062	58.9 1052	60.4 1043	62.0 1035	63.8 1022
56	50.9 1142	53.0 1129	56.7 1109	58.4 1100	59.8 1089	61.3 1081	63.0 1069	64.9 1057
58	51.6 1182	53.8 1168	57.7 1148	59.2 1137	60.6 1127	62.2 1117	64.0 1104	65.9 1088
60	52.3 1223	54.6 1208	58.7 1186	60.0 1173	61.5 1164	63.1 1152	65.0 1139	66.8 1118
62	53.0 1264	55.4 1249	59.4 1222	60.8 1211	62.3 1200	64.0 1187	66.0 1170	67.7 1149
64	53.7 1304	56.3 1289	60.1 1259	61.6 1248	63.2 1237	65.0 1221	66.9 1201	68.5 1181
66	54.5 1344	57.1 1328	60.9 1297	62.4 1284	64.0 1271	65.9 1254	67.7 1232	69.4 1213
68	55.2 1385	57.9 1366	61.6 1333	63.2 1321	64.9 1305	66.8 1285	68.5 1263	70.2 1245
70	55.9 1426	58.8 1404	62.3 1370	63.9 1357	65.7 1338	67.6 1316	69.3 1295	71.1 1278
72	56.7 1466	59.6 1442	63.1 1406	64.7 1391	66.6 1371	68.3 1347	70.0 1328	71.8 1312
74	57.4 1504	60.2 1479	63.8 1442	65.5 1424	67.5 1403	69.1 1379	70.8 1360	72.6 1347
76	58.2 1541	60.8 1515	64.6 1477	66.3 1457	68.2 1433	69.8 1411	71.6 1393	73.4 1381

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON	PER 1° ABOVE ISA	STRAIGHT LINE
ΔFF = – 0.3 %	ΔFF = + 6 %	ΔFF = + 10 %	ΔFF = + 0.3 %	ΔFF = – 5 %

R

RACE TRACK HOLDING PATTERN - 170KT

MAX. CRUISE THRUST LIMITS
CONFIGURATION 1
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%

N1 (%)
FF (KG/H/ENG)

WEIGHT (1000KG)	FL 15	FL 50	FL100	FL120	FL140	FL160	FL180	FL200
44	45.8 927	48.1 907	51.2 886	52.6 879	54.1 874	55.8 865	57.5 855	58.9 847
46	46.6 957	48.9 939	52.0 919	53.4 912	55.0 906	56.8 897	58.3 888	59.7 880
48	47.4 988	49.8 972	52.9 953	54.4 947	56.0 940	57.7 932	59.1 922	60.6 916
50	48.3 1022	50.5 1007	53.8 990	55.4 983	57.1 977	58.6 968	60.0 959	61.6 953
52	49.2 1058	51.3 1044	54.7 1028	56.4 1020	58.1 1016	59.4 1006	61.0 999	62.7 988
54	50.1 1096	52.1 1083	55.7 1067	57.5 1061	58.9 1055	60.4 1047	62.0 1038	63.8 1025
56	50.9 1136	53.0 1124	56.8 1107	58.5 1102	59.8 1097	61.3 1088	63.0 1075	64.9 1063
58	51.7 1178	53.9 1166	57.9 1150	59.3 1144	60.7 1140	62.3 1129	64.1 1114	66.1 1100
60	52.5 1221	54.8 1210	58.9 1194	60.2 1188	61.7 1184	63.4 1169	65.3 1155	67.1 1138
62	53.3 1266	55.8 1256	59.7 1238	61.1 1234	62.7 1227	64.5 1211	66.4 1195	68.1 1178
64	54.2 1313	56.8 1301	60.6 1286	62.1 1280	63.8 1269	65.6 1253	67.4 1236	69.2 1219
66	55.1 1361	57.8 1348	61.5 1333	63.1 1326	64.8 1313	66.8 1296	68.5 1278	70.3 1263
68	56.1 1411	58.9 1397	62.5 1381	64.1 1370	66.0 1356	67.8 1339	69.5 1321	71.4 1312
70	57.0 1461	59.9 1446	63.5 1430	65.2 1415	67.1 1402	68.8 1384	70.6 1368	72.5 1363
72	58.0 1511	60.7 1496	64.5 1476	66.3 1460	68.1 1448	69.8 1430	71.7 1418	73.6 1415
74	59.1 1562	61.5 1547	65.5 1522	67.4 1507	69.1 1495	70.9 1478	72.8 1472	74.8 1470
76	60.1 1615	62.4 1599	66.6 1569	68.4 1556	70.1 1544	71.9 1531	73.8 1527	75.9 1529

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**	**PER 1° ABOVE ISA**	**STRAIGHT LINE**
ΔFF = – 0.3 %	ΔFF = + 6 %	ΔFF = + 10 %	ΔFF = + 0.3 %	ΔFF = – 5 %

GENERAL

Descent tables are established for normal descent speed M.78/300kt/250kt and emergency descent at MMO/VMO with airbrakes extended, down to 1500 feet with :
· Normal air conditioning
· CG = 33 %
· Anti ice OFF
For normal descent, cabin vertical speed is limited to 350 feet/minute.

R

DESCENT - M.78/300KT/250KT									
IDLE THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF			ISA CG=33.0%		MAXIMUM CABIN RATE OF DESCENT 350FT/MIN				
WEIGHT (1000KG)	45				65				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
390	16.1	208	101	68.2	17.7	173	108	IDLE	241
370	14.6	177	90	69.4	16.9	169	102	IDLE	252
350	12.9	136	77	71.5	16.2	165	97	IDLE	264
330	12.1	125	71	IDLE	15.6	161	92	IDLE	277
310	11.7	123	68	IDLE	15.0	157	88	IDLE	289
290	11.2	120	64	IDLE	14.4	154	83	IDLE	300
270	10.6	116	60	IDLE	13.6	149	77	IDLE	300
250	10.1	112	56	IDLE	12.9	144	72	IDLE	300
240	9.8	110	54	IDLE	12.5	141	69	IDLE	300
220	9.1	105	49	IDLE	11.6	134	63	IDLE	300
200	8.5	98	45	IDLE	10.8	125	57	IDLE	300
180	7.8	90	40	IDLE	9.8	114	51	IDLE	300
160	7.1	80	36	IDLE	8.9	101	45	IDLE	300
140	6.3	68	31	IDLE	7.9	86	39	IDLE	300
120	5.6	57	27	IDLE	6.9	71	33	IDLE	300
100	4.8	47	22	IDLE	6.0	57	28	IDLE	300
50	1.7	12	7	IDLE	2.1	15	9	IDLE	250
15	.0	0	0	IDLE	.0	0	0	IDLE	250

CORRECTIONS	LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON	PER 1° ABOVE ISA
TIME	–	+ 7 %	+ 8 %	+ 0.3 %
FUEL	– 1 %	+30 %	+ 60 %	+ 0.9 %
DISTANCE	–	+ 7 %	+ 8 %	+ 1 %

R

EMERGENCY DESCENT - M.82/350KT

IDLE THRUST
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%

AIRBRAKES EXTENDED

WEIGHT (1000KG)	45				65				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
390	5.9	62	42	IDLE	7.9	85	57	IDLE	255
370	5.5	60	39	IDLE	7.5	83	54	IDLE	267
350	5.2	58	37	IDLE	7.1	81	51	IDLE	279
330	4.9	56	34	IDLE	6.8	78	48	IDLE	292
310	4.6	55	32	IDLE	6.4	76	45	IDLE	306
290	4.4	53	30	IDLE	6.1	74	43	IDLE	319
270	4.1	52	29	IDLE	5.8	72	40	IDLE	333
250	3.9	50	27	IDLE	5.5	71	38	IDLE	347
240	3.8	50	26	IDLE	5.3	70	37	IDLE	350
220	3.5	48	24	IDLE	4.9	67	34	IDLE	350
200	3.2	45	21	IDLE	4.5	62	30	IDLE	350
180	2.9	41	19	IDLE	4.1	57	27	IDLE	350
160	2.6	36	17	IDLE	3.6	51	24	IDLE	350
140	2.3	31	14	IDLE	3.2	43	20	IDLE	350
120	1.9	25	12	IDLE	2.7	36	17	IDLE	350
100	1.6	20	10	IDLE	2.3	29	14	IDLE	350
50	.8	9	5	IDLE	1.1	13	7	IDLE	350
0	.0	0	0	IDLE	.0	0	0	IDLE	350

GENERAL

In the go around configuration corresponding to the all engine procedure, the minimum steady gradient one engine inoperative required by the regulations is 2.1 % at a speed not exceeding 1.4 Vs. This requirement is also called approach climb performance by regulations.
The following graph allows to determine the go around limiting weight which satisfies the required gradient with the certified go around configurations 3 and 2.
The required gradient of 2.1 % is considered at the airport reference altitude. The power setting is «GO AROUND» thrust with the air conditioning ON. The speed is 1.23 Vs of the specified configuration. For the occasional cases where approach climb performance is found restrictive, a correction is given for an increased speed up to 1.4 Vs.

Note : Landing climb performance (2 engines running) is never limiting.

PROCEDURE

According to airport pressure altitude and temperature determine if the slats/flaps setting must be restricted as a function of the landing weight, in order to meet the go around gradient requirement of 2.1 %.
Establish the final approach configuration with one more step of flaps. If the approach is interrupted, retract the flaps by one step during the go-around.
In case of category II approach, JAR-OPS requires a regulatory approach climb gradient of 2.5 % to be maintained.
Use the tables for CAT II approach to determine the maximum approach climb limiting weight according to airport pressure altitude and temperature.

Note :
1. *If circumstances dictate, landing may be made at a weight corresponding to the maximum structural takeoff weight (refer to overweight landing procedure 3.02).*
2. *When icing conditions are predicted during the flight and TAT is less than 10° C and there is an evidence of significant ice accretion, to take into account ice formation on the non heated structure :*
   - *decrease the approach climb limiting weight by 7.2 %.*
   - R *in CONF FULL, the approach speed must not be lower than VREF + 5 knots and the landing distance must be multiplied by 1.1.*
     or
     in CONF 3, the approach speed must not be lower than VLS + 10 knots and the landing distance must be multiplied by 1.15.
3. *In the following tables corrections for anti ice are only valid for OAT lower than 10°C.*

APPROACH CLIMB LIMITING WEIGHT (1000 KG) ONE ENGINE OUT ONE ENGINE AT GO AROUND THRUST	Gradient : 2.1% High Air Conditioning Anti ice OFF V = 1.23 Vs	CONF 2

OAT (°C)	PRESSURE ALTITUDE (ft)											
	–1000	0	200	400	600	800	1000	1500	2000	5000	8000	9200
≤ 10	75.2	74.9	74.7	74.6	74.4	74.2	74.0	73.5	72.9	69.7	66.1	64.4
20	74.8	74.6	74.5	74.3	74.1	73.9	73.7	73.2	72.7	69.5	65.9	64.2
22	74.8	74.6	74.4	74.2	74.0	73.9	73.7	73.2	72.7	69.4	65.9	64.2
24	74.7	74.5	74.4	74.2	74.0	73.8	73.6	73.1	72.6	69.4	65.8	64.2
26	74.7	74.5	74.3	74.1	73.9	73.8	73.6	73.1	72.6	69.4	65.8	64.1
28	74.6	74.4	74.3	74.1	73.9	73.7	73.5	73.0	72.5	69.4	65.8	63.3
30	74.6	74.4	74.2	74.0	73.9	73.7	73.5	73.0	72.5	69.3	65.1	62.0
32	74.5	74.4	74.2	74.0	73.8	73.6	73.4	73.0	72.5	69.3	63.7	60.6
34	74.5	74.3	74.1	74.0	73.8	73.6	73.4	72.9	72.4	69.3	62.3	59.2
36	74.5	74.3	74.1	73.9	73.8	73.6	73.4	72.9	72.4	68.6	61.0	57.9
38	74.4	74.3	74.1	73.9	73.7	73.6	73.4	72.9	72.4	67.4	59.7	
40	74.4	74.2	74.1	73.9	73.7	73.6	73.4	72.9	72.4	66.2		
42	74.4	74.2	74.1	73.9	73.7	73.5	73.3	72.8	71.7	65.0		
44	74.4	74.1	74.0	73.8	73.5	73.0	72.6	71.5	70.5	63.8		
46	74.3	73.4	73.0	72.6	72.2	71.7	71.3	70.3	69.2			
48	73.5	72.1	71.7	71.3	70.9	70.4	70.0	69.0	68.0			
50	72.1	70.8	70.4	70.0	69.6	69.2	68.7	67.7	66.7			
52	70.9	69.5	69.1	68.7	68.3	67.9	67.5	66.5				
54	69.7	68.3	67.9	67.5								
55	69.0	67.7										

AIR CONDITIONING OFF : ADD	ENGINE ANTI ICE ON : SUBTRACT	TOTAL ANTI ICE ON : SUBTRACT	SPEED INCREASE PER 0.01 Vs ADD
1600 kg	250 kg	800 kg	250 kg

OCTO 10.0.2 AD112A01

APPROACH CLIMB LIMITING WEIGHT (1000 LB) ONE ENGINE OUT ONE ENGINE AT GO AROUND THRUST	Gradient : 2.1% High Air Conditioning Anti ice OFF V = 1.23 Vs	CONF 3

OAT (°C)	PRESSURE ALTITUDE (ft) –1000	0	200	400	600	800	1000	1500	2000	5000	8000	9200
≤ 10	72.7	72.4	72.3	72.1	71.9	71.7	71.5	71.0	70.5	67.3	63.8	62.2
20	72.4	72.2	72.0	71.8	71.6	71.4	71.2	70.7	70.2	67.1	63.6	62.0
22	72.3	72.1	71.9	71.7	71.6	71.4	71.2	70.7	70.2	67.1	63.6	62.0
24	72.2	72.0	71.9	71.7	71.5	71.3	71.1	70.6	70.1	67.1	63.5	62.0
26	72.2	72.0	71.8	71.6	71.5	71.3	71.1	70.6	70.1	67.0	63.5	61.9
28	72.1	72.0	71.8	71.6	71.4	71.2	71.0	70.6	70.0	67.0	63.5	61.2
30	72.1	71.9	71.7	71.6	71.4	71.2	71.0	70.5	70.0	67.0	62.9	59.9
32	72.1	71.9	71.7	71.5	71.3	71.2	71.0	70.5	70.0	67.0	61.6	58.6
34	72.0	71.8	71.7	71.5	71.3	71.1	70.9	70.5	70.0	66.9	60.2	57.2
36	72.0	71.8	71.6	71.5	71.3	71.1	70.9	70.4	69.9	66.3	58.9	56.0
38	72.0	71.8	71.6	71.4	71.3	71.1	70.9	70.4	69.9	65.2	57.7	
40	71.9	71.8	71.6	71.4	71.3	71.1	70.9	70.4	69.9	64.0		
42	71.9	71.8	71.6	71.4	71.2	71.0	70.8	70.3	69.3	62.8		
44	71.9	71.7	71.5	71.3	71.0	70.6	70.2	69.1	68.1	61.7		
46	71.8	71.0	70.6	70.2	69.7	69.3	68.9	67.9	66.9			
48	71.0	69.7	69.3	68.9	68.5	68.1	67.7	66.7	65.7			
50	69.7	68.4	68.0	67.6	67.2	66.8	66.4	65.4	64.4			
52	68.5	67.2	66.8	66.4	66.0	65.6	65.2	64.2				
54	67.3	66.1	65.7	65.3								
55	66.8	65.5										

AIR CONDITIONING OFF : ADD 1600 kg	ENGINE ANTI ICE ON : SUBTRACT 250 kg	TOTAL ANTI ICE ON : SUBTRACT 800 kg	SPEED INCREASE : PER 0.01 Vs ADD 250 kg

OCTO 10.0.2 AD112A01

LEFT INTENTIONALLY BLANK

APPROACH CLIMB LIMITING WEIGHT (1000 KG) ONE ENGINE OUT ONE ENGINE AT GO AROUND THRUST	Gradient : 2.5% High Air Conditioning Anti ice OFF	CAT II CONF 2

OAT (°C)	PRESSURE ALTITUDE (FT) -1000	0	200	400	600	800	1000	1500	2000	5000	8000	9200
≤ 10	74.4	74.2	74.0	73.8	73.6	73.4	73.2	72.7	72.2	69.0	65.4	63.7
20	74.1	73.9	73.7	73.5	73.3	73.2	73.0	72.5	72.0	68.8	65.3	63.6
22	74.0	73.8	73.6	73.5	73.3	73.1	72.9	72.4	71.9	68.8	65.2	63.6
24	74.0	73.8	73.6	73.4	73.2	73.1	72.9	72.4	71.9	68.7	65.2	63.6
26	73.9	73.7	73.5	73.4	73.2	73.0	72.8	72.3	71.9	68.7	65.2	63.5
28	73.9	73.7	73.5	73.3	73.1	73.0	72.8	72.3	71.8	68.7	65.2	62.7
30	73.8	73.6	73.5	73.3	73.1	72.9	72.7	72.3	71.8	68.6	64.6	61.4
32	73.8	73.6	73.4	73.3	73.1	72.9	72.7	72.2	71.8	68.6	63.2	60.1
34	73.7	73.6	73.4	73.2	73.0	72.9	72.7	72.2	71.7	68.6	61.8	58.7
36	73.7	73.5	73.4	73.2	73.0	72.8	72.7	72.2	71.7	68.0	60.5	57.4
38	73.7	73.5	73.3	73.2	73.0	72.8	72.6	72.2	71.7	66.8	59.2	
40	73.7	73.5	73.3	73.2	73.0	72.8	72.6	72.2	71.6	65.6		
42	73.6	73.5	73.3	73.1	73.0	72.8	72.6	72.1	71.0	64.5		
44	73.6	73.4	73.2	73.0	72.7	72.3	71.9	70.9	69.8	63.3		
46	73.5	72.7	72.3	71.9	71.5	71.0	70.6	69.6	68.6			
48	72.8	71.4	71.0	70.6	70.2	69.8	69.4	68.4	67.4			
50	71.4	70.1	69.7	69.3	68.9	68.5	68.1	67.2	66.2			
52	70.2	68.8	68.4	68.1	67.7	67.3	66.9	65.9				
54	69.0	67.7	67.3	66.9								
55	68.4	67.2										

AIR CONDITIONING OFF ADD 1500 kg	ENGINE ANTI ICE ON SUBTRACT 200 kg	TOTAL ANTI ICE ON SUBTRACT 800 kg

OCTO 12.0.1 AD112A01 A319-112

LEFT INTENTIONALLY BLANK

APPROACH CLIMB LIMITING WEIGHT (1000 KG) ONE ENGINE OUT ONE ENGINE AT GO AROUND THRUST	Gradient : 2.5% High Air Conditioning Anti ice OFF	CAT II CONF 3

	PRESSURE ALTITUDE (FT)											
OAT (°C)	**−1000**	**0**	**200**	**400**	**600**	**800**	**1000**	**1500**	**2000**	**5000**	**8000**	**9200**
≤ 10	70.0	69.8	69.6	69.4	69.2	69.1	68.9	68.4	67.9	64.9	61.6	60.1
20	69.7	69.5	69.4	69.2	69.0	68.8	68.6	68.2	67.7	64.7	61.4	59.9
22	69.7	69.5	69.3	69.1	68.9	68.8	68.6	68.1	67.6	64.7	61.4	59.9
24	69.6	69.4	69.3	69.1	68.9	68.7	68.5	68.1	67.6	64.7	61.4	59.9
26	69.6	69.4	69.2	69.0	68.9	68.7	68.5	68.0	67.5	64.6	61.3	59.9
28	69.5	69.3	69.2	69.0	68.8	68.6	68.4	68.0	67.5	64.6	61.3	59.1
30	69.5	69.3	69.1	68.9	68.8	68.6	68.4	67.9	67.5	64.6	60.8	57.9
32	69.4	69.3	69.1	68.9	68.7	68.6	68.4	67.9	67.4	64.6	59.5	56.7
34	69.4	69.2	69.1	68.9	68.7	68.5	68.4	67.9	67.4	64.5	58.3	55.4
36	69.4	69.2	69.0	68.9	68.7	68.5	68.3	67.9	67.4	64.0	57.1	54.3
38	69.3	69.2	69.0	68.8	68.7	68.5	68.3	67.9	67.4	62.9	55.9	
40	69.3	69.2	69.0	68.8	68.7	68.5	68.3	67.9	67.3	61.8		
42	69.3	69.2	69.0	68.8	68.6	68.4	68.3	67.8	66.8	60.8		
44	69.3	69.1	68.9	68.7	68.4	68.0	67.6	66.6	65.6	59.7		
46	69.2	68.4	68.0	67.6	67.2	66.8	66.4	65.5	64.5			
48	68.5	67.2	66.8	66.4	66.0	65.7	65.3	64.3	63.3			
50	67.2	66.0	65.6	65.2	64.9	64.5	64.1	63.2	62.2			
52	66.1	64.8	64.4	64.1	63.7	63.3	62.9	62.1				
54	65.0	63.8	63.4	63.0								
55	64.4	63.3										

AIR CONDITIONING OFF ADD 1400 kg	**ENGINE ANTI ICE ON SUBTRACT** 200 kg	**TOTAL ANTI ICE ON SUBTRACT** 800 kg

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INTRODUCTION

The alternate planning tables enable the flight crew to determine the fuel consumption and time required to cover a given air distance from go around at destination airport to landing at alternate airport.
These tables are established for :
- Go around : 80 kg or 180 lb
- Climb profile : 250KT/300KT/M.78
- Long range cruise
- Descent profile : M.78/300KT/250KT
- Approach and landing at alternate airport : 60 kg or 140 lb (4 min)
- ISA
- CG : 33 %
- Normal air conditioning
- Anti ice off

Note : 1. *In the tables, a "*" means that a step climb of 4000 feet has been made to reach the corresponding flight level.*
2. *The flight level shown on the top of each column is the final flight level.*
3. *For each degree Celcius above ISA temperature apply a fuel correction of 0.015 (kg/°C/NM) × △ISA (°C) × Air Distance (NM) or 0.033 (lb/°C/NM) × △ISA (°C) × Air Distance (NM)*

CORRECTION FOR DEVIATION FROM REFERENCE WEIGHT

The alternate planning tables are based on a reference landing weight at destination.
The fuel consumption must be corrected when the landing weight is different from the reference landing weight.
If it is lower (or greater) than the reference weight, subtract (or add) the value given in the correction part of the table per 1000 kg or 1000 lb below (or above) the reference weight.

R

ALTERNATE PLANNING FROM DESTINATION TO ALTERNATE AIRPORT
GO-AROUND : 80 KG - CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE
DESCENT : M.78/300KT/250KT - VMC PROCEDURE : 60 KG (4MIN)

REF. LDG WT AT DEST. = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 100	120	140	160	180	200	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL120	FL140 FL160	FL180 FL200
50	563 0.14	538 0.14					3		
100	961 0.25	921 0.24	903 0.23	891 0.23	883 0.23	879 0.22	6	5	5
150	1360 0.35	1305 0.34	1270 0.33	1240 0.32	1216 0.32	1198 0.31	10	7	8
200	1762 0.45	1690 0.43	1637 0.42	1590 0.41	1551 0.41	1519 0.40	13	10	10
250	2165 0.55	2076 0.53	2005 0.51	1941 0.51	1886 0.50	1840 0.48	16	13	13
300	2569 1.05	2464 1.02	2374 1.01	2293 1.00	2223 0.59	2162 0.57	19	15	15
350	2976 1.15	2852 1.11	2744 1.10	2647 1.09	2560 1.08	2485 1.05	22	18	18
400	3384 1.25	3242 1.21	3115 1.19	3001 1.18	2898 1.17	2809 1.14	25	20	20
450	3794 1.34	3632 1.30	3486 1.28	3355 1.27	3237 1.25	3134 1.22	28	23	23
500	4205 1.44	4024 1.39	3859 1.38	3711 1.36	3576 1.34	3460 1.31	31	25	25
550	4615 1.53	4416 1.49	4233 1.47	4068 1.45	3917 1.43	3786 1.39	34	28	28
600	5027 2.03	4809 1.58	4607 1.56	4425 1.54	4259 1.52	4114 1.48	37	30	30
650	5440 2.12	5203 2.07	4983 2.05	4784 2.03	4601 2.00	4442 1.56	40	33	32
700	5855 2.22	5598 2.16	5359 2.14	5143 2.12	4944 2.09	4770 2.04	43	36	35
750	6271 2.31	5994 2.26	5736 2.23	5502 2.21	5288 2.18	5098 2.12	46	38	37
800	6688 2.40	6390 2.35	6114 2.32	5863 2.30	5633 2.26	5428 2.21	48	41	40
850	7106 2.49	6788 2.44	6494 2.41	6225 2.39	5979 2.35	5758 2.29	51	43	42
900	7526 2.58	7187 2.53	6874 2.50	6587 2.47	6326 2.43	6089 2.37	53	46	44
950	7947 3.07	7587 3.02	7255 2.59	6951 2.56	6674 2.52	6421 2.45	56	48	47
1000	8369 3.16	7987 3.11	7636 3.08	7315 3.05	7022 3.00	6753 2.54	58	51	49
1050	8793 3.25	8389 3.20	8019 3.17	7680 3.14	7372 3.09	7087 3.02	60	53	51
1100	9218 3.34	8792 3.29	8403 3.26	8046 3.22	7722 3.17	7421 3.10	63	56	53
1150	9645 3.43	9195 3.38	8788 3.35	8414 3.31	8074 3.26	7755 3.18	65	58	56
1200	10073 3.51	9600 3.47	9174 3.44	8782 3.40	8426 3.34	8091 3.26	68	61	58

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 3 %	ΔFUEL = + 4 %	ΔFUEL = + 6 %

R

ALTERNATE PLANNING FROM DESTINATION TO ALTERNATE AIRPORT
GO-AROUND : 80 KG - CLIMB : 250KT/300KT/M.78 - CRUISE : LONG RANGE
DESCENT : M.78/300KT/250KT - VMC PROCEDURE : 60 KG (4MIN)

REF. LDG WT AT DEST. = 50000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 230	270	310	350	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL230 FL270	FL310 FL350	FL390
150	1178 0.30	1167 0.29	1177 0.28			8	10	
200	1477 0.38	1438 0.37	1422 0.36	1423 0.35		10	12	
250	1776 0.46	1709 0.44	1669 0.44	1652 0.42	1652 0.42	12	14	15
300	2076 0.54	1980 0.52	1915 0.51	1882 0.50	1869 0.48	14	17	18
350	2377 1.02	2253 1.00	2163 0.59	2112 0.57	2086 0.55	16	19	21
400	2678 1.10	2525 1.07	2410 1.06	2343 1.04	2304 1.02	18	22	24
450	2980 1.18	2799 1.15	2659 1.14	2575 1.11	2523 1.09	20	24	27
500	3283 1.26	3073 1.23	2908 1.21	2807 1.18	2742 1.15	22	27	30
550	3586 1.34	3347 1.30	3157 1.29	3040 1.25	2962 1.22	24	29	33
600	3890 1.42	3622 1.38	3407 1.36	3273 1.32	3183 1.29	26	32	36
650	4194 1.49	3898 1.45	3657 1.44	3507 1.39	3404 1.36	28	34	39
700	4499 1.57	4174 1.53	3908 1.51	3742 1.47	3626 1.42	30	37	43
750	4804 2.05	4450 2.00	4160 1.59	3977 1.54	3848 1.49	32	39	46
800	5110 2.13	4727 2.08	4412 2.06	4213 2.01	4071 1.56	34	42	49
850	5417 2.21	5004 2.15	4665 2.14	4449 2.08	4294 2.02	36	44	52
900	5724 2.29	5282 2.23	4919 2.21	4687 2.15	4518 2.09	38	47	56
950	6032 2.36	5561 2.30	5173 2.29	4924 2.22	4743 2.16	40	50	59
1000	6340 2.44	5840 2.38	5428 2.36	5162 2.29	4969 2.22	42	52	62
1050	6649 2.52	6119 2.45	5684 2.44	5401 2.36	5195 2.29	44	55	66
1100	6958 3.00	6399 2.53	5941 2.51	5641 2.43	5423 2.36	46	58	69
1150	7268 3.07	6680 3.00	6198 2.58	5881 2.50	5651 2.42	47	60	72
1200	7579 3.15	6961 3.08	6456 3.06	6122 2.57	5880 2.49	49	63	76

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 3 %	ΔFUEL = + 4 %	ΔFUEL = + 6 %

GENERAL

R The ground distance/air distance conversion tables show the air distance for a given
R ground distance due to the influence of the wind.
R Tables are given for :
R – M.78
R – Long range speed.

M.78

R

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND		WIND COMPONENTS (KT)				HEAD WIND
	+ 150	+ 100	+ 50	0	– 50	– 100	– 150
10	7	8	9	**10**	11	13	15
20	15	16	18	**20**	23	26	30
30	22	25	27	**30**	34	39	45
40	30	33	36	**40**	45	51	60
50	37	41	45	**50**	56	64	75
100	75	82	90	**100**	113	129	150
200	150	164	180	**200**	225	257	300
300	225	245	270	**300**	338	386	450
400	300	327	360	**400**	450	514	600
500	375	409	450	**500**	563	643	750
1000	750	818	900	**1000**	1125	1286	1501
1500	1125	1227	1350	**1500**	1688	1929	2251
2000	1500	1636	1800	**2000**	2248	2572	3001
2500	1875	2045	2250	**2500**	2813	3215	3752
3000	2250	2454	2700	**3000**	3375	3858	4502
3500	2624	2863	3150	**3500**	3938	4501	5252
4000	2999	3272	3600	**4000**	4500	5144	6003
4500	3374	3681	4050	**4500**	5063	5787	6753
5000	3749	4090	4500	**5000**	5626	6430	7503

FLIP23 A320211 M565A1PIP 3410 03301.000011 0250300 .7800 .00000 0 0300350 0 0 77 64 43 61 18590 FCOM-N0–03–50–002–001

LONG RANGE SPEED UP TO FL270

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND		WIND COMPONENTS (KT)				HEAD WIND
	+ 150	+ 100	+ 50	0	– 50	– 100	– 150
10	7	8	9	**10**	12	14	17
20	14	16	18	**20**	23	27	34
30	21	24	26	**30**	35	41	51
40	28	31	35	**40**	46	55	68
50	36	39	44	**50**	58	69	84
100	71	79	88	**100**	116	137	169
200	142	157	176	**200**	232	275	338
300	213	236	264	**300**	347	412	507
400	284	314	352	**400**	463	550	676
500	355	393	440	**500**	579	687	845
1000	710	786	880	**1000**	1158	1374	1690
1500	1065	1179	1320	**1500**	1736	2061	2535
2000	1420	1572	1760	**2000**	2315	2748	3380
2500	1775	1965	2201	**2500**	2894	3435	4225
3000	2130	2358	2641	**3000**	3473	4122	5070
3500	2485	2751	3081	**3500**	4051	4809	5915
4000	2840	3144	3521	**4000**	4630	5496	6760
4500	3195	3537	3961	**4500**	5209	6183	7605
5000	3550	3930	4401	**5000**	5788	6870	8450

FLIP23 A319–114 CFM56–5A5 3410 03301.000011 0250300 .7801 .00000 0 0300350 0 0 70 61 40 57 18590 FCOM-N0–03–50–003–210

LONG RANGE SPEED ABOVE FL270

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND		WIND COMPONENTS (KT)				HEAD WIND
	+ 150	+ 100	+ 50	0	– 50	– 100	– 150
10	7	8	9	**10**	11	13	15
20	15	16	18	**20**	23	26	30
30	22	25	27	**30**	34	39	45
40	30	33	36	**40**	45	51	60
50	37	41	45	**50**	56	64	75
100	75	82	90	**100**	113	129	150
200	150	164	180	**200**	225	257	300
300	225	245	270	**300**	338	386	450
400	300	327	360	**400**	450	514	600
500	375	409	450	**500**	563	643	750
1000	750	818	900	**1000**	1125	1286	1500
1500	1125	1227	1350	**1500**	1688	1929	2251
2000	1500	1636	1800	**2000**	2250	2572	3001
2500	1875	2045	2250	**2500**	2813	3215	3751
3000	2250	2454	2700	**3000**	3375	3858	4501
3500	2625	2863	3150	**3500**	3938	4501	5252
4000	3000	3272	3600	**4000**	4500	5144	6002
4500	3375	3681	4050	**4500**	5063	5787	6752
5000	3749	4090	4500	**5000**	5625	6430	7502

FLIP23 A319–114 CFM56–5A5 3410 03301.000011 0250300 .7801 .00000 0 0300350 0 0 70 61 40 57 18590 FCOM-N0–03–50–004–210

06.00 CONTENTS

INTRODUCTION

This chapter provides the single engine performance data to be used for the conduct and monitoring of the flight following an engine failure.
The diversion strategy (descent and cruise speed schedules) shall be selected, and specified in the operator's routes specifications, as a function of the prevailing operational factors (e.g. obstacles clearance requirements and/or ETOPS operation).

FLIGHT PREPARATION

In readiness for a possible engine failure occurring during the flight, any flight shall be planned so as to comply with any of the following requirements, as applicable :
· obstacle clearance,
· oxygen,
· maximum diversion distance (ETOPS operation).
The following FCOM sections provide flight preparation and fuel planning information :
· 2.05.10 thru 2.05.60, for Standard Fuel Planning,
· 2.04.40, for Extended Range Operation (ETOPS) and associated fuel requirements.

STRATEGY

Depending on the prevailing operational constraints, the most appropriate diversion strategy shall be selected, out of the following options :

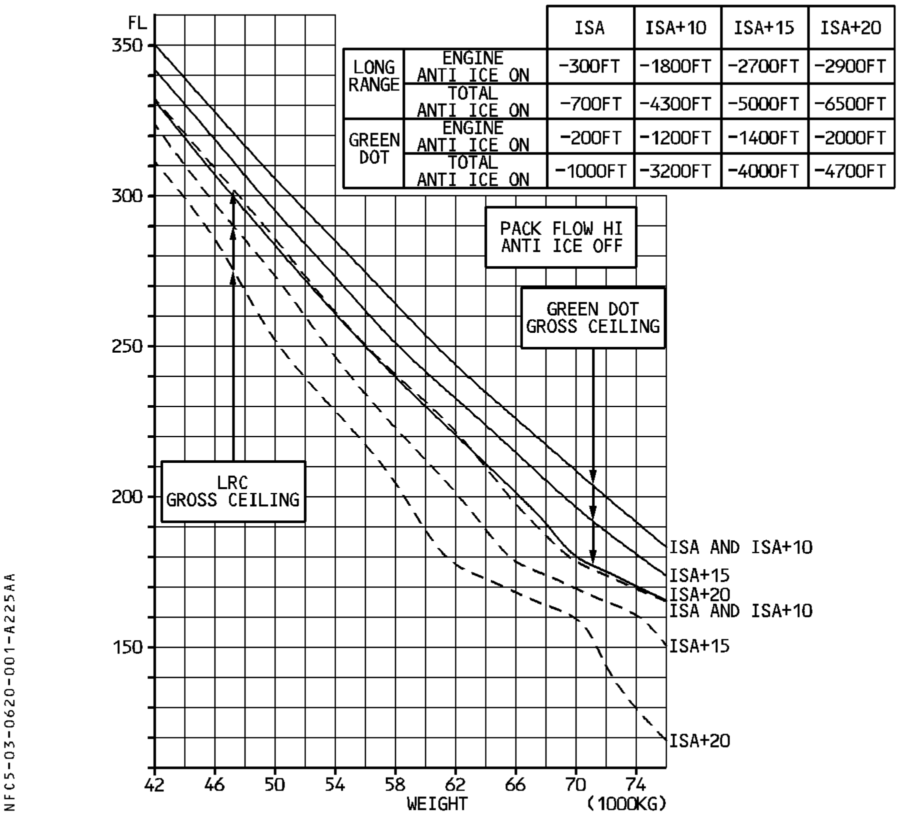
	STANDARD STRATEGY	OBSTACLE STRATEGY	FIXED SPEED STRATEGIES	
			320 KT	VMO
DESCENT TO CEILING	. M.78/300KT . MCT	. Green Dot Speed . MCT	. M.78/320KT . MCT	. M.80/350KT . MCT
CRUISE	LR ceiling LR speed	– Obstacle not cleared: Maintain Green Dot Speed at MCT – Obstacle cleared : Revert to standard strategy	FL per 2.04.40 MCT/320KT	FL per 2.04.40 MCT/350KT
DESCENT TO LANDING	IDLE/M.78/300KT/250KT			
Approx increase in fuel consumption compared with both engines operative	+ 33 %			

For ETOPS operations, any of the above diversion strategies can be used provided that the selected strategy and speed schedule is used in :

· establishing the area of operation (maximum diversion distance), as described in Section 2.04.40,
· calculating the diversion fuel requirements for the single engine ETOPS critical scenario, as provided in section 2.04.40,
· demonstrating the applicable obstacle clearance requirements (net flight path and net ceiling).

During the diversion, the flight crew is expected to use the planned speed schedule. However, based on the evaluation of the actual situation, the pilot in command has the authority to deviate from this planned one engine inoperative speed.

GROSS CEILINGS AT LONG RANGE AND GREEN DOT SPEEDS



		ISA	ISA+10	ISA+15	ISA+20
LONG RANGE	ENGINE ANTI ICE ON	-300FT	-1800FT	-2700FT	-2900FT
	TOTAL ANTI ICE ON	-700FT	-4300FT	-5000FT	-6500FT
GREEN DOT	ENGINE ANTI ICE ON	-200FT	-1200FT	-1400FT	-2000FT
	TOTAL ANTI ICE ON	-1000FT	-3200FT	-4000FT	-4700FT

Note : If severe icing conditions are encountered, ice formation may build up on non
R *heated structure and therefore the ceiling will be reduced by :*
R *· 4000 feet for aircraft weight below or equal to 60000 kg*
R *· 7500 feet for aircraft weight above or equal to 75000 kg*
R *· linear interpolation must be applied between the two aircraft weights*

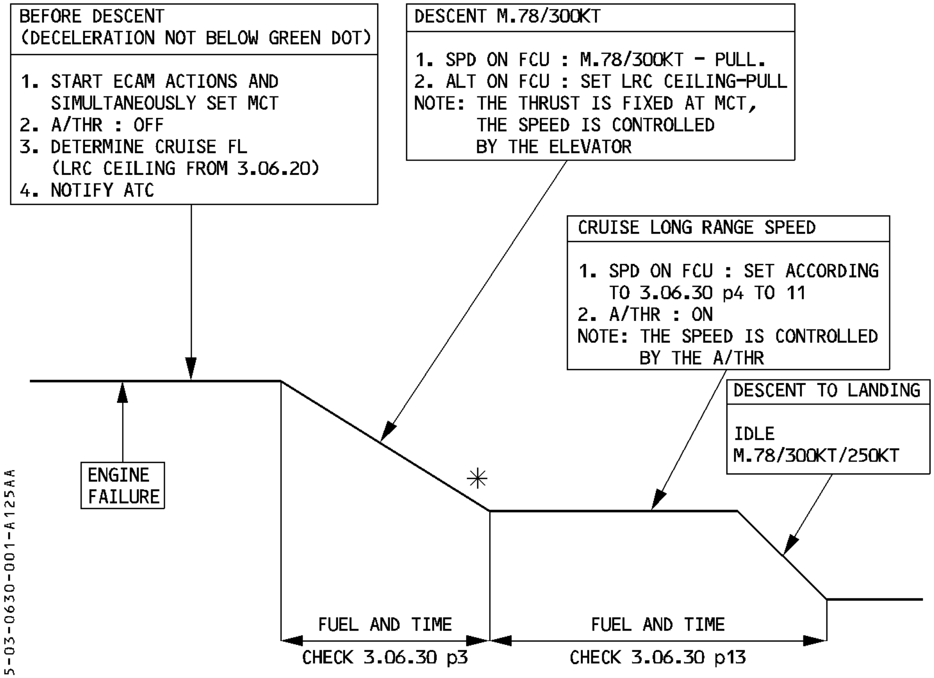
NET CEILING AT GREEN DOT SPEED

To obtain the net ceiling at green dot speed, apply the following corrections to the gross ceiling at green dot speed :

	WEIGHT (1000 KG)									
	42	46	50	54	58	62	66	70	74	76
≤ISA+10	–5100FT	–5300FT	–5600FT	–5600FT	–5700FT	–5800FT	–5300FT	–4700FT	–4900FT	–5100FT
ISA+20	–5400FT	–5700FT	–5700FT	–5800FT	–6000FT	–5200FT	–5000FT	–5100FT	–6500FT	–7200FT

PROCEDURE

Unless a specific procedure has been established before dispatch (ETOPS, mountainous areas) the recommended procedure is as follows :



✳ IF V/S BECOMES < 500 feet/minute SELECT V/S MODE.

EXAMPLE

Given :
GW at engine failure = 70 000 kg
FL at engine failure = 310
Temperature = ISA
Distance to diversion airport = 540 NM
No wind

Find :
R LRC ceiling : (see 3.06.20 p1) FL180
R Descent to cruise level : (FL180) Distance = 234 – 98 = 136 NM
R (see 3.06.30 p3) Fuel = 1275 – 585 = 690 kg
R Time = 35.4 – 16 = 19.4 min
R Cruise at long range speed (FL180) to landing
R (Weight = 70 000 – 690 = 69 310 kg : Distance = 540 – 136 = 404 NM)
Determine on (3.06.30 p13) time and fuel consumption at ISA conditions and for a
R reference weight of 55 000 kg. Interpolate the remaining air distance of 404 NM at FL180.
R Fuel : 2329 kg
R Time : 1 h 21 min
Correction due to actual in-cruise weight
ΔFuel = + 23 kg per 1000 kg above reference weight
R ΔFuel = + 23 kg × (69.3 – 55) ~ 329 kg

Result :
R Total Fuel = 690 + 2329 + 329 = 3348 kg
R Time = 1 h 21 min + 20 min = 1 h 41 min

R

DESCENT - M.78/300KT - 1 ENGINE OUT									
MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF			ISA CG=33.0%		MINIMUM RATE OF DESCENT 500FT/MIN				
WEIGHT (1000KG)	50				70				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	IAS (KT)
390	42.5	1435	287	MCT					241
370	40.7	1396	274	MCT	39.9	1391	268	MCT	252
350	39.0	1353	261	MCT	38.4	1357	257	MCT	264
330	37.3	1309	248	MCT	36.9	1318	246	MCT	277
310	35.7	1263	236	MCT	35.4	1275	234	MCT	289
290	34.2	1215	224	MCT	33.8	1225	221	MCT	300
270	32.0	1144	208	MCT	31.5	1151	204	MCT	300
250	29.3	1055	188	MCT	28.9	1062	185	MCT	300
230	26.0	936	165	MCT	25.8	952	163	MCT	300
220	24.0	863	151	V/S	24.0	885	151	MCT	300
210	22.0	789	137	V/S	22.0	811	137	V/S	300
200	20.0	716	124	V/S	20.0	735	124	V/S	300
190	18.0	643	111	V/S	18.0	659	111	V/S	300
180	16.0	571	98	V/S	16.0	585	98	V/S	300
170	14.0	499	85	V/S	14.0	511	85	V/S	300
160	12.0	427	72	V/S	12.0	437	72	V/S	300
150	10.0	356	60	V/S	10.0	364	60	V/S	300
140	8.0	284	47	V/S	8.0	290	47	V/S	300
100	.0	0	0	V/S	.0	0	0	V/S	300

CORRECTIONS	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON	PER 1° ABOVE ISA
TIME	– 0.4 %	– 1 %	–
FUEL	+ 2 %	+ 5 %	+ 0.3 %
DISTANCE	– 0.3 %	– 0.6 %	+ 0.3 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
PACK FLOW HI
ANTI-ICING OFF

ISA
CG=33.0%

N1 (%) **MACH**
KG/H **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	FL100		FL120		FL140		FL160		FL180		FL200	
48	75.8	.459	77.3	.474	78.8	.489	79.7	.498	81.3	.516	82.1	.524
	1951	254	1912	252	1881	251	1821	246	1803	245	1751	239
	150.2	293	157.0	300	163.6	308	170.8	311	177.1	319	183.9	322
50	76.6	.465	78.6	.484	79.5	.494	80.7	.507	82.1	.521	82.8	.528
	2001	257	1987	258	1928	253	1889	250	1857	248	1801	241
	148.2	297	154.5	307	161.1	311	167.5	316	173.8	323	180.1	324
52	77.8	.474	79.3	.490	80.2	.498	81.7	.515	82.7	.524	83.7	.537
	2072	262	2042	261	1975	256	1953	254	1904	249	1872	245
	146.0	303	152.0	310	158.6	313	164.4	321	170.5	325	176.1	330
54	79.0	.484	80.0	.494	81.1	.506	82.6	.521	83.2	.527	84.7	.546
	2149	268	2089	263	2043	260	2014	258	1950	251	1947	249
	143.8	309	149.8	313	155.8	318	161.5	325	167.4	326	172.1	335
56	79.8	.489	80.6	.497	82.1	.514	83.1	.524	84.0	.534	85.5	.553
	2205	271	2134	265	2110	264	2061	259	2019	254	2015	253
	141.7	312	147.7	315	153.1	323	158.7	327	163.9	331	168.5	340
58	80.4	.493	81.4	.504	83.0	.521	83.6	.527	84.9	.542	86.1	.557
	2253	273	2197	269	2174	267	2106	260	2091	258	2074	255
	139.8	315	145.3	319	150.5	327	156.0	329	160.6	336	165.0	342
60	80.9	.496	82.3	.511	83.5	.524	84.3	.532	85.8	.550	86.7	.560
	2297	275	2264	273	2224	269	2168	263	2166	262	2131	256
	137.9	317	143.0	324	148.1	329	153.1	332	157.3	341	161.5	344
62	81.6	.501	83.1	.518	84.0	.526	85.1	.539	86.4	.555	87.4	.565
	2353	278	2330	276	2271	270	2241	267	2229	264	2195	259
	136.0	320	140.8	328	145.7	331	150.2	336	154.2	344	158.1	347
64	82.4	.508	83.8	.523	84.5	.529	85.9	.547	87.0	.559	88.1	.571
	2422	281	2389	279	2318	272	2316	271	2286	266	2271	262
	133.9	324	138.6	331	143.4	332	147.3	341	151.3	346	154.5	351
66	83.2	.515	84.3	.525	85.2	.535	86.6	.553	87.5	.562	88.7	.574
	2490	285	2438	280	2387	275	2387	274	2348	268	2330	263
	131.9	329	136.5	333	140.9	336	144.6	345	148.3	348	151.2	352
68	84.0	.521	84.7	.528	85.9	.542	87.2	.557	88.2	.567	88.7	.563
	2556	288	2485	282	2462	279	2446	276	2415	270	2321	258
	130.0	332	134.5	334	138.4	341	142.1	348	145.4	351	148.9	346
70	84.6	.524	85.2	.531	86.7	.548	87.7	.560	88.7	.570	88.7	.547
	2611	291	2538	283	2535	282	2503	277	2474	272	2310	250
	128.2	335	132.5	336	136.0	345	139.6	349	142.6	353	145.5	336
72	85.0	.527	85.9	.537	87.3	.554	88.2	.563	88.7	.561	88.7	.513
	2659	292	2610	287	2607	285	2566	279	2466	267	2288	234
	126.4	336	130.3	340	133.7	348	137.0	352	140.8	347	137.7	315
74	85.4	.528	86.6	.543	87.8	.557	88.8	.567	88.7	.548		
	2704	293	2685	290	2666	287	2631	281	2455	261		
	124.7	337	128.2	344	131.5	351	134.5	354	138.2	339		

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = + 3 %	△FUEL = + 6 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
PACK FLOW HI
ANTI-ICING OFF

ISA
CG=33.0%

N1 (%) / **MACH**
KG/H / **IAS (KT)**
NM/1000KG / **TAS (KT)**

WEIGHT (1000KG)	FL210		FL220		FL230		FL240		FL250		FL260	
48	82.5	.528	83.2	.537	84.0	.547	84.6	.554	85.0	.558	85.6	.565
	1727	236	1723	235	1724	235	1713	233	1697	230	1690	228
	187.1	323	189.9	327	192.6	332	195.4	335	198.1	336	200.4	339
50	83.5	.537	84.3	.547	84.8	.554	85.3	.558	85.8	.564	86.5	.571
	1798	240	1798	240	1788	238	1769	235	1760	233	1760	231
	182.7	328	185.3	333	188.0	336	190.6	337	192.8	339	194.6	343
52	84.5	.546	85.1	.554	85.5	.558	86.0	.563	86.7	.571	87.2	.573
	1873	245	1863	243	1844	240	1833	237	1834	236	1814	231
	178.5	334	181.0	337	183.6	339	185.8	340	187.5	344	189.2	343
54	85.3	.553	85.7	.558	86.2	.563	86.9	.571	87.4	.573	88.4	.585
	1940	248	1920	245	1907	242	1908	241	1890	237	1920	237
	174.5	339	177.0	340	179.1	342	180.9	345	182.5	345	182.8	351
56	86.0	.558	86.4	.562	87.1	.570	87.6	.573	88.4	.582	88.6	.573
	1998	250	1982	247	1980	245	1968	242	1981	241	1926	232
	170.8	341	172.9	343	174.6	346	176.1	347	176.8	350	178.4	344
58	86.6	.561	87.2	.568	87.8	.574	88.4	.579	88.5	.568	88.5	.547
	2056	252	2052	250	2045	247	2044	244	1977	234	1908	221
	167.1	343	168.8	346	170.2	348	171.2	350	172.9	342	171.7	328
60	87.3	.567	87.9	.574	88.4	.576	88.5	.567	88.5	.540		
	2124	254	2123	252	2105	248	2047	239	1960	223		
	163.3	347	164.7	350	166.0	349	167.5	343	166.0	325		
62	88.1	.574	88.5	.575	88.6	.566	88.5	.543				
	2201	257	2180	253	2117	244	2030	228				
	159.4	351	160.8	351	162.4	344	161.6	328				
64	88.6	.575	88.6	.566	88.6	.545						
	2257	258	2187	249	2102	234						
	155.8	352	157.6	345	157.3	331						
66	88.7	.564	88.6	.546								
	2254	253	2173	240								
	153.1	345	153.2	333								
68	88.7	.547										
	2242	245										
	149.3	335										
70	88.7	.499										
	2213	223										
	138.0	305										
72												
74												

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
PACK FLOW HI
ANTI-ICING OFF

ISA+10
CG=33.0%

N1 (%) **MACH**
KG/H **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	FL100		FL120		FL140		FL160		FL180		FL200	
48	77.0	.456	78.6	.471	80.2	.487	81.1	.496	82.8	.514	83.7	.522
	1978	252	1941	251	1913	250	1854	245	1837	244	1787	238
	150.0	297	156.7	304	163.2	312	170.2	316	176.5	324	183.1	327
50	77.9	.462	79.9	.482	80.9	.492	82.2	.505	83.6	.520	84.4	.527
	2028	255	2017	257	1963	252	1926	250	1895	247	1839	240
	148.0	300	154.1	311	160.6	315	166.9	321	173.1	328	179.3	330
52	79.1	.471	80.7	.487	81.6	.496	83.3	.513	84.2	.523	85.3	.535
	2102	261	2075	260	2011	255	1994	254	1944	248	1913	244
	145.7	306	151.6	315	158.1	318	163.8	327	169.8	330	175.3	335
54	80.4	.482	81.4	.492	82.6	.504	84.1	.520	84.8	.526	86.3	.544
	2182	266	2127	262	2081	259	2056	257	1993	250	1989	249
	143.5	313	149.3	318	155.2	323	160.8	331	166.6	332	171.3	341
56	81.1	.487	82.0	.495	83.6	.512	84.7	.523	85.7	.534	87.2	.551
	2241	270	2173	264	2149	263	2104	258	2065	254	2062	252
	141.3	317	147.2	320	152.5	328	158.0	332	163.1	337	167.6	346
58	81.8	.492	82.9	.503	84.5	.519	85.2	.525	86.6	.542	87.8	.556
	2295	272	2241	268	2218	267	2151	260	2141	258	2123	254
	139.3	320	144.8	324	149.9	332	155.3	334	159.7	342	164.1	348
60	82.4	.495	83.8	.510	85.0	.522	85.9	.531	87.4	.549	88.4	.560
	2341	274	2311	272	2270	268	2215	262	2217	261	2183	256
	137.4	322	142.4	329	147.4	335	152.4	338	156.5	347	160.6	351
62	83.1	.500	84.7	.517	85.5	.525	86.7	.538	88.1	.554	89.1	.564
	2400	277	2380	276	2319	270	2289	266	2280	264	2250	258
	135.4	325	140.1	333	145.0	336	149.4	342	153.4	350	157.1	354
64	83.9	.507	85.4	.521	86.1	.528	87.5	.545	88.6	.558	89.8	.571
	2470	281	2440	278	2369	271	2366	270	2339	265	2329	261
	133.3	329	137.9	336	142.7	338	146.6	347	150.5	352	153.6	358
66	84.7	.513	85.8	.524	86.8	.534	88.3	.552	89.2	.561	90.3	.571
	2540	284	2490	280	2443	275	2441	273	2404	267	2379	262
	131.3	334	135.8	338	140.1	342	143.8	351	147.5	354	150.5	358
68	85.6	.519	86.3	.526	87.5	.541	88.8	.556	89.9	.566	90.3	.560
	2609	288	2536	281	2518	278	2503	275	2473	270	2370	256
	129.4	338	133.8	339	137.6	347	141.2	353	144.5	357	148.0	351
70	86.1	.523	86.8	.530	88.3	.548	89.4	.559	90.3	.568	90.3	.543
	2664	290	2594	283	2596	282	2562	277	2527	271	2357	248
	127.5	340	131.8	342	135.2	351	138.7	356	141.8	358	144.3	340
72	86.5	.525	87.5	.535	89.0	.553	89.9	.563	90.3	.558	90.3	.502
	2715	291	2667	286	2667	285	2628	279	2518	266	2330	229
	125.7	341	129.6	346	132.9	354	136.2	358	139.9	352	134.8	314
74	86.9	.527	88.2	.542	89.5	.556	90.5	.567	90.3	.545		
	2761	292	2744	289	2728	286	2699	281	2506	259		
	124.0	342	127.4	350	130.7	357	133.6	361	137.3	344		

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
PACK FLOW HI
ANTI-ICING OFF

ISA+10
CG=33.0%

N1 (%) — **MACH**
KG/H — **IAS (KT)**
NM/1000KG — **TAS (KT)**

WEIGHT (1000KG)	FL210		FL220		FL230		FL240		FL250		FL260	
48	84.2	.527	84.9	.536	85.7	.546	86.3	.553	86.8	.558	87.4	.564
	1765	236	1764	235	1766	235	1755	233	1739	230	1731	228
	186.3	329	189.0	333	191.7	338	194.4	341	197.1	343	199.3	345
50	85.1	.536	85.9	.546	86.5	.553	87.0	.557	87.6	.564	88.3	.570
	1837	240	1839	239	1830	238	1814	235	1805	233	1803	231
	181.9	334	184.5	339	187.1	342	189.6	344	191.8	346	193.6	349
52	86.1	.545	86.7	.552	87.2	.557	87.8	.563	88.5	.571	88.9	.571
	1913	244	1905	242	1887	240	1878	237	1880	236	1859	231
	177.7	340	180.2	343	182.7	345	184.8	347	186.5	351	188.1	350
54	87.0	.552	87.4	.556	87.9	.561	88.7	.570	89.2	.572	90.2	.585
	1983	247	1964	244	1950	242	1955	240	1938	236	1971	237
	173.7	344	176.1	346	178.2	348	179.9	352	181.4	352	181.6	358
56	87.6	.556	88.1	.561	88.8	.569	89.3	.572	90.2	.581	90.3	.571
	2043	249	2027	246	2028	245	2015	241	2033	240	1970	231
	169.9	347	172.0	349	173.7	352	175.1	353	175.7	357	177.2	349
58	88.3	.560	88.9	.567	89.5	.572	90.2	.578	90.2	.565	90.3	.543
	2106	251	2102	249	2092	246	2096	244	2022	233	1952	219
	166.1	350	167.8	353	169.3	354	170.1	356	171.8	347	170.1	332
60	89.0	.566	89.6	.572	90.2	.575	90.2	.564	90.2	.535		
	2176	254	2172	251	2159	248	2091	238	2003	220		
	162.3	353	163.7	356	164.9	356	166.4	348	164.2	329		
62	89.8	.572	90.2	.573	90.3	.563	90.2	.538				
	2252	257	2230	252	2161	242	2074	226				
	158.5	357	159.8	356	161.4	349	160.0	332				
64	90.3	.573	90.3	.562	90.3	.540						
	2311	257	2231	247	2145	232						
	154.9	358	156.6	350	155.9	334						
66	90.3	.561	90.3	.541								
	2301	252	2217	238								
	152.2	350	151.9	337								
68	90.3	.542										
	2287	243										
	148.0	339										
70												
72												
74												

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
PACK FLOW HI
ANTI-ICING OFF

ISA+15
CG=33.0%

N1 (%) — **MACH**
KG/H — **IAS (KT)**
NM/1000KG — **TAS (KT)**

WEIGHT (1000KG)	FL100		FL120		FL140		FL160		FL180		FL200	
48	77.7	.455	79.2	.470	80.9	.486	81.9	.495	83.5	.513	84.5	.522
	1993	252	1956	250	1929	249	1871	244	1854	243	1806	238
	149.8	299	156.5	306	163.0	314	169.9	318	176.2	327	182.7	330
50	78.5	.460	80.6	.481	81.6	.491	83.0	.504	84.4	.519	85.2	.526
	2042	254	2035	256	1981	252	1944	249	1914	246	1861	240
	147.8	302	153.9	313	160.3	318	166.6	324	172.7	331	178.9	333
52	79.7	.470	81.4	.486	82.4	.495	84.0	.513	85.0	.522	86.1	.534
	2117	260	2092	259	2031	254	2015	253	1963	248	1933	244
	145.5	308	151.4	317	157.7	320	163.4	329	169.4	333	174.8	338
54	81.0	.480	82.1	.491	83.4	.503	84.9	.519	85.6	.525	87.1	.543
	2200	266	2145	262	2102	258	2077	256	2014	250	2010	248
	143.2	315	149.1	320	154.9	326	160.4	333	166.2	335	170.9	343
56	81.8	.486	82.7	.494	84.3	.511	85.5	.522	86.5	.533	88.0	.551
	2260	269	2192	264	2172	262	2128	258	2088	253	2084	252
	141.1	319	146.9	322	152.1	331	157.6	335	162.7	340	167.1	348
58	82.5	.491	83.6	.502	85.3	.518	86.0	.524	87.4	.541	88.6	.555
	2318	272	2261	267	2241	266	2174	259	2164	257	2146	254
	139.0	322	144.5	327	149.5	335	154.9	337	159.3	345	163.6	351
60	83.1	.494	84.6	.509	85.8	.521	86.7	.530	88.3	.549	89.2	.559
	2362	273	2334	272	2292	268	2242	262	2243	261	2209	256
	137.1	324	142.0	332	147.0	337	151.9	341	156.0	350	160.1	354
62	83.8	.499	85.4	.516	86.3	.524	87.5	.537	88.9	.554	89.9	.564
	2424	276	2404	275	2342	269	2316	266	2308	264	2277	258
	135.1	328	139.8	336	144.7	339	149.0	345	152.9	353	156.6	357
64	84.7	.506	86.1	.521	86.8	.527	88.3	.545	89.5	.557	90.0	.556
	2496	280	2465	278	2394	271	2393	270	2367	265	2278	254
	133.0	332	137.6	339	142.3	341	146.1	350	150.0	355	154.3	352
66	85.5	.513	86.6	.523	87.6	.533	89.1	.551	89.9	.558	90.0	.542
	2567	284	2516	279	2468	274	2467	273	2412	266	2267	248
	131.0	336	135.5	341	139.7	345	143.4	354	147.4	355	151.4	343
68	86.3	.518	87.1	.525	88.3	.540	89.6	.555	89.9	.549	90.0	.520
	2636	287	2564	280	2545	278	2530	275	2405	261	2251	238
	129.0	340	133.5	342	137.2	349	140.8	356	145.4	350	146.3	329
70	86.8	.522	87.6	.529	89.1	.547	90.2	.558	89.9	.536		
	2690	289	2624	283	2625	281	2592	277	2396	255		
	127.2	342	131.4	345	134.8	354	138.3	358	142.6	342		
72	87.3	.524	88.3	.535	89.8	.553	90.7	.562	89.9	.516		
	2740	290	2698	286	2698	284	2660	279	2382	245		
	125.4	344	129.2	348	132.5	357	135.7	361	138.1	329		
74	87.7	.526	89.0	.541	90.3	.556	91.3	.566				
	2789	291	2776	289	2761	286	2732	281				
	123.7	345	127.0	353	130.3	360	133.1	364				

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
PACK FLOW HI
ANTI-ICING OFF

ISA+15
CG=33.0%

N1 (%) **MACH**
KG/H **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	**FL210**		**FL220**		**FL230**		**FL240**		**FL250**		**FL260**	
48	85.0 1786 185.8	.527 236 332	85.7 1785 188.5	.536 235 337	86.6 1786 191.2	.546 235 342	87.1 1775 193.9	.552 233 344	87.6 1758 196.5	.557 230 346	88.2 1751 198.8	.563 228 348
50	85.9 1859 181.5	.535 240 337	86.8 1861 184.0	.545 239 342	87.4 1852 186.5	.552 238 346	87.9 1835 189.1	.557 235 347	88.4 1826 191.2	.563 232 349	89.1 1824 193.0	.570 230 352
52	86.9 1935 177.2	.544 244 343	87.6 1928 179.7	.552 242 346	88.1 1911 182.1	.557 239 348	88.6 1901 184.3	.562 237 350	89.3 1902 185.9	.570 235 354	89.8 1881 187.5	.571 231 353
54	87.8 2005 173.2	.551 247 347	88.3 1987 175.6	.556 244 349	88.8 1977 177.7	.562 242 351	89.5 1980 179.3	.570 240 355	89.8 1942 181.4	.567 234 352	89.9 1882 182.9	.557 225 344
56	88.4 2066 169.5	.556 249 350	89.0 2051 171.5	.560 246 352	89.7 2053 173.1	.568 245 355	89.9 2008 175.4	.565 238 352	89.8 1930 177.0	.551 227 342	89.9 1860 173.4	.522 210 322
58	89.1 2130 165.6	.560 251 353	89.7 2126 167.3	.567 249 356	89.9 2074 169.9	.563 242 352	89.9 1997 171.4	.549 231 342	89.8 1907 166.5	.512 210 317		
60	89.8 2201 161.8	.565 254 356	90.0 2142 164.4	.561 246 352	89.9 2063 166.2	.548 236 343	89.9 1975 162.3	.515 216 321				
62	90.0 2210 159.2	.558 250 352	89.9 2130 161.2	.547 240 343	89.9 2043 158.3	.517 222 323						
64	90.0 2198 156.1	.545 244 343	89.9 2112 154.6	.520 228 326								
66	90.0 2181 150.6	.521 233 328										
68												
70												
72												
74												

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
PACK FLOW HI
ANTI-ICING OFF

ISA+20
CG=33.0%

N1 (%) **MACH**
KG/H **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	FL100		FL120		FL140		FL160		FL180		FL200	
48	78.3	.454	79.9	.468	81.6	.485	82.6	.494	84.3	.512	85.3	.521
	2009	251	1969	249	1945	249	1887	244	1874	243	1826	238
	149.6	301	156.3	308	162.7	316	169.6	320	175.8	329	182.3	333
50	79.1	.459	81.3	.480	82.3	.490	83.7	.503	85.2	.518	86.0	.526
	2058	254	2052	256	1999	251	1962	249	1933	246	1882	240
	147.6	304	153.6	315	160.0	320	166.2	326	172.3	333	178.4	336
52	80.4	.469	82.1	.485	83.1	.495	84.8	.512	85.8	.521	86.9	.534
	2134	259	2111	259	2050	254	2034	253	1983	247	1955	244
	145.3	310	151.1	319	157.4	323	163.0	332	169.0	335	174.3	341
54	81.7	.479	82.8	.490	84.1	.503	85.6	.518	86.4	.524	87.9	.543
	2217	265	2165	261	2124	258	2098	256	2033	249	2033	248
	143.0	317	148.7	322	154.5	328	160.0	336	165.8	337	170.4	346
56	82.5	.485	83.4	.494	85.1	.511	86.2	.521	87.3	.532	88.8	.550
	2278	268	2213	263	2196	262	2149	258	2111	253	2107	251
	140.8	321	146.6	324	151.8	333	157.2	338	162.2	342	166.7	351
58	83.2	.490	84.4	.501	86.0	.518	86.7	.524	88.2	.540	89.4	.554
	2338	271	2284	267	2265	266	2197	259	2188	257	2170	254
	138.7	324	144.1	329	149.1	338	154.4	339	158.8	347	163.1	354
60	83.8	.493	85.3	.508	86.6	.521	87.5	.530	89.0	.548	89.6	.550
	2384	273	2356	271	2316	267	2267	262	2266	261	2187	251
	136.8	326	141.7	334	146.6	340	151.5	343	155.6	353	160.6	351
62	84.6	.499	86.2	.515	87.1	.523	88.3	.537	89.4	.547	89.6	.539
	2448	276	2427	275	2365	269	2342	266	2299	260	2178	246
	134.8	330	139.4	338	144.3	341	148.5	348	153.1	352	157.9	344
64	85.4	.506	86.9	.520	87.6	.526	89.1	.544	89.4	.538	89.6	.522
	2522	280	2489	277	2418	270	2421	269	2294	256	2167	238
	132.6	335	137.2	341	141.9	343	145.7	353	150.9	346	153.8	333
66	86.3	.512	87.4	.522	88.4	.533	89.9	.551	89.4	.527	89.5	.487
	2593	283	2541	279	2495	274	2496	273	2287	250	2150	222
	130.6	339	135.1	343	139.3	348	142.9	357	148.1	339	144.7	311
68	87.1	.518	87.8	.525	89.1	.540	90.4	.555	89.4	.509		
	2662	287	2591	280	2575	278	2560	275	2278	242		
	128.7	343	133.1	345	136.8	352	140.3	359	143.8	328		
70	87.6	.521	88.4	.529	89.9	.546	91.0	.557	89.4	.477		
	2717	289	2654	282	2653	281	2619	276	2270	226		
	126.8	345	131.0	348	134.4	356	137.9	361	135.0	307		
72	88.0	.523	89.1	.535	90.6	.552	91.0	.550				
	2770	290	2729	286	2728	284	2613	272				
	125.0	346	128.7	351	132.0	360	136.3	356				
74	88.5	.525	89.8	.541	90.7	.548	90.9	.539				
	2819	291	2808	289	2738	282	2604	267				
	123.3	348	126.6	356	130.5	357	134.2	349				

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
ΔFUEL = + 3 %	ΔFUEL = + 6 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
PACK FLOW HI
ANTI-ICING OFF

ISA+20
CG=33.0%

N1 (%) / **MACH**
KG/H / **IAS (KT)**
NM/1000KG / **TAS (KT)**

WEIGHT (1000KG)	FL210		FL220		FL230		FL240		FL250		FL260	
48	85.8 1807 185.3	.527 236 335	86.5 1804 188.1	.535 235 339	87.4 1805 190.7	.545 234 344	88.0 1794 193.4	.552 232 347	88.5 1779 196.0	.556 229 349	89.1 1772 198.2	.562 227 351
50	86.8 1880 181.0	.535 239 340	87.6 1883 183.5	.545 239 345	88.2 1873 186.0	.552 237 348	88.7 1857 188.5	.556 234 350	89.3 1848 190.7	.562 232 352	89.5 1805 193.7	.560 226 350
52	87.8 1958 176.7	.544 244 346	88.4 1952 179.1	.552 242 350	88.9 1934 181.6	.556 239 351	89.5 1924 183.7	.562 237 353	89.4 1852 187.1	.553 228 347	89.5 1793 189.1	.543 219 339
54	88.6 2028 172.7	.551 247 350	89.1 2012 175.1	.556 244 352	89.6 1990 177.4	.559 241 353	89.5 1917 180.6	.550 232 346	89.4 1839 182.0	.534 220 335	89.5 1769 177.0	.502 202 313
56	89.3 2089 169.0	.555 249 353	89.6 2056 171.4	.556 244 352	89.5 1982 174.4	.547 235 346	89.5 1904 175.6	.532 223 334	89.4 1814 167.4	.485 199 304		
58	89.6 2121 165.8	.553 248 352	89.6 2048 168.6	.545 239 345	89.5 1969 169.7	.529 227 334	89.4 1880 162.6	.486 204 306				
60	89.6 2113 163.1	.542 243 345	89.6 2035 164.1	.527 231 334	89.5 1947 157.8	.486 208 307						
62	89.6 2101 158.8	.525 235 334	89.5 2015 153.2	.487 213 309								
64	89.5 2082 148.9	.487 217 310										
66												
68												
70												
72												
74												

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = + 3 %	ΔFUEL = + 6 %

IN CRUISE QUICK CHECK AT LONG RANGE SPEED

The following in cruise quick check tables allow the flight crew to determine the fuel consumption and time required to cover a given air distance from any moment in cruise to landing, with one engine inoperative.
These tables are established for :

- Cruise Mach number : long range
- Descent profile : M.78/300kt/250kt
- Approach and landing : 110 kg or 240 lb – 6 minute IMC
- ISA
- CG = 33 %
- Pack Flow HI
- Anti ice OFF

Note : *1. In the tables, the asterisk (*) means that a step climb of 4000 feet must be flown to reach the corresponding flight level.*
2. The flight level shown on top of each column is the final flight level.
3. For each degree Celsius above ISA temperature apply a fuel correction of 0.015 (kg/°C/NM) × △ ISA (°C) × air distance (NM) or 0.033 (lb/°C/NM) × △ ISA (°C) × air distance (NM).

CORRECTION FOR DEVIATION FROM REFERENCE WEIGHT

The in cruise quick check tables are based on a reference initial weight.
A correction on the fuel consumption has to be made, when the actual initial weight is different from the reference initial weight.
If it is lower (or greater) than the reference weight, subtract (or add) the value given in the correction part of the table per 1000 kg or 1000 lb below (or above) the reference initial weight (see example 3.06.30 p2).

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING - ONE ENGINE FAILURE
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 55000 KG
PACK FLOW HI
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 100	150	200	220	240	250	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL150	FL200 FL220	FL240 FL250
200	1399 0.45	1190 0.44	1055 0.42	1008 0.42	967 0.41	950 0.41	7	7	7
250	1746 0.55	1505 0.53	1346 0.51	1291 0.51	1244 0.50	1225 0.50	10	10	11
300	2091 1.04	1819 1.03	1635 1.00	1573 1.00	1521 0.59	1499 0.59	12	13	15
350	2436 1.14	2132 1.12	1924 1.09	1854 1.08	1796 1.08	1772 1.07	15	17	19
400	2780 1.24	2445 1.21	2212 1.18	2134 1.17	2070 1.16	2044 1.16	18	20	22
450	3123 1.34	2756 1.31	2499 1.27	2414 1.26	2344 1.25	2315 1.25	20	23	26
500	3465 1.44	3067 1.40	2785 1.37	2693 1.35	2616 1.34	2585 1.34	23	26	29
550	3806 1.54	3376 1.50	3070 1.46	2970 1.44	2887 1.43	2853 1.42	25	29	33
600	4147 2.04	3685 1.59	3354 1.55	3247 1.53	3158 1.52	3121 1.51	28	32	36
650	4486 2.14	3994 2.09	3638 2.04	3523 2.02	3427 2.00	3388 2.00	30	35	40
700	4825 2.24	4301 2.19	3920 2.13	3798 2.11	3696 2.09	3654 2.09	33	38	43
750	5162 2.35	4607 2.28	4202 2.23	4072 2.20	3964 2.18	3919 2.17	35	41	47
800	5499 2.45	4913 2.38	4482 2.32	4346 2.29	4231 2.27	4183 2.26	38	44	50
850	5835 2.55	5217 2.47	4762 2.41	4618 2.38	4497 2.36	4446 2.35	40	47	53
900	6170 3.05	5521 2.57	5041 2.50	4890 2.47	4762 2.45	4708 2.44	43	50	56
950	6504 3.16	5823 3.07	5318 3.00	5161 2.56	5026 2.54	4969 2.53	45	53	60
1000	6837 3.26	6125 3.17	5595 3.09	5431 3.05	5288 3.02	5229 3.01	47	56	63
1050	7170 3.36	6427 3.26	5872 3.18	5700 3.14	5550 3.11	5488 3.10	50	59	66
1100	7501 3.47	6727 3.36	6147 3.28	5968 3.23	5811 3.20	5747 3.19	52	62	69
1150	7832 3.57	7027 3.46	6421 3.37	6236 3.32	6071 3.29	6004 3.28	54	65	72
1200	8162 4.08	7325 3.56	6695 3.47	6502 3.41	6331 3.38	6261 3.37	56	68	76
1250	8491 4.18	7623 4.06	6968 3.56	6768 3.50	6589 3.47	6517 3.46	59	71	79
1300	8820 4.29	7920 4.15	7240 4.06	7033 3.59	6847 3.56	6771 3.55	61	74	82
1350	9147 4.40	8217 4.25	7511 4.15	7298 4.08	7104 4.05	7025 4.04	63	76	85
1400	9474 4.50	8512 4.35	7781 4.25	7561 4.18	7359 4.14	7279 4.13	65	79	88

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
ΔFUEL = + 2.5 %	ΔFUEL = + 5 %

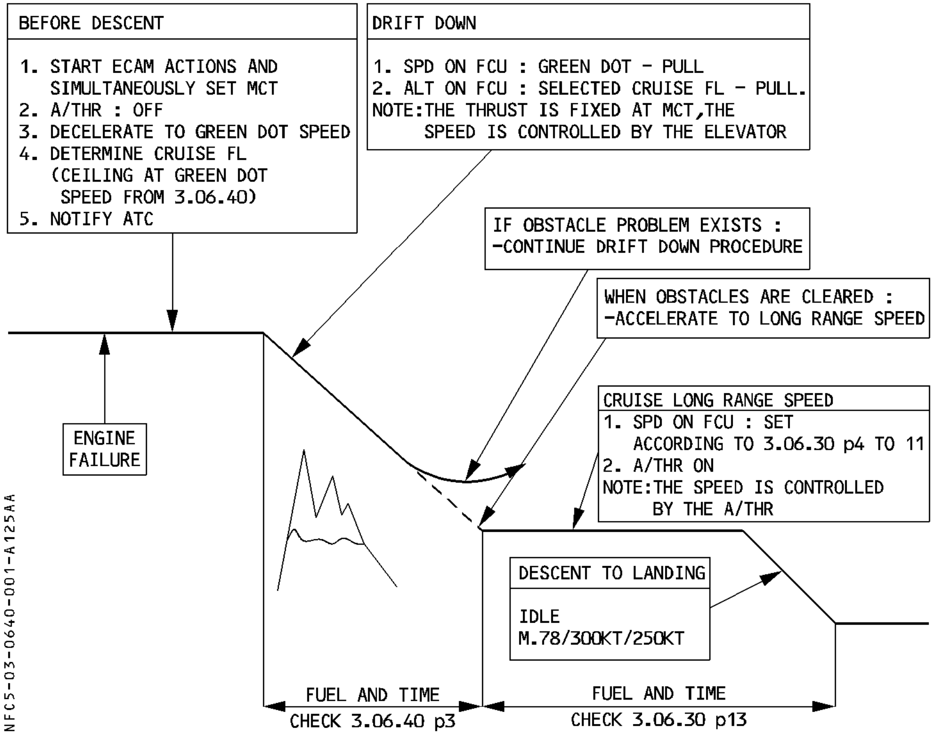
PROCEDURE

In order to maintain the highest possible level, the drift down procedure must be adopted. This requires maximum continuous thrust on the remaining engine at green dot speed.

- If, having reached drift down ceiling altitude, an obstacle problem remains, the drift down procedure must be maintained so as to fly an ascending cruise profile.
- If, after drift down, no obstacle problem remains, the speed should be allowed to increase to long range speed and maintained. The subsequent cruise should be made using either the long range speed by adjusting it as a function of aircraft weight or by maintaining the initial cruise speed.

Note : *Due to the fact that the long range speed is higher than the green dot speed, the cruise will be made at an altitude lower than the drift down ceiling.*

R



EXAMPLE

Given :

GW at engine failure = 62000 kg
FL at engine failure = 350
Temperature = ISA
Distance to destination airport = 1500 NM
No wind

Find :

R Level off (drift down ceiling) : 25300 ft
(see 3.06.40 p3)
R Distance : 356 NM
R Fuel : 2000 kg
R Time : 1 h 05 min
R LRC ceiling : (see 3.06.20 p1) FL220
R Cruise at long range speed (FL220) to landing
R (weight = 62000 – 2000 = 60000 kg : Distance = 1500 – 356 = 1144 NM)
Determine on (3.06.30 p13) time and fuel consumption at ISA conditions for a reference
R weight of 55000 kg. Interpolate the remaining air distance of 1144 NM at FL220.
R Fuel : 6204 kg
R Time : 3 h 31 min
Correction due to actual in-cruise weight
R ΔFuel = + 65 kg per 1000 kg above reference weight
R ΔFuel = + 65 kg × (70 – 55) = 325 kg

Result :

R Total Fuel = 6204 + 325 + 2000 = 8529 kg
R Time = 3 h 31 min + 1 h 05 min = 4 h 36 min

R

GROSS FLIGHT PATH DESCENT AT GREEN DOT SPEED

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA CG=33.0%	**DISTANCE (NM) TIME (MIN)** **INITIAL SPEED(KT) FUEL(1000KG)** **LEVEL OFF (FT)**

INIT. GW (1000KG)	INITIAL FLIGHT LEVEL 230	250	270	290	310	330	350	370	390
48						158 30 194 .8 32100	230 43 196 1.1 32300	269 49 198 1.2 32400	294 53 200 1.3 32400
50					78 15 196 .4 30800	207 39 198 1.0 31200	258 48 200 1.2 31300	290 53 202 1.4 31400	313 57 204 1.4 31400
52					169 32 200 .9 30000	241 45 202 1.2 30200	279 51 204 1.4 30300	307 56 206 1.5 30300	329 59 208 1.5 30400
54				82 16 202 .5 28700	209 39 204 1.1 29100	260 48 206 1.3 29200	292 54 208 1.5 29300	317 58 210 1.6 29300	337 61 212 1.6 29400
56				172 33 206 1.0 28000	242 45 208 1.3 28100	281 52 210 1.5 28200	310 57 212 1.6 28300	332 61 214 1.7 28300	352 64 216 1.8 28400
58			102 20 208 .6 26700	217 41 210 1.2 27000	267 50 212 1.5 27200	301 56 214 1.6 27300	326 60 216 1.7 27300	347 63 218 1.8 27300	365 66 220 1.9 27400
60			179 34 212 1.1 25900	248 47 214 1.4 26100	289 54 216 1.6 26200	318 59 218 1.8 26300	341 63 220 1.9 26300	361 66 222 1.9 26400	378 68 224 2.0 26400
62		105 20 214 .7 24700	223 43 216 1.4 25000	274 52 218 1.6 25100	307 57 220 1.8 25200	335 62 222 1.9 25300	356 65 224 2.0 25300	374 68 226 2.0 25400	392 71 228 2.1 25400
64		169 32 218 1.1 24000	242 46 220 1.5 24200	285 53 222 1.7 24300	315 59 224 1.9 24300	339 63 226 2.0 24400	360 66 228 2.1 24400	379 69 230 2.1 24400	395 71 232 2.2 24500
66	68 13 220 .5 22800	206 39 222 1.3 23200	261 49 224 1.6 23300	296 55 226 1.8 23400	324 60 228 2.0 23500	347 64 230 2.1 23500	366 67 232 2.1 23600	384 69 234 2.2 23600	400 72 236 2.2 23600
68	154 30 224 1.0 22200	233 44 226 1.5 22400	277 52 228 1.8 22500	308 57 230 1.9 22600	333 62 232 2.1 22700	355 65 234 2.1 22700	373 68 236 2.2 22700	389 70 238 2.3 22700	405 72 240 2.3 22800
70	197 38 228 1.4 21500	255 48 230 1.7 21600	292 55 232 1.9 21700	320 60 234 2.0 21800	343 63 236 2.2 21800	361 66 238 2.2 21900	380 69 240 2.3 21900	396 71 242 2.3 21900	
72	227 43 232 1.6 20700	272 51 234 1.8 20900	306 57 236 2.0 20900	331 61 238 2.2 21000	351 65 240 2.2 21000	372 68 242 2.3 21100	389 70 244 2.4 21100	405 72 246 2.4 21100	
74	250 47 236 1.8 20000	291 55 238 2.0 20100	320 60 240 2.2 20100	342 63 242 2.3 20200	363 66 244 2.4 20200	381 69 246 2.4 20200	398 72 248 2.5 20300	412 74 250 2.5 20300	

CORRECTIONS	**DISTANCE**	**TIME**	**FUEL**	**LEVEL OFF**
ENGINE ANTI ICE ON	+ 2 %	+ 3 %	+ 7 %	− 100 ft
TOTAL ANTI ICE ON	+ 7 %	+ 8 %	+ 10 %	− 700 ft

R

GROSS FLIGHT PATH DESCENT AT GREEN DOT SPEED

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA+10 CG=33.0%	**DISTANCE (NM) TIME (MIN)** **INITIAL SPEED(KT) FUEL(1000KG)** **LEVEL OFF (FT)**

INIT. GW (1000KG)	INITIAL FLIGHT LEVEL 230	250	270	290	310	330	350	370	390
48						167 31 194 .8 32100	239 43 196 1.1 32200	278 50 198 1.3 32300	306 54 200 1.4 32400
50					83 15 196 .4 30800	215 39 198 1.1 31100	266 48 200 1.3 31200	299 54 202 1.4 31300	324 57 204 1.5 31300
52					177 33 200 .9 29900	248 45 202 1.3 30100	288 52 204 1.4 30200	317 57 206 1.5 30300	340 60 208 1.6 30300
54				101 19 202 .6 28700	217 40 204 1.2 29000	269 49 206 1.4 29200	301 54 208 1.5 29200	328 59 210 1.6 29300	348 62 212 1.7 29300
56				179 33 206 1.0 27900	248 45 208 1.3 28100	288 52 210 1.5 28200	319 57 212 1.7 28300	342 61 214 1.7 28300	363 64 216 1.8 28300
58			108 20 208 .6 26700	224 42 210 1.3 27000	273 50 212 1.5 27100	309 56 214 1.7 27200	336 60 216 1.8 27300	357 64 218 1.9 27300	377 67 220 1.9 27400
60			185 35 212 1.1 25900	255 47 214 1.5 26100	297 54 216 1.7 26200	328 59 218 1.8 26200	352 63 220 1.9 26300	372 66 222 2.0 26300	390 69 224 2.1 26400
62		112 21 214 .7 24600	230 43 216 1.4 25000	283 52 218 1.7 25100	319 58 220 1.9 25200	345 63 222 2.0 25300	368 66 224 2.1 25300	387 69 226 2.1 25300	405 71 228 2.2 25400
64		177 33 218 1.1 23900	250 47 220 1.6 24100	294 54 222 1.8 24200	325 59 224 1.9 24300	351 63 226 2.0 24300	372 67 228 2.1 24400	391 69 230 2.2 24400	408 72 232 2.2 24400
66	87 16 220 .6 22800	214 40 222 1.4 23100	270 50 224 1.7 23300	306 56 226 1.9 23400	335 61 228 2.0 23400	358 65 230 2.1 23500	379 68 232 2.2 23500	397 70 234 2.3 23500	414 73 236 2.3 23600
68	163 31 224 1.1 22100	242 45 226 1.6 22400	287 53 228 1.8 22500	318 58 230 2.0 22500	345 63 232 2.1 22600	366 66 234 2.2 22600	387 69 236 2.3 22700	403 71 238 2.4 22700	419 73 240 2.4 22700
70	205 39 228 1.4 21400	263 49 230 1.8 21600	301 55 232 2.0 21700	331 60 234 2.1 21700	355 64 236 2.2 21800	375 67 238 2.3 21800	394 70 240 2.4 21800	411 72 242 2.4 21900	
72	236 44 232 1.6 20700	283 52 234 1.9 20800	317 58 236 2.1 20900	343 62 238 2.2 20900	365 66 240 2.3 21000	385 69 242 2.4 21000	403 71 244 2.5 21000	419 74 246 2.5 21000	
74	259 48 236 1.8 19900	300 55 238 2.1 20000	328 60 240 2.2 20000	354 64 242 2.4 20100	374 67 244 2.4 20100	394 70 246 2.5 20200	412 73 248 2.6 20200	427 75 250 2.6 20200	

CORRECTIONS	**DISTANCE**	**TIME**	**FUEL**	**LEVEL OFF**
ENGINE ANTI ICE ON	+ 2 %	+ 3 %	+ 7 %	– 100 ft
TOTAL ANTI ICE ON	+ 7 %	+ 8 %	+ 10 %	– 700 ft

R

GROSS FLIGHT PATH DESCENT AT GREEN DOT SPEED

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA+15 CG=33.0%	**DISTANCE (NM) TIME (MIN)** **INITIAL SPEED(KT) FUEL(1000KG)** **LEVEL OFF (FT)**

INIT. GW (1000KG)	INITIAL FLIGHT LEVEL 230	250	270	290	310	330	350	370	390
48					70 13 192 .3 30800	213 39 194 1.0 31200	265 48 196 1.2 31400	300 54 198 1.4 31400	325 58 200 1.4 31500
50					181 34 196 .9 30000	253 47 198 1.2 30200	295 54 200 1.4 30300	324 58 202 1.5 30300	347 62 204 1.6 30400
52				110 21 198 .6 28700	225 42 200 1.2 29000	277 51 202 1.4 29100	312 57 204 1.5 29200	338 61 206 1.6 29300	360 64 208 1.7 29300
54				189 36 202 1.0 27800	258 48 204 1.4 28000	299 55 206 1.5 28100	329 60 208 1.7 28200	353 64 210 1.7 28200	373 67 212 1.8 28200
56			129 25 204 .7 26500	234 44 206 1.3 26800	286 53 208 1.5 27000	320 59 210 1.7 27100	345 63 212 1.8 27100	369 66 214 1.9 27200	388 69 216 1.9 27200
58			198 37 208 1.1 25700	264 49 210 1.5 25900	306 57 212 1.7 26000	336 62 214 1.8 26100	361 66 216 1.9 26100	382 69 218 2.0 26100	400 71 220 2.0 26200
60		131 25 210 .8 24500	234 44 212 1.4 24800	289 54 214 1.7 24900	325 60 216 1.8 25000	353 65 218 2.0 25000	375 68 220 2.0 25100	395 71 222 2.1 25100	413 74 224 2.2 25100
62		186 35 214 1.2 23700	255 48 216 1.5 23900	298 56 218 1.8 24000	329 61 220 1.9 24100	354 65 222 2.0 24100	376 68 224 2.1 24200	395 71 226 2.1 24200	412 73 228 2.2 24200
64	113 22 216 .7 22600	221 42 218 1.4 22900	274 51 220 1.7 23100	310 57 222 1.9 23100	337 62 224 2.0 23200	362 66 226 2.1 23200	380 69 228 2.2 23300	398 71 230 2.2 23300	417 74 232 2.3 23300
66	176 34 220 1.2 21900	248 47 222 1.6 22100	289 54 224 1.8 22200	323 60 226 2.0 22300	347 64 228 2.1 22300	369 67 230 2.2 22400	388 70 232 2.2 22400	406 72 234 2.3 22400	421 74 236 2.3 22500
68	214 41 224 1.4 21200	270 51 226 1.8 21300	305 57 228 1.9 21400	334 62 230 2.1 21500	358 65 232 2.2 21500	378 69 234 2.3 21500	397 71 236 2.3 21600	414 74 238 2.4 21600	
70	245 46 228 1.7 20400	289 54 230 1.9 20500	320 59 232 2.1 20600	347 64 234 2.2 20600	369 67 236 2.3 20700	388 70 238 2.4 20700	407 73 240 2.4 20700	421 75 242 2.5 20700	
72	268 50 232 1.9 19500	308 57 234 2.1 19600	336 62 236 2.2 19700	361 66 238 2.3 19800	381 69 240 2.4 19800	400 72 242 2.5 19800	417 74 244 2.6 19900	433 77 246 2.6 19900	
74	292 55 236 2.1 18700	325 60 238 2.2 18700	352 65 240 2.4 18800	374 68 242 2.5 18900	393 71 244 2.6 18900	411 74 246 2.6 18900	428 76 248 2.7 19000	442 78 250 2.7 19000	

CORRECTIONS	DISTANCE	TIME	FUEL	LEVEL OFF
ENGINE ANTI ICE ON	+ 2 %	+ 3 %	+ 7 %	– 100 ft
TOTAL ANTI ICE ON	+ 7 %	+ 8 %	+ 10 %	– 700 ft

R

GROSS FLIGHT PATH DESCENT AT GREEN DOT SPEED

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA+20 CG=33.0%	**DISTANCE (NM) TIME (MIN)** **INITIAL SPEED(KT) FUEL(1000KG)** **LEVEL OFF (FT)**

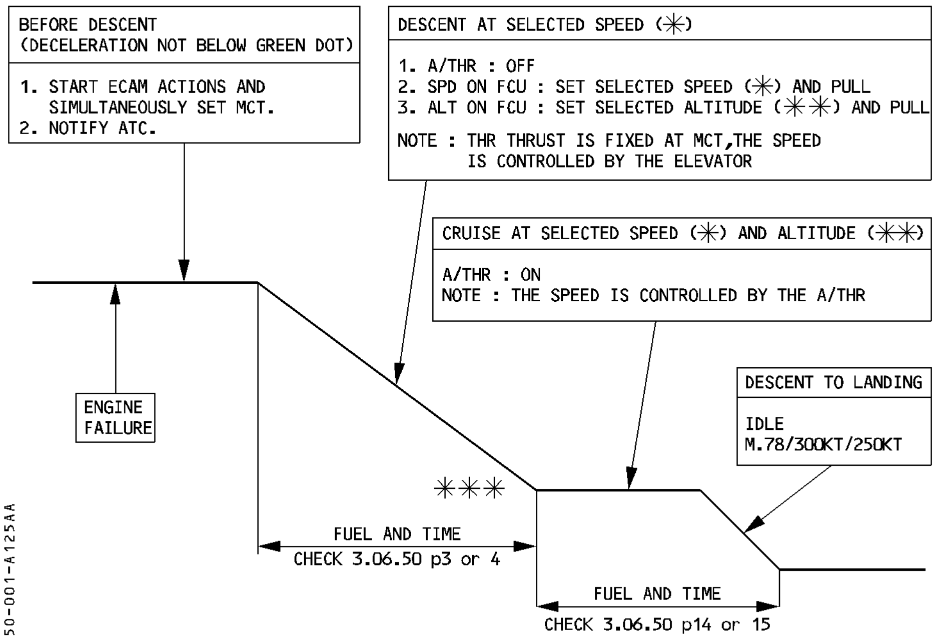
INIT. GW (1000KG)	INITIAL FLIGHT LEVEL 230	250	270	290	310	330	350	370	390
48					183 34 192 .9 29900	256 48 194 1.2 30100	298 55 196 1.4 30200	328 60 198 1.5 30300	351 63 200 1.6 30300
50				118 22 194 .6 28600	228 43 196 1.1 28900	281 52 198 1.4 29100	315 58 200 1.5 29100	341 62 202 1.6 29200	364 66 204 1.7 29200
52				192 37 198 1.0 27700	261 49 200 1.3 27900	302 56 202 1.5 28000	332 61 204 1.6 28100	355 65 206 1.7 28100	377 68 208 1.8 28100
54			137 26 200 .8 26500	237 45 202 1.3 26700	287 54 204 1.5 26900	322 60 206 1.7 27000	349 64 208 1.8 27000	371 68 210 1.8 27000	390 70 212 1.9 27100
56		15 3 202 .1 24900	203 39 204 1.1 25500	269 51 206 1.5 25700	309 58 208 1.7 25800	339 63 210 1.8 25900	364 67 212 1.9 26000	384 70 214 1.9 26000	403 73 216 2.0 26000
58		145 28 206 .9 24300	238 45 208 1.4 24600	288 54 210 1.6 24700	324 61 212 1.8 24800	354 66 214 1.9 24900	377 69 216 2.0 24900	398 73 218 2.1 24900	416 75 220 2.1 25000
60		197 38 210 1.2 23500	260 49 212 1.5 23700	300 57 214 1.7 23800	332 62 216 1.9 23900	357 66 218 2.0 23900	378 69 220 2.0 23900	397 72 222 2.1 24000	414 74 224 2.1 24000
62	139 27 212 .9 22400	231 44 214 1.4 22700	279 53 216 1.7 22800	315 59 218 1.8 22900	343 64 220 2.0 22900	367 68 222 2.1 23000	386 71 224 2.1 23000	404 73 226 2.2 23000	421 76 228 2.2 23100
64	194 38 216 1.3 21600	257 49 218 1.6 21800	298 56 220 1.8 21900	329 62 222 2.0 22000	354 66 224 2.1 22000	375 69 226 2.2 22100	394 72 228 2.2 22100	412 74 230 2.3 22100	
66	228 44 220 1.5 20800	279 53 222 1.8 20900	314 59 224 2.0 21000	342 64 226 2.1 21100	365 68 228 2.2 21100	386 71 230 2.3 21200	404 73 232 2.3 21200	421 76 234 2.4 21200	
68	257 49 224 1.7 19900	299 57 226 2.0 20100	329 62 228 2.1 20100	356 66 230 2.2 20200	376 70 232 2.3 20200	396 72 234 2.4 20300	412 75 236 2.4 20300	429 77 238 2.5 20300	
70	286 55 228 1.9 19000	321 61 230 2.1 19100	350 66 232 2.3 19200	373 69 234 2.4 19200	393 72 236 2.5 19300	411 75 238 2.5 19300	429 78 240 2.6 19400	445 80 242 2.6 19400	
72	309 59 232 2.1 18100	341 64 234 2.3 18100	366 68 236 2.4 18200	388 72 238 2.5 18300	407 75 240 2.6 18300	425 77 242 2.7 18300	442 80 244 2.7 18400		
74	273 51 236 1.9 17400	305 57 238 2.1 17500	330 61 240 2.2 17500	354 65 242 2.3 17500	374 68 244 2.4 17600	393 71 246 2.5 17600	409 73 248 2.5 17600		

CORRECTIONS	**DISTANCE**	**TIME**	**FUEL**	**LEVEL OFF**
ENGINE ANTI ICE ON	+ 2 %	+ 3 %	+ 7 %	– 100 ft
TOTAL ANTI ICE ON	+ 7 %	+ 8 %	+ 10 %	– 700 ft

– For LONG RANGE CRUISE table (Refer to 3.06.30 p4 to 11)
– For IN CRUISE QUICK CHECK (Refer to 3.06.30 p12)

PROCEDURE

This section provides single engine performance data for two fixed speed diversion strategies (fixed descent and cruise speed schedules) recommended for ETOPS operation, provided that the requirements set forth in section 3.06.10, GENERAL, are complied with.



✳ USE M.80/350KT OR M.78/320KT AS ESTABLISHED BEFORE DISPATCH.

✳✳ SET 15000 feet OR VALUE ESTABLISHED BEFORE DISPATCH.

✳✳✳ IF V/S BECOMES < 500 feet/minute SELECT V/S MODE.

EXAMPLE

Given :

GW at engine failure = 70000 kg
FL at engine failure = 350
Temperature = ISA
Distance to diversion airport = 500 NM
Speed selected before dispatch = 350 KT
Cruise level for diversion
Selected before dispatch = FL180

Find :

R Descent to cruise level : Distance = 184 – 94 = 90 NM
R (See 3.06.50 p3) Fuel = 1056 – 476 = 580 kg
R Time = 24.8 – 13.3 = 11.5 min

Cruise
R Weight = 70000 – 580 = 69420 kg
R Distance = 500 – 90 = 410 NM
Determine (3.06.50 p14) time and fuel consumption at ISA conditions for a reference weight of 55000 kg
R Interpolate the remaining distance of 410 NM at FL180
R Fuel = 2573 kg
R Time = 1 h 13 min
Correction due to actual in-cruise weight :
R = ΔFuel+ 2 kg per 1000 kg above reference weight
R ΔFuel = + 2 kg × (69.5 – 55) ~ 29 kg

Result :

R Total Fuel = 2573 + 29 + 580 = 3182 kg
R Time = 1h13 min + 12 min = 1 h 25 min

R

DESCENT - M.80/350KT - 1 ENGINE OUT									
MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF			ISA CG=33.0%		**MINIMUM RATE OF DESCENT 500FT/MIN**				
WEIGHT (1000KG)	**50**				**70**				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	IAS (KT)
390	25.7	1041	191	MCT					248
370	24.2	1009	179	MCT	26.1	1086	194	MCT	260
350	22.7	973	168	MCT	24.8	1056	184	MCT	272
330	21.4	936	157	MCT	23.5	1022	174	MCT	284
310	20.1	899	147	MCT	22.2	985	164	MCT	297
290	18.9	863	138	MCT	21.0	946	154	MCT	311
270	17.9	828	130	MCT	19.8	906	144	MCT	324
250	17.0	796	123	MCT	18.6	867	135	MCT	338
230	16.2	764	116	MCT	17.6	827	127	MCT	350
220	15.6	743	111	MCT	16.8	799	121	MCT	350
210	14.9	718	106	MCT	16.1	769	115	MCT	350
200	14.3	691	101	MCT	15.2	735	108	MCT	350
190	13.5	660	95	MCT	14.3	698	101	MCT	350
180	12.7	626	89	MCT	13.3	657	94	MCT	350
170	11.8	585	82	MCT	12.2	609	86	MCT	350
160	10.6	532	74	MCT	11.0	549	76	MCT	350
150	9.3	467	64	MCT	9.5	476	65	MCT	350
140	7.7	391	53	MCT	7.8	395	54	MCT	350
100	.0	0	0	V/S	.0	0	0	V/S	350

CORRECTIONS	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**	**PER 1° ABOVE ISA**
TIME	– 0.5 %	– 2.5 %	–
FUEL	+ 1 %	+ 1.5 %	+ 0.3 %
DISTANCE	– 0.5 %	– 3 %	+ 0.3 %

R

DESCENT - M.78/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF	ISA CG=33.0%	MINIMUM RATE OF DESCENT 500FT/MIN

WEIGHT (1000KG)	50				70				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	IAS (KT)
390	36.5	1343	256	MCT					241
370	34.7	1304	242	MCT	34.8	1316	244	MCT	252
350	32.9	1261	229	MCT	33.4	1282	233	MCT	264
330	31.2	1216	216	MCT	31.9	1243	221	MCT	277
310	29.7	1171	204	MCT	30.3	1199	210	MCT	289
290	28.2	1126	193	MCT	28.8	1153	198	MCT	302
270	26.9	1083	183	MCT	27.4	1106	187	MCT	315
250	25.4	1030	172	MCT	25.6	1045	173	MCT	320
230	23.4	959	157	MCT	23.4	966	157	MCT	320
220	22.3	916	148	MCT	22.2	920	148	MCT	320
210	21.0	867	139	MCT	20.9	868	138	MCT	320
200	19.6	810	129	MCT	19.4	810	128	MCT	320
190	17.9	742	117	MCT	17.8	744	116	MCT	320
180	16.0	663	104	V/S	16.0	669	104	MCT	320
170	14.0	578	90	V/S	14.0	584	90	V/S	320
160	12.0	495	77	V/S	12.0	499	77	V/S	320
150	10.0	412	64	V/S	10.0	415	64	V/S	320
140	8.0	329	50	V/S	8.0	332	50	V/S	320
100	.0	0	0	V/S	.0	0	0	V/S	320

CORRECTIONS	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**	**PER 1° ABOVE ISA**
TIME	− 0.4 %	− 1 %	−
FUEL	+ 2 %	+ 5 %	+ 0.3 %
DISTANCE	− 0.5 %	− 0.8 %	+ 0.3 %

R

CRUISE - MCT/341KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA CG=33.0%	**N1 (%)** **KG/H** **NM/1000KG**	**MACH** **IAS (KT)** **TAS (KT)**

WEIGHT (1000KG)	**FL100**		**FL150**		**FL160**		**FL180**		**FL200**		**FL220**	
48	89.6	.614	90.0	.632	90.0	.635	88.7	.620	88.6	.622	88.6	.623
	3256	341	2907	320	2839	316	2511	296	2364	286	2225	275
	120.4	392	136.1	396	139.6	396	152.8	384	161.6	382	170.6	379
50	89.6	.613	90.0	.630	90.0	.633	88.7	.617	88.6	.619	88.6	.619
	3257	341	2907	319	2839	315	2510	295	2362	284	2223	273
	120.2	391	135.8	395	139.2	395	152.3	382	160.9	380	169.7	377
52	89.6	.612	90.0	.628	90.0	.631	88.7	.614	88.6	.615	88.6	.614
	3258	340	2907	318	2838	314	2508	294	2360	283	2220	271
	119.9	391	135.4	394	138.8	394	151.7	380	160.1	378	168.6	374
54	89.6	.611	90.0	.626	90.1	.629	88.7	.612	88.7	.612	88.6	.609
	3259	340	2906	317	2837	313	2507	292	2358	281	2218	269
	119.7	390	135.0	392	138.4	393	151.0	379	159.3	376	167.4	371
56	89.6	.610	90.0	.624	90.1	.627	88.7	.608	88.7	.607	88.7	.603
	3260	339	2906	316	2837	312	2506	291	2356	279	2215	266
	119.4	389	134.6	391	137.9	391	150.3	377	158.4	373	166.0	368
58	89.6	.608	90.0	.622	90.1	.624	88.7	.605	88.7	.603	88.7	.596
	3261	338	2906	315	2836	310	2504	289	2353	277	2210	263
	119.0	388	134.1	390	137.4	390	149.6	375	157.3	370	164.4	363
60	89.6	.607	90.0	.620	90.1	.622	88.7	.601	88.7	.597	88.7	.588
	3263	337	2905	314	2835	309	2502	287	2349	274	2203	259
	118.7	387	133.6	388	136.9	388	148.7	372	156.1	367	162.6	358
62	89.6	.605	90.0	.617	90.1	.619	88.7	.597	88.7	.590	88.7	.578
	3264	336	2905	313	2834	308	2499	285	2343	271	2196	254
	118.4	386	133.1	387	136.3	386	147.8	369	154.7	362	160.4	352
64	89.6	.604	90.0	.615	90.1	.616	88.7	.591	88.7	.582	88.6	.566
	3265	336	2904	311	2833	306	2494	282	2337	267	2187	249
	118.0	385	132.6	385	135.7	384	146.8	366	153.1	358	157.6	345
66	89.6	.602	90.1	.612	90.1	.613	88.7	.585	88.7	.574	88.6	.546
	3267	335	2904	310	2832	304	2488	279	2330	263	2173	240
	117.6	384	132.0	383	135.0	382	145.6	362	151.2	352	153.2	333
68	89.7	.600	90.1	.609	90.2	.609	88.7	.578	88.7	.563		
	3268	334	2903	308	2831	303	2481	275	2321	258		
	117.2	383	131.3	381	134.3	380	144.2	358	148.9	346		
70	89.7	.598	90.1	.605	90.2	.605	88.7	.570	88.7	.547		
	3267	332	2902	306	2829	300	2474	272	2310	250		
	116.9	382	130.6	379	133.4	377	142.6	353	145.5	336		
72	89.7	.596	90.1	.601	90.2	.600	88.7	.561	88.7	.513		
	3265	331	2901	304	2828	298	2466	267	2288	234		
	116.5	380	129.8	377	132.4	374	140.8	347	137.7	315		
74	89.7	.593	90.1	.596	90.2	.594	88.7	.548				
	3263	330	2897	302	2822	295	2455	261				
	116.1	379	129.0	374	131.4	371	138.2	339				

ENGINE ANTI ICE ON △FUEL = + 1.5 %	**TOTAL ANTI ICE ON** △FUEL = + 3.5 %

R

CRUISE - MCT/340KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
PACK FLOW HI
ANTI-ICING OFF

ISA+10
CG=33.0%

N1 (%) **MACH**
KG/H **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL160		FL180		FL200		FL220	
48	91.1	.612	91.6	.631	91.7	.634	90.3	.618	90.3	.620	90.3	.621
	3323	340	2974	320	2906	315	2567	296	2416	285	2273	274
	119.8	398	135.3	403	138.7	403	152.1	390	160.8	389	169.8	386
50	91.1	.611	91.6	.629	91.7	.632	90.4	.616	90.3	.617	90.3	.617
	3324	340	2974	319	2906	314	2566	294	2414	283	2271	272
	119.6	398	135.0	401	138.4	402	151.5	389	160.1	387	168.9	384
52	91.1	.610	91.6	.627	91.7	.630	90.4	.613	90.3	.614	90.3	.613
	3325	339	2974	318	2905	313	2565	293	2412	282	2269	270
	119.3	397	134.6	400	138.0	401	150.9	387	159.4	384	167.9	381
54	91.1	.609	91.6	.625	91.7	.628	90.4	.610	90.3	.610	90.3	.607
	3326	339	2974	317	2904	312	2564	292	2410	280	2266	268
	119.1	396	134.2	399	137.5	399	150.3	385	158.6	382	166.7	378
56	91.2	.608	91.7	.623	91.7	.626	90.4	.607	90.3	.606	90.3	.601
	3328	338	2974	316	2903	311	2562	290	2407	278	2263	265
	118.8	395	133.8	398	137.1	398	149.6	383	157.6	379	165.2	374
58	91.2	.607	91.7	.621	91.8	.623	90.4	.603	90.3	.601	90.3	.594
	3329	337	2973	315	2902	310	2560	288	2404	276	2257	262
	118.5	394	133.3	396	136.6	396	148.8	381	156.6	376	163.6	369
60	91.2	.605	91.7	.619	91.8	.621	90.4	.599	90.3	.595	90.3	.585
	3330	336	2973	313	2901	309	2558	286	2399	273	2250	258
	118.1	393	132.8	395	136.1	395	147.9	378	155.3	373	161.8	364
62	91.2	.604	91.7	.616	91.8	.618	90.4	.595	90.3	.588	90.3	.575
	3332	336	2973	312	2900	307	2553	284	2393	270	2242	253
	117.8	392	132.3	393	135.5	393	147.1	376	153.9	368	159.6	358
64	91.2	.602	91.7	.613	91.8	.615	90.4	.589	90.3	.580	90.3	.562
	3333	335	2972	311	2899	306	2548	281	2386	266	2231	247
	117.4	391	131.8	392	134.9	391	146.0	372	152.3	363	156.6	350
66	91.2	.600	91.7	.611	91.8	.611	90.4	.583	90.3	.571	90.3	.541
	3335	334	2972	309	2898	304	2542	278	2379	262	2217	238
	117.0	390	131.2	390	134.2	389	144.8	368	150.5	358	151.9	337
68	91.2	.598	91.7	.607	91.8	.608	90.4	.576	90.3	.560		
	3334	332	2971	308	2896	302	2535	274	2370	256		
	116.7	389	130.5	388	133.4	387	143.4	363	148.0	351		
70	91.2	.596	91.8	.604	91.8	.603	90.3	.568	90.3	.543		
	3332	331	2970	306	2895	300	2527	271	2357	248		
	116.3	388	129.8	386	132.6	384	141.8	358	144.3	340		
72	91.2	.594	91.8	.600	91.9	.598	90.3	.558	90.3	.502		
	3330	330	2969	304	2892	297	2518	266	2330	229		
	115.9	386	129.0	383	131.6	381	139.9	352	134.8	314		
74	91.2	.591	91.8	.595	91.9	.593	90.3	.545				
	3328	329	2963	301	2886	294	2506	259				
	115.5	384	128.2	380	130.6	377	137.3	344				

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = + 1.5 %	△FUEL = + 3.5 %

R

CRUISE - MCT/332KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
PACK FLOW HI
ANTI-ICING OFF

ISA+15
CG=33.0%

N1 (%) **MACH**
KG/H **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL160		FL180		FL200		FL220	
48	90.7	.597	91.3	.614	91.4	.617	89.9	.601	90.0	.604	90.0	.604
	3187	332	2840	311	2775	307	2446	287	2317	277	2177	266
	122.9	392	139.3	396	142.8	396	156.5	383	164.8	382	174.1	379
50	90.7	.596	91.3	.612	91.4	.615	89.9	.598	90.0	.600	90.0	.599
	3186	331	2840	310	2775	306	2444	285	2316	276	2174	264
	122.7	391	138.9	395	142.3	395	155.9	381	164.0	380	173.0	376
52	90.7	.595	91.3	.610	91.4	.613	89.9	.595	90.0	.597	90.0	.594
	3185	331	2841	309	2775	305	2441	284	2313	274	2170	262
	122.5	390	138.4	393	141.8	394	155.3	379	163.1	377	171.9	373
54	90.7	.593	91.3	.608	91.4	.611	89.9	.591	90.0	.592	90.0	.587
	3184	330	2842	308	2776	304	2438	282	2309	271	2164	259
	122.3	389	138.0	392	141.3	392	154.5	377	162.2	374	170.4	369
56	90.7	.592	91.3	.606	91.4	.609	89.9	.587	90.0	.587	90.0	.580
	3182	329	2842	307	2776	302	2435	280	2304	269	2157	255
	122.0	388	137.4	391	140.7	391	153.7	374	161.1	371	168.7	364
58	90.7	.590	91.3	.604	91.4	.606	89.9	.583	90.0	.580	90.0	.571
	3181	328	2843	306	2776	301	2431	278	2299	266	2150	251
	121.7	387	136.9	389	140.1	389	152.8	371	159.7	367	166.8	359
60	90.7	.588	91.3	.601	91.4	.603	89.9	.578	90.0	.573	90.0	.561
	3179	327	2844	304	2777	300	2427	275	2293	263	2142	246
	121.4	386	136.3	388	139.5	387	151.7	368	158.2	363	164.4	352
62	90.7	.586	91.3	.599	91.5	.600	89.9	.572	90.0	.565	89.9	.547
	3177	326	2843	303	2777	298	2423	273	2286	259	2130	240
	121.0	385	135.7	386	138.8	385	150.5	364	156.4	358	161.2	343
64	90.7	.584	91.3	.595	91.5	.596	89.9	.565	90.0	.556	89.9	.520
	3175	324	2840	301	2773	296	2417	269	2278	254	2112	228
	120.7	383	135.1	384	138.1	383	149.0	360	154.3	352	154.6	326
66	90.7	.582	91.3	.592	91.5	.592	89.9	.558	90.0	.542		
	3173	323	2836	299	2769	294	2412	266	2267	248		
	120.3	382	134.4	381	137.3	380	147.4	355	151.4	343		
68	90.7	.579	91.3	.587	91.5	.587	89.9	.549	90.0	.520		
	3171	322	2832	297	2764	291	2405	261	2251	238		
	119.9	380	133.7	379	136.4	377	145.4	350	146.3	329		
70	90.7	.577	91.3	.583	91.4	.582	89.9	.536				
	3169	320	2828	295	2758	288	2396	255				
	119.5	379	132.8	375	135.4	373	142.6	342				
72	90.7	.574	91.3	.577	91.4	.575	89.9	.516				
	3166	319	2823	292	2752	285	2382	245				
	119.0	377	131.8	372	134.2	369	138.1	329				
74	90.7	.571	91.3	.571	91.4	.569						
	3164	317	2817	289	2746	282						
	118.4	375	130.7	368	133.0	365						

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
ΔFUEL = + 1.5 %	ΔFUEL = + 3.5 %

R

CRUISE - MCT/323KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
PACK FLOW HI
ANTI-ICING OFF

ISA+20
CG=33.0%

N1 (%) **MACH**
KG/H **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL160		FL180		FL200		FL220	
48	90.1	.582	90.9	.598	91.0	.602	89.4	.582	89.7	.587	89.6	.585
	3048	323	2718	303	2657	299	2319	277	2216	269	2078	258
	126.2	385	143.2	389	146.7	390	161.3	374	169.1	375	178.5	371
50	90.1	.580	90.9	.596	91.0	.599	89.4	.579	89.7	.583	89.6	.580
	3047	322	2716	302	2657	298	2318	276	2212	267	2074	255
	126.0	384	142.7	388	146.2	388	160.6	372	168.2	372	177.2	367
52	90.1	.579	90.9	.594	91.0	.597	89.4	.575	89.7	.578	89.6	.573
	3046	321	2714	301	2655	296	2315	274	2208	265	2069	252
	125.7	383	142.3	386	145.7	387	159.8	370	167.1	369	175.6	363
54	90.1	.577	90.9	.591	91.0	.594	89.4	.571	89.7	.573	89.6	.565
	3045	320	2712	299	2652	295	2313	272	2204	262	2063	248
	125.4	382	141.8	385	145.1	385	158.8	367	165.9	366	173.7	358
56	90.1	.575	90.9	.589	91.0	.591	89.4	.566	89.7	.566	89.6	.556
	3043	319	2710	298	2649	293	2310	270	2199	259	2056	244
	125.1	381	141.3	383	144.6	383	157.7	364	164.4	361	171.4	352
58	90.1	.573	90.9	.586	91.0	.588	89.4	.561	89.6	.559	89.6	.545
	3042	318	2707	296	2646	292	2307	267	2193	256	2048	239
	124.8	379	140.7	381	143.9	381	156.4	361	162.6	357	168.6	345
60	90.1	.571	90.9	.583	91.0	.584	89.4	.554	89.6	.550	89.6	.527
	3040	317	2704	295	2643	290	2303	264	2187	251	2035	231
	124.4	378	140.1	379	143.2	379	154.8	357	160.6	351	164.1	334
62	90.1	.569	90.9	.579	91.0	.580	89.4	.547	89.6	.539	89.5	.487
	3039	316	2701	293	2639	288	2299	260	2178	246	2015	213
	124.0	377	139.4	376	142.4	376	153.1	352	157.9	344	153.2	309
64	90.1	.567	90.9	.575	91.0	.576	89.4	.538	89.6	.522		
	3037	315	2698	291	2635	285	2294	256	2167	238		
	123.5	375	138.6	374	141.5	373	150.9	346	153.8	333		
66	90.1	.565	90.9	.571	91.0	.570	89.4	.527	89.5	.487		
	3035	313	2694	288	2630	283	2287	250	2150	222		
	123.1	374	137.7	371	140.5	369	148.1	339	144.7	311		
68	90.1	.562	90.8	.565	91.0	.564	89.4	.509				
	3033	312	2690	286	2625	279	2278	242				
	122.6	372	136.6	368	139.2	366	143.8	328				
70	90.1	.559	90.8	.559	91.0	.557	89.4	.477				
	3031	310	2685	282	2619	276	2270	226				
	122.0	370	135.5	364	137.9	361	135.0	307				
72	90.1	.556	90.8	.553	91.0	.550						
	3028	308	2679	279	2613	272						
	121.4	368	134.1	359	136.3	356						
74	90.1	.552	90.8	.545	90.9	.539						
	3026	306	2673	275	2604	267						
	120.7	365	132.5	354	134.2	349						

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = + 1.5 %	ΔFUEL = + 3.5 %

R

CRUISE - MCT/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA CG=33.0%	**N1 (%)** **KG/H** **NM/1000KG**	**MACH** **IAS (KT)** **TAS (KT)**

WEIGHT (1000KG)	**FL100**		**FL150**		**FL160**		**FL180**		**FL200**		**FL220**	
48	86.3	.576	89.9	.631	90.0	.635	88.7	.620	88.6	.622	88.6	.623
	2843	320	2901	320	2839	316	2511	296	2364	286	2225	275
	129.4	368	136.3	395	139.6	396	152.8	384	161.6	382	170.6	379
50	86.5	.576	90.0	.630	90.0	.633	88.7	.617	88.6	.619	88.6	.619
	2856	320	2907	319	2839	315	2510	295	2362	284	2223	273
	128.8	368	135.8	395	139.2	395	152.3	382	160.9	380	169.7	377
52	86.6	.576	90.0	.628	90.0	.631	88.7	.614	88.6	.615	88.6	.614
	2871	320	2907	318	2838	314	2508	294	2360	283	2220	271
	128.1	368	135.4	394	138.8	394	151.7	380	160.1	378	168.6	374
54	86.7	.576	90.0	.626	90.1	.629	88.7	.612	88.7	.612	88.6	.609
	2887	320	2906	317	2837	313	2507	292	2358	281	2218	269
	127.4	368	135.0	392	138.4	393	151.0	379	159.3	376	167.4	371
56	86.9	.576	90.0	.624	90.1	.627	88.7	.608	88.7	.607	88.7	.603
	2904	320	2906	316	2837	312	2506	291	2356	279	2215	266
	126.7	368	134.6	391	137.9	391	150.3	377	158.4	373	166.0	368
58	87.0	.576	90.0	.622	90.1	.624	88.7	.605	88.7	.603	88.7	.596
	2921	320	2906	315	2836	310	2504	289	2353	277	2210	263
	125.9	368	134.1	390	137.4	390	149.6	375	157.3	370	164.4	363
60	87.2	.576	90.0	.620	90.1	.622	88.7	.601	88.7	.597	88.7	.588
	2939	320	2905	314	2835	309	2502	287	2349	274	2203	259
	125.2	368	133.6	388	136.9	388	148.7	372	156.1	367	162.6	358
62	87.4	.576	90.0	.617	90.1	.619	88.7	.597	88.7	.590	88.7	.578
	2958	320	2905	313	2834	308	2499	285	2343	271	2196	254
	124.4	368	133.1	387	136.3	386	147.8	369	154.7	362	160.4	352
64	87.5	.576	90.0	.615	90.1	.616	88.7	.591	88.7	.582	88.6	.566
	2979	320	2904	311	2833	306	2494	282	2337	267	2187	249
	123.5	368	132.6	385	135.7	384	146.8	366	153.1	358	157.6	345
66	87.7	.576	90.1	.612	90.1	.613	88.7	.585	88.7	.574	88.6	.546
	2999	320	2904	310	2832	304	2488	279	2330	263	2173	240
	122.7	368	132.0	383	135.0	382	145.6	362	151.2	352	153.2	333
68	87.9	.576	90.1	.609	90.2	.609	88.7	.578	88.7	.563		
	3021	320	2903	308	2831	303	2481	275	2321	258		
	121.8	368	131.3	381	134.3	380	144.2	358	148.9	346		
70	88.1	.576	90.1	.605	90.2	.605	88.7	.570	88.7	.547		
	3043	320	2902	306	2829	300	2474	272	2310	250		
	120.9	368	130.6	379	133.4	377	142.6	353	145.5	336		
72	88.3	.576	90.1	.601	90.2	.600	88.7	.561	88.7	.513		
	3067	320	2901	304	2828	298	2466	267	2288	234		
	120.0	368	129.8	377	132.4	374	140.8	347	137.7	315		
74	88.5	.576	90.1	.596	90.2	.594	88.7	.548				
	3092	320	2897	302	2822	295	2455	261				
	119.0	368	129.0	374	131.4	371	138.2	339				

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
ΔFUEL = + 2 %	ΔFUEL = + 5 %

R

CRUISE - MCT/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
PACK FLOW HI
ANTI-ICING OFF

ISA+10
CG=33.0%

N1 (%) **MACH**
KG/H **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL160		FL180		FL200		FL220	
48	88.0	.576	91.6	.631	91.7	.634	90.3	.618	90.3	.620	90.3	.621
	2916	320	2974	320	2906	315	2567	296	2416	285	2273	274
	128.5	375	135.3	403	138.7	403	152.1	390	160.8	389	169.8	386
50	88.1	.576	91.6	.629	91.7	.632	90.4	.616	90.3	.617	90.3	.617
	2929	320	2974	319	2906	314	2566	294	2414	283	2271	272
	127.9	375	135.0	401	138.4	402	151.5	389	160.1	387	168.9	384
52	88.3	.576	91.6	.627	91.7	.630	90.4	.613	90.3	.614	90.3	.613
	2945	320	2974	318	2905	313	2565	293	2412	282	2269	270
	127.2	375	134.6	400	138.0	401	150.9	387	159.4	384	167.9	381
54	88.4	.576	91.6	.625	91.7	.628	90.4	.610	90.3	.610	90.3	.607
	2961	320	2974	317	2904	312	2564	292	2410	280	2266	268
	126.5	375	134.2	399	137.5	399	150.3	385	158.6	382	166.7	378
56	88.5	.576	91.7	.623	91.7	.626	90.4	.607	90.3	.606	90.3	.601
	2979	320	2974	316	2903	311	2562	290	2407	278	2263	265
	125.8	375	133.8	398	137.1	398	149.6	383	157.6	379	165.2	374
58	88.7	.576	91.7	.621	91.8	.623	90.4	.603	90.3	.601	90.3	.594
	2996	320	2973	315	2902	310	2560	288	2404	276	2257	262
	125.1	375	133.3	396	136.6	396	148.8	381	156.6	376	163.6	369
60	88.9	.576	91.7	.619	91.8	.621	90.4	.599	90.3	.595	90.3	.585
	3015	320	2973	313	2901	309	2558	286	2399	273	2250	258
	124.3	375	132.8	395	136.1	395	147.9	378	155.3	373	161.8	364
62	89.0	.576	91.7	.616	91.8	.618	90.4	.595	90.3	.588	90.3	.575
	3035	320	2973	312	2900	307	2553	284	2393	270	2242	253
	123.5	375	132.3	393	135.5	393	147.1	376	153.9	368	159.6	358
64	89.2	.576	91.7	.613	91.8	.615	90.4	.589	90.3	.580	90.3	.562
	3055	320	2972	311	2899	306	2548	281	2386	266	2231	247
	122.6	375	131.8	392	134.9	391	146.0	372	152.3	363	156.6	350
66	89.4	.576	91.7	.611	91.8	.611	90.4	.583	90.3	.571	90.3	.541
	3077	320	2972	309	2898	304	2542	278	2379	262	2217	238
	121.8	375	131.2	390	134.2	389	144.8	368	150.5	358	151.9	337
68	89.6	.576	91.7	.607	91.8	.608	90.4	.576	90.3	.560		
	3099	320	2971	308	2896	302	2535	274	2370	256		
	120.9	375	130.5	388	133.4	387	143.4	363	148.0	351		
70	89.8	.576	91.8	.604	91.8	.603	90.3	.568	90.3	.543		
	3122	320	2970	306	2895	300	2527	271	2357	248		
	120.0	375	129.8	386	132.6	384	141.8	358	144.3	340		
72	90.0	.576	91.8	.600	91.9	.598	90.3	.558	90.3	.502		
	3146	320	2969	304	2892	297	2518	266	2330	229		
	119.1	375	129.0	383	131.6	381	139.9	352	134.8	314		
74	90.2	.576	91.8	.595	91.9	.593	90.3	.545				
	3172	320	2963	301	2886	294	2506	259				
	118.1	375	128.2	380	130.6	377	137.3	344				

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = + 2 %	△FUEL = + 5 %

R

CRUISE - MCT/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
PACK FLOW HI
ANTI-ICING OFF

ISA+15
CG=33.0%

N1 (%) / **MACH**
KG/H / **IAS (KT)**
NM/1000KG / **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL160		FL180		FL200		FL220	
48	88.8	.576	91.3	.614	91.4	.617	89.9	.601	90.0	.604	90.0	.604
	2953	320	2840	311	2775	307	2446	287	2317	277	2177	266
	128.0	378	139.3	396	142.8	396	156.5	383	164.8	382	174.1	379
50	88.9	.576	91.3	.612	91.4	.615	89.9	.598	90.0	.600	90.0	.599
	2967	320	2840	310	2775	306	2444	285	2316	276	2174	264
	127.4	378	138.9	395	142.3	395	155.9	381	164.0	380	173.0	376
52	89.1	.576	91.3	.610	91.4	.613	89.9	.595	90.0	.597	90.0	.594
	2982	320	2841	309	2775	305	2441	284	2313	274	2170	262
	126.8	378	138.4	393	141.8	394	155.3	379	163.1	377	171.9	373
54	89.2	.576	91.3	.608	91.4	.611	89.9	.591	90.0	.592	90.0	.587
	2999	320	2842	308	2776	304	2438	282	2309	271	2164	259
	126.1	378	138.0	392	141.3	392	154.5	377	162.2	374	170.4	369
56	89.4	.576	91.3	.606	91.4	.609	89.9	.587	90.0	.587	90.0	.580
	3016	320	2842	307	2776	302	2435	280	2304	269	2157	255
	125.3	378	137.4	391	140.7	391	153.7	374	161.1	371	168.7	364
58	89.5	.576	91.3	.604	91.4	.606	89.9	.583	90.0	.580	90.0	.571
	3034	320	2843	306	2776	301	2431	278	2299	266	2150	251
	124.6	378	136.9	389	140.1	389	152.8	371	159.7	367	166.8	359
60	89.7	.576	91.3	.601	91.4	.603	89.9	.578	90.0	.573	90.0	.561
	3053	320	2844	304	2777	300	2427	275	2293	263	2142	246
	123.8	378	136.3	388	139.5	387	151.7	368	158.2	363	164.4	352
62	89.9	.576	91.3	.599	91.5	.600	89.9	.572	90.0	.565	89.9	.547
	3073	320	2843	303	2777	298	2423	273	2286	259	2130	240
	123.0	378	135.7	386	138.8	385	150.5	364	156.4	358	161.2	343
64	90.0	.576	91.3	.595	91.5	.596	89.9	.565	90.0	.556	89.9	.520
	3094	320	2840	301	2773	296	2417	269	2278	254	2112	228
	122.2	378	135.1	384	138.1	383	149.0	360	154.3	352	154.6	326
66	90.2	.576	91.3	.592	91.5	.592	89.9	.558	90.0	.542		
	3116	320	2836	299	2769	294	2412	266	2267	248		
	121.3	378	134.4	381	137.3	380	147.4	355	151.4	343		
68	90.4	.576	91.3	.587	91.5	.587	89.9	.549	90.0	.520		
	3138	320	2832	297	2764	291	2405	261	2251	238		
	120.5	378	133.7	379	136.4	377	145.4	350	146.3	329		
70	90.6	.576	91.3	.583	91.4	.582	89.9	.536				
	3162	320	2828	295	2758	288	2396	255				
	119.6	378	132.8	375	135.4	373	142.6	342				
72	90.7	.574	91.3	.577	91.4	.575	89.9	.516				
	3166	319	2823	292	2752	285	2382	245				
	119.0	377	131.8	372	134.2	369	138.1	329				
74	90.7	.571	91.3	.571	91.4	.569						
	3164	317	2817	289	2746	282						
	118.4	375	130.7	368	133.0	365						

ENGINE ANTI ICE ON
∆FUEL = + 2 %

TOTAL ANTI ICE ON
∆FUEL = + 5 %

R

CRUISE - MCT/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
PACK FLOW HI
ANTI-ICING OFF

ISA+20
CG=33.0%

N1 (%) / **MACH**
KG/H / **IAS (KT)**
NM/1000KG / **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL160		FL180		FL200		FL220	
48	89.6	.576	90.9	.598	91.0	.602	89.4	.582	89.7	.587	89.6	.585
	2990	320	2718	303	2657	299	2319	277	2216	269	2078	258
	127.5	381	143.2	389	146.7	390	161.3	374	169.1	375	178.5	371
50	89.8	.576	90.9	.596	91.0	.599	89.4	.579	89.7	.583	89.6	.580
	3004	320	2716	302	2657	298	2318	276	2212	267	2074	255
	127.0	381	142.7	388	146.2	388	160.6	372	168.2	372	177.2	367
52	89.9	.576	90.9	.594	91.0	.597	89.4	.575	89.7	.578	89.6	.573
	3020	320	2714	301	2655	296	2315	274	2208	265	2069	252
	126.3	381	142.3	386	145.7	387	159.8	370	167.1	369	175.6	363
54	90.0	.576	90.9	.591	91.0	.594	89.4	.571	89.7	.573	89.6	.565
	3037	320	2712	299	2652	295	2313	272	2204	262	2063	248
	125.6	381	141.8	385	145.1	385	158.8	367	165.9	366	173.7	358
56	90.1	.575	90.9	.589	91.0	.591	89.4	.566	89.7	.566	89.6	.556
	3043	319	2710	298	2649	293	2310	270	2199	259	2056	244
	125.1	381	141.3	383	144.6	383	157.7	364	164.4	361	171.4	352
58	90.1	.573	90.9	.586	91.0	.588	89.4	.561	89.6	.559	89.6	.545
	3042	318	2707	296	2646	292	2307	267	2193	256	2048	239
	124.8	379	140.7	381	143.9	381	156.4	361	162.6	357	168.6	345
60	90.1	.571	90.9	.583	91.0	.584	89.4	.554	89.6	.550	89.6	.527
	3040	317	2704	295	2643	290	2303	264	2187	251	2035	231
	124.4	378	140.1	379	143.2	379	154.8	357	160.6	351	164.1	334
62	90.1	.569	90.9	.579	91.0	.580	89.4	.547	89.6	.539	89.5	.487
	3039	316	2701	293	2639	288	2299	260	2178	246	2015	213
	124.0	377	139.4	376	142.4	376	153.1	352	157.9	344	153.2	309
64	90.1	.567	90.9	.575	91.0	.576	89.4	.538	89.6	.522		
	3037	315	2698	291	2635	285	2294	256	2167	238		
	123.5	375	138.6	374	141.5	373	150.9	346	153.8	333		
66	90.1	.565	90.9	.571	91.0	.570	89.4	.527	89.5	.487		
	3035	313	2694	288	2630	283	2287	250	2150	222		
	123.1	374	137.7	371	140.5	369	148.1	339	144.7	311		
68	90.1	.562	90.8	.565	91.0	.564	89.4	.509				
	3033	312	2690	286	2625	279	2278	242				
	122.6	372	136.6	368	139.2	366	143.8	328				
70	90.1	.559	90.8	.559	91.0	.557	89.4	.477				
	3031	310	2685	282	2619	276	2270	226				
	122.0	370	135.5	364	137.9	361	135.0	307				
72	90.1	.556	90.8	.553	91.0	.550						
	3028	308	2679	279	2613	272						
	121.4	368	134.1	359	136.3	356						
74	90.1	.552	90.8	.545	90.9	.539						
	3026	306	2673	275	2604	267						
	120.7	365	132.5	354	134.2	349						

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = + 2 %	△FUEL = + 5 %

GENERAL

The following in cruise quick check tables allow the flight crew to determine the fuel consumption and the time required to cover a given air distance from any moment in cruise to landing with one engine inoperative.
These tables are established for :
- Cruise speed : MCT/VMO, MCT/320 KT.
- Descent profile : M.78/300KT/250KT
- Approach and landing : 110 kg or 240 lb – 6 minute IMC
- ISA
- CG = 33 %
- Pack flow HI
- Anti ice OFF

Note : 1. *In the tables, the asterisk "*" means that a step climb of 4000 feet has been made to reach the corresponding flight level.*
2. *The flight level shown on the top of each column is the final flight level.*
3. *For each degree celsius above ISA apply a fuel correction of*
0.015 (kg/°C/NM) × ΔISA (°C) × Air Distance (NM)
or 0.033 (lb/°C/NM) × ΔISA (°C) × Air Distance (NM)

CORRECTION FOR DEVIATION FROM REFERENCE WEIGHT

The in cruise quick check tables are based on a reference initial weight.
The fuel consumption must be corrected when the actual weight is different from the reference initial weight.
If it is lower (or greater) than the reference weight, subtract (or add) the value given in the correction part of the table per 1000 kg or 1000 lb below (or above) the reference weight (see example 3.06.50 p 2).

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING - ONE ENGINE FAILURE
CRUISE : MCT/VMO - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 55000 KG PACK FLOW HI ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 100	150	160	180	200	220	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL150	FL160 FL180	FL200 FL220
200	1633 0.37	1346 0.38	1302 0.38	1179 0.39	1100 0.39	1031 0.40	0	0	0
250	2051 0.45	1717 0.46	1664 0.46	1511 0.47	1415 0.47	1330 0.48	0	0	1
300	2470 0.53	2088 0.54	2027 0.54	1843 0.55	1730 0.55	1630 0.56	0	1	2
350	2888 1.00	2459 1.01	2389 1.01	2175 1.03	2044 1.03	1929 1.04	1	1	3
400	3306 1.08	2830 1.09	2751 1.09	2506 1.11	2359 1.11	2228 1.12	1	1	4
450	3724 1.16	3201 1.16	3112 1.16	2837 1.19	2672 1.19	2526 1.20	2	2	5
500	4141 1.23	3571 1.24	3474 1.24	3168 1.27	2986 1.27	2824 1.28	2	3	5
550	4558 1.31	3941 1.32	3835 1.32	3499 1.34	3299 1.35	3122 1.36	2	3	6
600	4975 1.39	4311 1.39	4196 1.39	3829 1.42	3612 1.43	3420 1.44	3	4	7
650	5393 1.46	4681 1.47	4557 1.47	4159 1.50	3925 1.51	3717 1.52	3	4	8
700	5810 1.54	5050 1.55	4917 1.54	4489 1.58	4238 1.59	4014 2.00	4	5	9
750	6226 2.02	5420 2.02	5278 2.02	4819 2.06	4550 2.07	4310 2.08	4	5	10
800	6643 2.09	5789 2.10	5638 2.10	5148 2.14	4862 2.15	4606 2.16	5	6	10
850	7059 2.17	6158 2.17	5998 2.17	5478 2.22	5174 2.23	4902 2.24	5	6	11
900	7476 2.25	6527 2.25	6358 2.25	5807 2.29	5486 2.30	5198 2.32	5	7	12
950	7892 2.32	6896 2.32	6718 2.32	6136 2.37	5797 2.38	5494 2.40	6	8	13
1000	8308 2.40	7265 2.40	7078 2.40	6465 2.45	6109 2.46	5789 2.48	6	8	13
1050	8724 2.48	7633 2.48	7437 2.47	6793 2.53	6420 2.54	6084 2.56	7	9	14
1100	9139 2.55	8002 2.55	7797 2.55	7122 3.01	6731 3.02	6379 3.03	7	9	15
1150	9555 3.03	8370 3.03	8156 3.03	7450 3.09	7042 3.10	6674 3.11	7	9	16
1200	9970 3.11	8737 3.10	8515 3.10	7778 3.16	7352 3.18	6968 3.19	8	10	16
1250	10385 3.18	9105 3.18	8873 3.18	8106 3.24	7662 3.25	7262 3.27	8	10	17
1300	10801 3.26	9473 3.25	9232 3.25	8433 3.32	7973 3.33	7556 3.35	8	11	17
1350	11215 3.33	9840 3.33	9590 3.33	8761 3.40	8282 3.41	7850 3.43	9	11	18
1400	11630 3.41	10208 3.40	9949 3.40	9088 3.47	8592 3.49	8143 3.51	9	12	19

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
ΔFUEL = + 2.5 %	ΔFUEL = + 5 %

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING - ONE ENGINE FAILURE
CRUISE : MCT/320KT - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 110 KG (6MIN)

REF. INITIAL WEIGHT = 55000 KG PACK FLOW HI ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	100	**150**	**160**	**180**	**200**	**220**	**FL100 FL150**	**FL160 FL180**	**FL200 FL220**
200	1542 0.39	1346 0.38	1302 0.38	1179 0.39	1100 0.39	1031 0.40	0	0	0
250	1935 0.47	1717 0.46	1664 0.46	1511 0.47	1415 0.47	1330 0.48	1	0	1
300	2327 0.55	2088 0.54	2027 0.54	1843 0.55	1730 0.55	1630 0.56	2	1	2
350	2719 1.03	2459 1.01	2389 1.01	2175 1.03	2044 1.03	1929 1.04	2	1	3
400	3110 1.12	2830 1.09	2751 1.09	2506 1.11	2359 1.11	2228 1.12	3	1	4
450	3501 1.20	3201 1.16	3112 1.16	2837 1.19	2672 1.19	2526 1.20	4	2	5
500	3891 1.28	3571 1.24	3474 1.24	3168 1.27	2986 1.27	2824 1.28	5	3	5
550	4281 1.36	3941 1.32	3835 1.32	3499 1.34	3299 1.35	3122 1.36	6	3	6
600	4671 1.44	4311 1.39	4196 1.39	3829 1.42	3612 1.43	3420 1.44	7	4	7
650	5060 1.52	4681 1.47	4557 1.47	4159 1.50	3925 1.51	3717 1.52	7	4	8
700	5449 2.00	5051 1.55	4917 1.54	4489 1.58	4238 1.59	4014 2.00	8	5	9
750	5838 2.09	5421 2.02	5278 2.02	4819 2.06	4550 2.07	4310 2.08	9	5	10
800	6226 2.17	5791 2.10	5638 2.10	5148 2.14	4862 2.15	4606 2.16	10	6	10
850	6614 2.25	6161 2.17	5998 2.17	5478 2.22	5174 2.23	4902 2.24	11	6	11
900	7001 2.33	6531 2.25	6358 2.25	5807 2.29	5486 2.30	5198 2.32	12	7	12
950	7388 2.41	6901 2.33	6718 2.32	6136 2.37	5797 2.38	5494 2.40	12	8	13
1000	7774 2.49	7270 2.40	7078 2.40	6465 2.45	6109 2.46	5789 2.48	13	8	13
1050	8160 2.58	7640 2.48	7437 2.47	6793 2.53	6420 2.54	6084 2.56	14	9	14
1100	8546 3.06	8009 2.55	7797 2.55	7122 3.01	6731 3.02	6379 3.03	15	9	15
1150	8931 3.14	8379 3.03	8156 3.03	7450 3.09	7042 3.10	6674 3.11	16	9	16
1200	9316 3.22	8748 3.10	8515 3.10	7778 3.16	7352 3.18	6968 3.19	16	10	16
1250	9701 3.30	9117 3.18	8873 3.18	8106 3.24	7662 3.25	7262 3.27	17	10	17
1300	10086 3.38	9486 3.26	9232 3.25	8433 3.32	7973 3.33	7556 3.35	18	11	17
1350	10471 3.46	9855 3.33	9590 3.33	8761 3.40	8282 3.41	7850 3.43	19	11	18
1400	10855 3.55	10224 3.41	9949 3.40	9088 3.47	8592 3.49	8143 3.51	19	12	19

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
ΔFUEL = + 2.5 %	ΔFUEL = + 5 %

HOLDING

R

RACE TRACK HOLDING PATTERN - GREEN DOT SPEED - 1 ENGINE OUT								
MAX. CONTINUOUS THRUST LIMITS CLEAN CONFIGURATION PACK FLOW HI ANTI-ICING OFF					ISA CG=33.0%		**N1 (%)** **FF (KG/H)**	
WEIGHT (1000KG)	**FL 15**	**FL 50**	**FL100**	**FL120**	**FL140**	**FL160**	**FL180**	**FL200**
48	61.1 1680	63.5 1661	67.9 1622	69.6 1595	71.3 1574	73.2 1562	75.2 1558	77.1 1560
50	62.1 1745	64.6 1728	69.0 1675	70.7 1652	72.6 1632	74.4 1627	76.4 1623	78.3 1629
52	63.0 1812	65.7 1794	70.1 1731	71.9 1708	73.7 1696	75.6 1692	77.6 1694	79.5 1697
54	64.0 1879	66.8 1854	71.2 1788	73.0 1767	74.8 1761	76.8 1757	78.7 1763	80.6 1767
56	65.0 1946	67.9 1913	72.2 1845	74.1 1831	76.0 1826	77.9 1827	79.8 1831	81.6 1841
58	65.9 2014	69.0 1970	73.3 1903	75.1 1897	77.1 1892	78.9 1896	80.9 1901	82.5 1917
60	66.9 2077	70.0 2025	74.3 1967	76.2 1963	78.1 1962	79.9 1966	81.8 1974	83.4 1994
62	67.9 2136	70.9 2080	75.3 2033	77.3 2029	79.1 2031	81.0 2036	82.7 2050	84.4 2076
64	68.9 2194	71.9 2138	76.3 2100	78.3 2096	80.0 2101	81.9 2107	83.5 2127	85.2 2160
66	69.9 2252	72.8 2197	77.3 2166	79.2 2166	81.0 2171	82.7 2182	84.4 2203	86.0 2247
68	70.8 2308	73.7 2256	78.3 2234	80.0 2236	81.9 2242	83.6 2260	85.2 2287	86.8 2335
70	71.6 2363	74.6 2316	79.2 2301	80.9 2307	82.8 2316	84.4 2334	86.0 2373	87.7 2426
72	72.5 2423	75.5 2380	80.0 2373	81.8 2379	83.5 2392	85.2 2412	86.8 2461	88.6 2530
74	73.3 2483	76.3 2449	80.8 2444	82.7 2451	84.3 2468	86.0 2498	87.5 2550	
76	74.1 2544	77.2 2518	81.7 2517	83.5 2527	85.0 2544	86.7 2585	88.3 2641	
ENGINE ANTI ICE ON ΔFF = + 3 %			**TOTAL ANTI ICE ON** ΔFF = 7 %			**PER 1° ABOVE ISA** ΔFF = + 0.3 %		

DESCENT TO LANDING

R

DESCENT - M.78/300KT/250KT - 1 ENGINE OUT

IDLE THRUST PACK FLOW HI ANTI-ICING OFF		ISA CG=33.0%							
WEIGHT (1000KG)	50				70				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
390	14.3	79	86	IDLE					241
370	13.6	77	82	IDLE	16.7	95	101	IDLE	252
350	13.1	75	77	IDLE	16.1	93	96	IDLE	264
330	12.5	74	73	IDLE	15.5	91	91	IDLE	277
310	12.0	72	70	IDLE	14.9	89	87	IDLE	289
290	11.6	70	66	IDLE	14.3	86	82	IDLE	300
270	11.0	68	62	IDLE	13.5	83	76	IDLE	300
250	10.3	65	57	IDLE	12.7	80	71	IDLE	300
240	10.0	64	55	IDLE	12.3	79	68	IDLE	300
220	9.4	61	50	IDLE	11.5	75	62	IDLE	300
200	8.7	57	46	IDLE	10.6	70	56	IDLE	300
180	8.0	52	41	IDLE	9.7	64	50	IDLE	300
160	7.3	47	37	IDLE	8.8	57	45	IDLE	300
140	6.6	41	32	IDLE	7.9	49	39	IDLE	300
120	5.9	35	28	IDLE	7.0	41	33	IDLE	300
100	5.1	29	24	IDLE	6.0	34	28	IDLE	300
50	1.8	9	8	IDLE	2.2	10	9	IDLE	250
15	.0	0	0	IDLE	.0	0	0	IDLE	250

CORRECTIONS	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON	PER 1° ABOVE ISA
TIME	+ 3.5 %	+ 5 %	+ 0.3 %
FUEL	+ 30 %	+ 50 %	+ 0.5 %
DISTANCE	+ 3.5 %	+ 4 %	+ 0.5 %

GENERAL

The ground distance/air distance conversion tables are used to calculate the air distance for a given ground distance due to the influence of the wind.

Tables are given for :

- LONG RANGE SPEED
- FIXED SPEEDS

LONG RANGE SPEED

GROUND DIST. (NM)	AIR DISTANCE (NM)						
	TAIL WIND		WIND COMPONENTS (KT)				HEAD WIND
	+150	+100	+ 50	0	–50	–100	–150
10	7	8	9	**10**	12	14	17
20	14	16	18	**20**	23	28	35
30	21	23	26	**30**	35	42	52
40	28	31	35	**40**	47	56	69
50	35	39	44	**50**	58	70	87
60	42	47	53	**60**	70	84	104
70	49	55	61	**70**	81	97	121
80	56	62	70	**80**	93	111	138
90	63	70	79	**90**	105	125	156
100	70	78	88	**100**	116	139	173
200	141	156	175	**200**	233	278	346
300	211	234	263	**300**	349	418	519
400	281	312	351	**400**	466	557	692
500	352	390	438	**500**	582	696	865
600	422	468	526	**600**	698	835	1038
700	492	546	614	**700**	815	974	1211
800	563	624	701	**800**	931	1113	1385
900	633	702	789	**900**	1047	1253	1558
1000	703	780	877	**1000**	1164	1392	1731
1100	773	858	964	**1100**	1280	1531	1904
1200	844	936	1052	**1200**	1397	1670	2077
1300	914	1014	1140	**1300**	1513	1809	2250
1400	984	1092	1227	**1400**	1629	1948	2423
1500	1055	1171	1315	**1500**	1746	2088	2596
1600	1125	1249	1403	**1600**	1862	2227	2769
1700	1195	1327	1490	**1700**	1978	2366	2942
1800	1266	1405	1578	**1800**	2095	2505	3115
1900	1336	1483	1666	**1900**	2211	2644	3288
2000	1406	1561	1753	**2000**	2328	2783	3461

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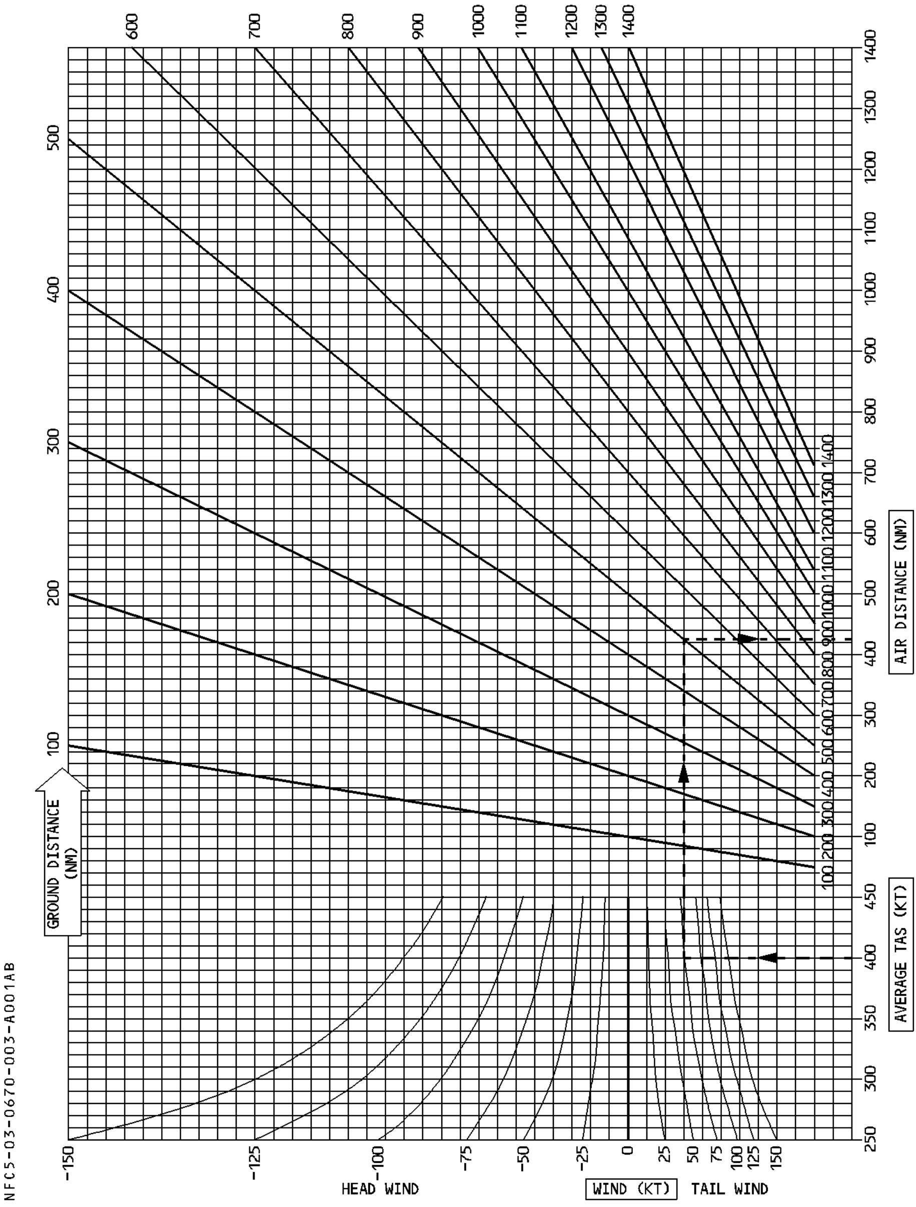
FIXED SPEEDS



Pages

DEFINITION

Operations Engineering Bulletins (OEB) supplement the information and procedures contained in the different sections of the FCOM. OEB's are issued if there is a need for fast transmission of technical and/or procedural information having an operational impact to all flight crews concerned.
They are the result of continuous monitoring of the in-service performance of the aircraft fleet.
If compliance with an OEB has been identified as having a significant impact on aircraft operation, based on all information available at the time of issuance of this OEB, this OEB is printed on orange coloured paper. Associated with this OEB, a temporary revision of the Quick Reference Handbook (QRH) sets forth the correct related procedure.
However, the recommendations contained in all outstanding OEB's should also be reviewed with the highest attention.
Although the OEB's are not approved by the Airworthiness Authorities, the content might be subject to incorporation into the approved Airplane Flight Manual (AFM) or issuance of a Consigne de Navigabilité (CN)/Airworthiness Directive (AD).

DISTRIBUTION

Operating Engineering Bulletins are distributed to all identified holders of a FCOM and to those who need fast information concerning new or revised operational issues. Responsible persons within the operators organization are requested to ensure fast and complete distribution to all flight crews concerned.
R OEB's are filed in numerical order in FCOM chapter 7
This chapter contains a STATUS LIST and a LIST OF APPLICABLE OEB's (PER ATA CHAPTER) which are updated and re-issued with each normal FCOM revision.

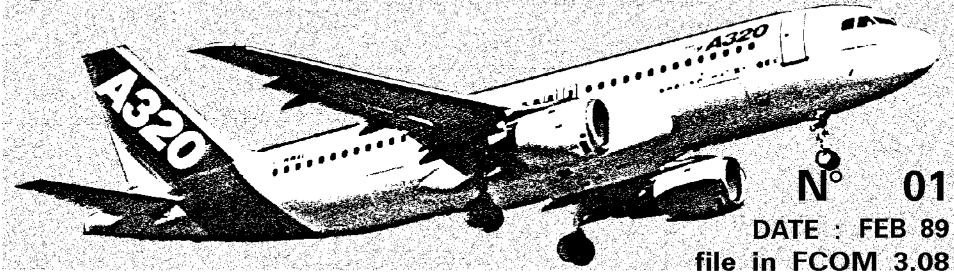
COMPLIANCE

Airbus Industrie recommends that all flight crews review on a regular basis all applicable OEB's and strictly adhere to the contained information, procedures and warnings.

N°	TITLE
"To be filled by the operator, if needed"	

N°	TITLE
"To be filled by the operator, if needed"	

A319/A320/A321 - FCOM BULLETIN



N° 01

DATE : FEB 89

file in FCOM 3.08

INTRODUCTION

It appears that there is a need for additional information concerning technical / operational matters closely related to the three volumes of the FCOM.
This information will be different in content from that of the OPERATIONS ENGINEERING BULLETINS.
OEB's are issued as the need arises to quickly transmit technical and procedural information when a specific problem arises which has an operational impact. They are normally the consequence of a detected defect / abnormal behaviour of the airplane or of one of its systems.

The new bulletin will be issued periodically and will be called « FCOM BULLETIN ». It will deal with one or several subjects and will include additional information with regard to procedures, system descriptions, performance, regulations... and will contain explanations which are very often difficult to incorporate in the FCOM itself.

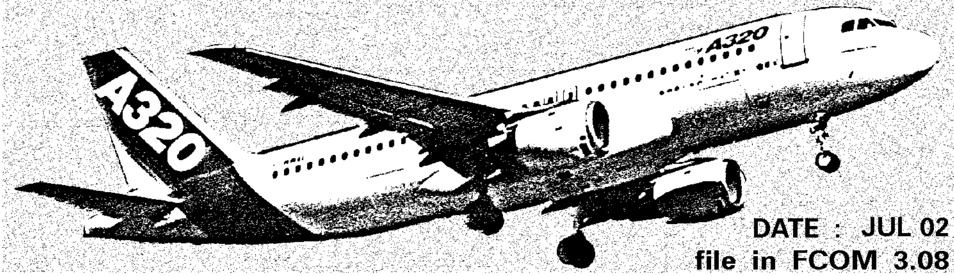
It may sometimes happen that the boundary between OEB's and the FCOM BULLETINS is not apparent, but remember that our main target is to inform airline crews about their aircraft.

It is sincerely hoped that this additional means of communication will benefit all of us and will help to keep a closer contact between AIRBUS INDUSTRIE operations Engineering and its customers.

Obviously all of your suggestions will be welcomed.

We suggest that the FCOM BULLETINS are filed in FCOM Volume 3 Section 8. These bulletins will not be updaded.

A318/A319/A320/A321 - FCOM BULLETIN



DATE : JUL 02
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LIST OF EFFECTIVE FCOM BULLETINS

BULLETIN N°	SUBJECT
01/1	INTRODUCTION
02/2	CARBON BRAKES WEAR
05/2	OPERATION IN WINDSHEAR/DOWNBURST CONDITIONS
07/2	IAE V2500 N1 MODE
15/2	CABIN FANS
22/3	AVOIDING TAILSTRIKES
23/2	ENGINE STARTING WITH APU IN CROSSWIND CONDITIONS
26/2	FQI ACCURACY
30/1	ELECTRONIC INTERFERENCE FROM PORTABLE EQUIPMENT CARRIED ON BY PASSENGERS
33/2	THRUST ACCELERATION IN A/THR MODES
34/1	AVOID DISORDER IN THE COCKPIT
36/2	RADIO ALTIMETER ANOMALIES DURING ADVERSE WEATHER CONDITIONS
37/1	FMGS NAVIGATION DATABASE
39/2	SPECIFIC FEATURES OF THE FMGS FULL STANDARD
40/1	STOWAGE OF THIRD OCCUPANT SEAT
41/2	VMO / MMO DETERMINATION
43/2	OPERATION OF FLEETS WITH/WITHOUT CPIP
44/2	A320 IAE AUTOLAND LONG FLARE
46/2	CHARACTERISTIC AND PROTECTION SPEEDS

	BULLETIN N°	SUBJECT
	47/2	GROUND SPEED MINI FUNCTION
	48/2	MMEL AND MEL USE
	49/2	ILS1/ILS2 GLIDESLOPE DISCREPANCY ON SPECIFIC TYPE OF ILS
	50/2	PUBLICATION OF SOME ATTENDANT INFORMATION BULLETINS
	51/2	ERRONEOUS AIRSPEED/ALTITUDE INDICATIONS
	52/1	EGPWS DATABASE
	53/2	USE OF FINAL APP MODE AND NAV DATABASE VALIDATION
R	54/2	AIRCRAFT HANDLING IN FINAL APPROACH
R	55/1	USE OF RUDDER ON TRANSPORT CATEGORY AIRPLANES

A318/A319/A320/A321 - FCOM BULLETIN

N° 02/2

DATE : APR 99

file in FCOM 3.08

SUBJECT : CARBON BRAKES WEAR

- Steel-brakes are such that wear is directly proportional to the energy applied. In other words, the strongest the brake demand, the greatest the wear.

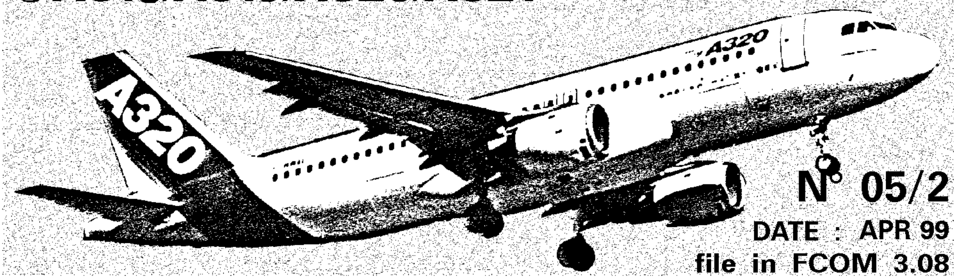
  This no longer applies with Carbon-brakes where more complex phenomenons (such as temperature) interface.

  One of them must be underlined due to its great contribution to brakes-wear :

  – Numerous tests have shown that around 50 % of the carbon-brakes wear appears when taxiing before take off with coldbrakes. What must be kept in mind is that cold carbon-brakes are very touchy to numerous solicitations. Wear is proportional to the number of brake applications and not to the energy applied.

- That is why, and despite the obvious lack of procedure as far as braking is concerned, it is worth recalling that when taxiing before takeoff, brake should not be solicited too often. Needless to add that nosewheel steering must be done with the appropriate cockpit command and not through brake pedals.

A318/A319/A320/A321 - FCOM BULLETIN



N° 05/2
DATE : APR 99
file in FCOM 3.08

SUBJECT : OPERATION IN WINDSHEAR / DOWNBURST CONDITIONS

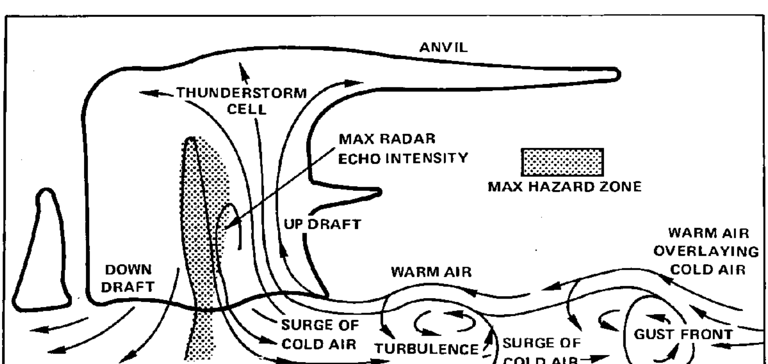
GENERALITY

Windshear-related problems are generally connected to « a change in wind direction and/or speed over a very short distance in the atmosphere ». The most prominent meteorological conditions conducive to this are :

- convective storm shear (air mass and frontal thunderstorms, downburst, wet and dry microburst),
- non-convective (cold and warm) frontal systems,
- windshear associated with strong winds near the ground.

WINDSHEAR ASSOCIATED WITH CONVECTIVE CLOUDS AND STORM CELLS

- The air-mass thunderstorm develops from localized earth surface heating with air rising and cooling to form cumulus clouds. As these keep growing, heavy rain and hail precipitation begins to develop in the higher areas thereby cutting off the updraft energy source and eventually dissipating the thunderstorm cell. A surge of cold air emerging from the heavy rain and associated downdraft can produce :
  - a downburst, i.e. strong downdrafts inducing an outburst of damaging winds on or near the ground,
  - a gust front with blowing dust on the earth surface,
  - a shear boundary with turbulent flow due to interaction with the warm, undisturbed environmental air,



Air-Mass Thunderstorm

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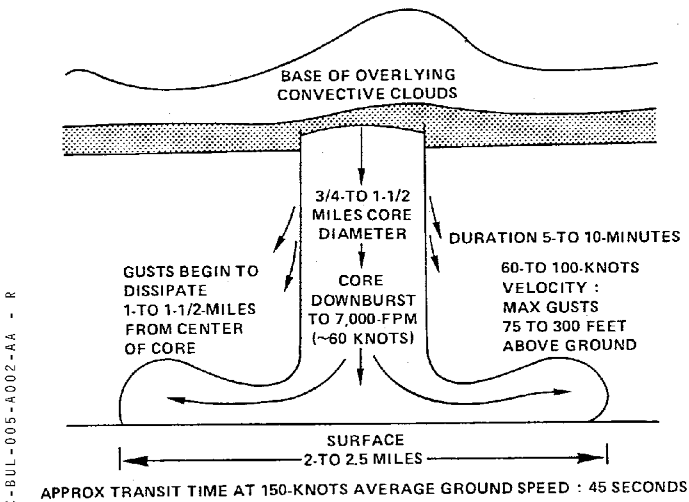
– Frontal thunderstorms are usually more tilted in the vertical, allowing precipitation to fall away from the updraft and airflow intensity within the storm accelerating much more than for the simple air-mass thunderstorm, sometimes resulting in a tornado.

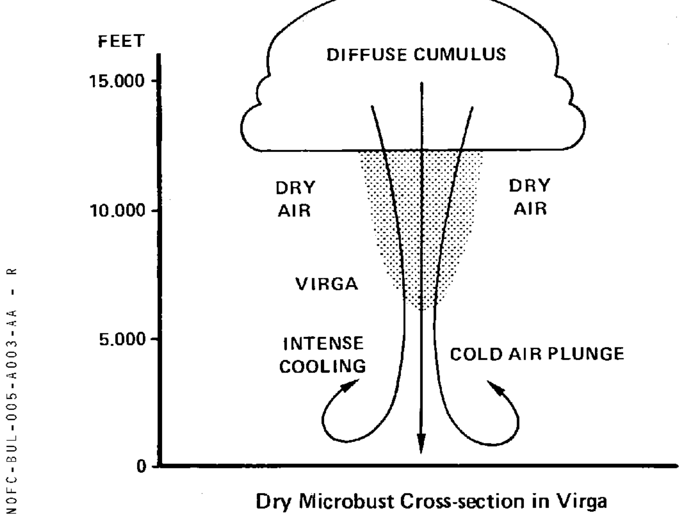
– Microbursts consist of intense, non rotating, highly localized downward airflows with velocities up to 7 000 fpm that may emanate below a convective cloud base. Some of these microbursts will expose penetrating aircraft to major safety hazards whatever technique is used in anticipation / reaction.



Wet Microburst Cross-section

Microbursts can take 2-5 minutes to develop maximum intensity and may then be sustained for an equal period of time. They tend to develop in groups which may be merged, delaying dissipation to 30 minutes. Present knowledge contends that approximately one in a hundred heavy rain thunderstorms produce microbursts. It was determined that microbursts can also occur in relatively dry conditions. Once it gains sufficient downward momentum, a downflow with evaporative cooling accelerates to the earth's surface to induce a «dry microburst» with very light or non-existant precipitation, called virga. «Wet microbursts» are expected to occur in the wet regions of the world. Dry microbursts are commonly seen in the dry areas and most likely below cumulus cloud when dew point is 30 ° C or more below ambient temperature.
Changes in meteorological conditions associated with both macro and microbursts tend to be very complicated.

CONDITIONS	MACROBURSTS	MICROBURSTS
Air temperature	: ISA + 15 ° decreasing	ISA + 15 ° increasing or decreasing
Dew point spread	: increase (20-40 ° C)	increase (20-40 ° C)
Surface pressure	: rise or fall (up to 2/3 mb)	rise or fall (up to 2/3 mb)



Dry Microbust Cross-section in Virga

WINDSHEAR ASSOCIATED WITH NON-CONVECTIVE FRONTAL SYSTEMS

Substantial differences in winds can be encountered by approaching and departing aircraft close to low pressure centers and their associated cold, warm and occluded fronts.

Penetrating a cold front on either side leads to a headwind increase, potentially bringing a performance increasing shear. Pilots are advised to beware of thunderstorms in the vicinity that may contribute to amplify windshear conditions.

Penetrating a warm front on either side exposes to a headwind decrease, potentially resulting in a performance decreasing shear generally not exceeding performance limits of the aircraft.

Windshear at a warm front is more severe than at a cold front with large head/tail and vertical wind changes in the lowest 1 000 feet above ground level.

The magnitude of the windshear may become significant when :

- the temperature difference across the front is at least 6 ◦ C.
- the temperature gradient of the front shows a minimum of 6 ◦ C over 50 Nm,
- the speed of frontal movement is greater than 30 kts.

WINDSHEAR ASSOCIATED WITH STRONG WINDS NEAR THE GROUND

Very similar to a surface boundary layer with increasing winds and approximately constant wind direction.

Low altitude jet streams may be found in a variety of situations such as strong low altitude jet winds, nocturnal jet winds, terrain-induced low altitude windshear, mountain-wave and downslope flows, strong surface winds combined with small hills or large buildings, lake and seabreeze windshear due to temperature gradients between sun-heated terrain and water-cooled air. In particular, strong temperature change across an inversion may trigger very variable wind conditions.

OPTIONAL SYSTEMS INTEGRATED ON THE AIRCRAFT

PREDICTIVE WINDSHEAR

Predictive Windshear is incorporated into the weather radar system to enable the detection of a microburst windshear event within 5NM forward of the aircraft. It is based on dynamic Doppler effects.

When a windshear is detected, the system generates the appropriate annunciation to the crew to alert them of a potential danger. There are different alert levels depending on :

– the severity of the windshear event detected,
– the distance and angular position between the aircraft and the windshear,
– the altitude and speed of the aircraft,
– the flight phase.

The Predictive Windshear system provides advanced warning for the crew to escape a windshear event using normal handling technique or to initiate a recovery maneuver earlier.

REACTIVE WINDSHEAR

Reactive Windshear advises the crew when windshear conditions have been entered. The system generates an audio and visual warning to the crew. The FAC measures the difference between the impredicate energy state and the minimum energy state for flight security. At a defined threshold, a message is displayed on the PFD and an aural warning alert is provided to the crew :

– at takeoff, from 5 seconds after lift off up to 1300 feet RA.
– at landing, from 1300 feet RA down to 50 feet RA,

BRIEFING AND PREPARATION

a) ANALYSE weather information during preflight :

- weather messages provided by the airline,
- aviation surface observations,
- NOTAMS,
- SIGMETS, particularly convective sigmets,
- terminal forecasts,
- area forecasts, possibly mentioning the Low Level Wind Shear Alert System (LLWSAS) installed on the periphery of certain airports (USA only).

b) LISTEN to pilot reports (PIREPS) on wind shear. PIREPS should include :

- location of shear encountered,
- altitude of shear encountered,
- airspeed change experienced (knots gained or lost)
- type of aircraft undergoing the shear,

Note : Pilots should always report any windshear encountered to Air Traffic Control.

c) LOOK OUT for weather clues on the way to the airport and/or from the cockpit (parked, taxi or airborne) such as :

- extreme variations in wind velocity/direction in a very short time span,
- isolated rainshowers with or without lightning showing divergences from the raincore and clear curling horizontal vortex rolls, within 5 miles of the airport,
- heavy precipitation along intended flight path,
- lightning, thunderstorms or evidence of any tornadic feature in airport vicinity,
- evidence of a gust front such as blowing dust on the airport surface, suggesting the possible passage of a thunderstorm within 15 minutes,
- evidence of convective activity particularly with anvil clouds in dry areas, supercells, low echos, mushroom, sinkhole and/or giant ant-eater clouds, cumulo nimbus mamatus and altocumulus.

Note : The existence of other types of shear can occur due to local obstruction, topographical and meteorological conditions. It is important for crews to realize that windshear conditions should be considered cumulative : simultaneous conditions can increase the severity of effects.

d) **EXAMINE** the approach or take-off area with the airplane weather radar to determine whether returns are in the vicinity of the airport or intended flight path,

- flight operations below 10,000 ft such as take-off and landings require 2 to 3 degrees upward tilt for target detections up to 40Nm ; if there is significant weather activity, the tilt angle should be adjusted to provide a solid ground return outside of the desired range to ensure that no overscanning will occur.

Note : since radar echoes are due to precipitation reflection, dry environment situations and conditions to dry microbursts may not be detectable by weather radar ;

e) **MONITOR** the aircraft instruments whenever windshear is suspected :

- any rapid change in the relationship between airspeed and groundspeed represents a windshear ; groundspeed must be compared with airspeed, on the ND's. (GS/TAS)
- airspeed tendency (Vc trend) :
  - acceleration in headwind/updraft,
  - deceleration in tailwind/downdraft,
- direction and intensity of wind (computed by the IRS and displayed on ND's) allows a comparison at the initial approach altitude (1 500 to 2 000 ft AGL), with the reported runway surface wind to check any shear situation between the airplane and the runway,
- speed margin from α-prot speed (shown by a red and amber strip along the speed scale of the PFD's),
- rate of descent (on stabilized ILS approach) :
  - high rate suggesting a strong tailwind,
  - low rate suggesting a strong headwind,
- rate of climb :
  - high rate suggesting a strong headwind,
  - low rate suggesting a strong tailwind.

- pitch attitude :
  increasing - with headwind shear,
  - with downdraft shear,

  decreasing - with tailwind shear,
  - with updraft shear,

- power needed :
  to hold the glideslope :

  - less power necessary suggesting a strong tail wind,
  - more power necessary suggesting a strong headwind

  to hold a climb angle :

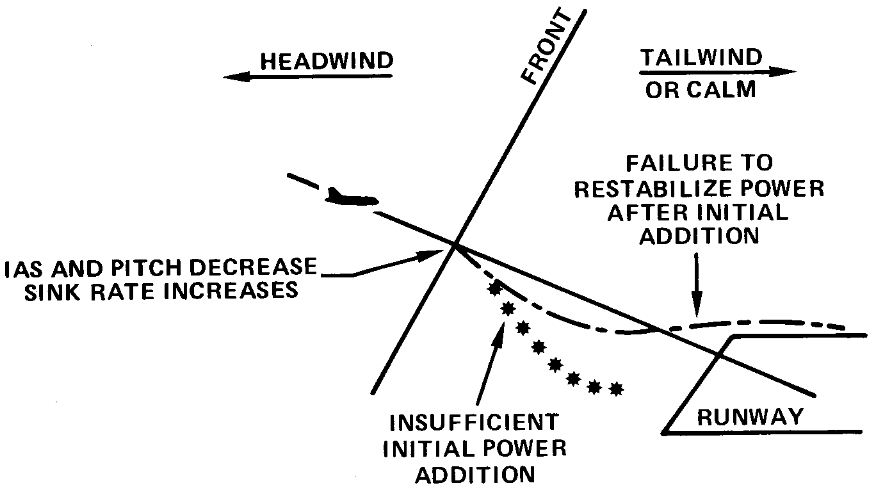
  - less power necessary suggesting a strong headwind,
  - more power necessary suggesting a strong tailwind,

INFLUENCE OF WINDSHEAR ON AIRCRAFT PERFORMANCE

DECREASED PERFORMANCE

Headwind to tailwind
Headwind to calm
Calm to tailwind
Headwind to decreased headwind.

APPROACH WITH A TAILWIND SHEAR



NOFC-BUL-005-A007-AA - R

- airspeed decreases, lift decreases,
- A / C nose begins to pitch down,
- A / C begins to drop below the glide slope,

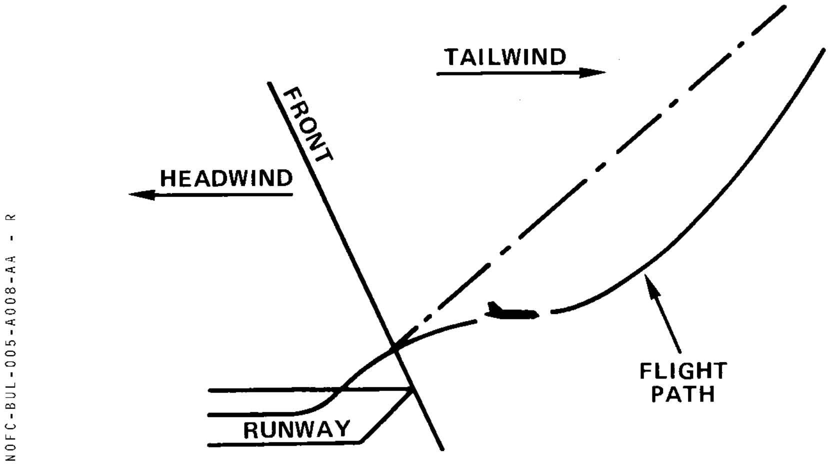
In this case the A/C is both slow and low in a « power deficient » state.

Consequences :

. If the pilot pulls the nose up to recapture the glide slope without selecting sufficient power : the A / C will loose altitude very rapidly and may even reach the ground before the power deficiency is corrected, resulting in a hard landing.

. or if sufficient power is set to regain the glideslope before reaching the ground : the « double negative » problem may arise if the pilot does not quickly retard the throttles after glide recapture, i.e. throttles set too high for a stabilized approach in a no-wind condition leading to a long and fast landing.

TAKE OFF WITH A TAILWIND SHEAR



. airspeed decreases, lift decreases,
. A / C nose begins to pitch down,
. A / C drops below its nominal flight path,

Consequences :

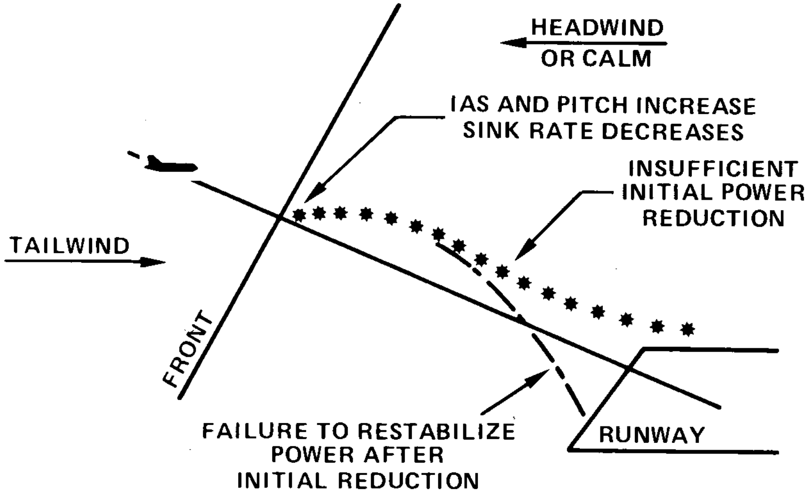
. Because of aircraft inertia, attitude and ground speed will be initially maintained upon encountering windshear but airspeed will decrease, causing a reduction in lift which will result in a downward acceleration and a nose down pitching moment.

. If there is no pilot action, the aircraft will descend below its nominal flight path. Because of aircraft stability, original angle of attack and airspeed will eventually be recovered, but on a reduced flight path.

INCREASED PERFORMANCE

Tailwind to headwind
Calm to headwind
Tailwind to calm
Headwind to increased headwind

APPROACH WITH A HEADWIND SHEAR



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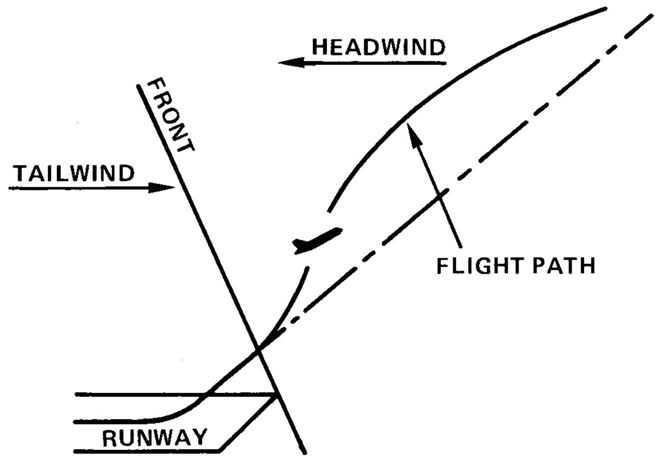
The reverse of the previous case prevails :
. airspeed increases, lift increases,
. A / C nose begins to pitch up,
. A / C balloons above the glide slope,
In this case the A / C is both fast and high in a « power excessive » state.

Consequences :

. the pilot does not initially reduce power, the aircraft will gain altitude and airspeed resulting in a long, fast landing with the possibility of an overrun.

. or if the pilot reduces thrust to regain the glideslope and initial airspeed : the « double negative » problem can arise if the thrust is not recovered which leads to a high sink rate and possible short, hard landing.

TAKE OFF WITH A HEADWIND SHEAR



NOFC-BUL-005-A010-AA - R

The reverse of the previous case prevails :
. airspeed increases, lift increases,
. A / C nose begins to pitch up,
. A / C rises above its nominal flight path

Note

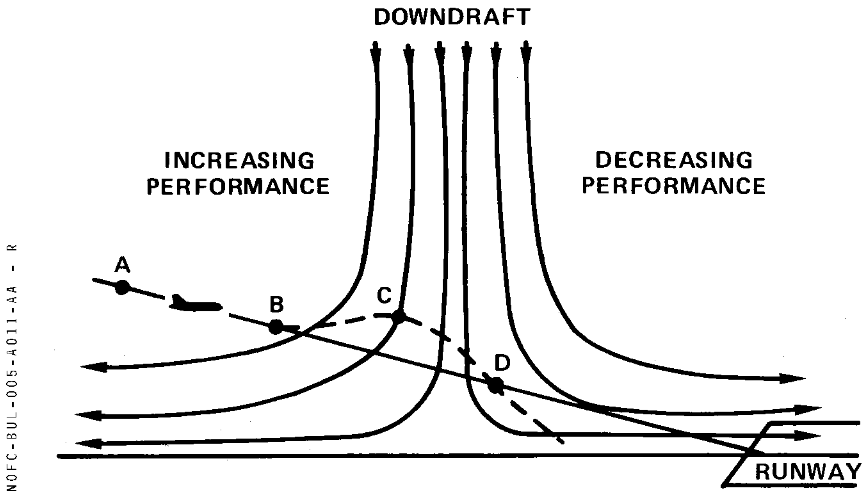
. A headwind shear usually leads to increased aircraft performance.

. The resulting increase in lift may however lead to an excessive angle of attack which could eventually trigger the α-prot function once out of the shear.

INCREASED PERFORMANCE FOLLOWED BY DECREASED PERFORMANCE

Downdraft + tailwind shear

APPROACH THROUGH MICROBURST



. at point A the aircraft is on speed and on glide slope.

. at point B it encounters an increasing headwind. Its airspeed and pitch increase and it balloons above the glide slope.

. at point C the « moment of truth » occurs :

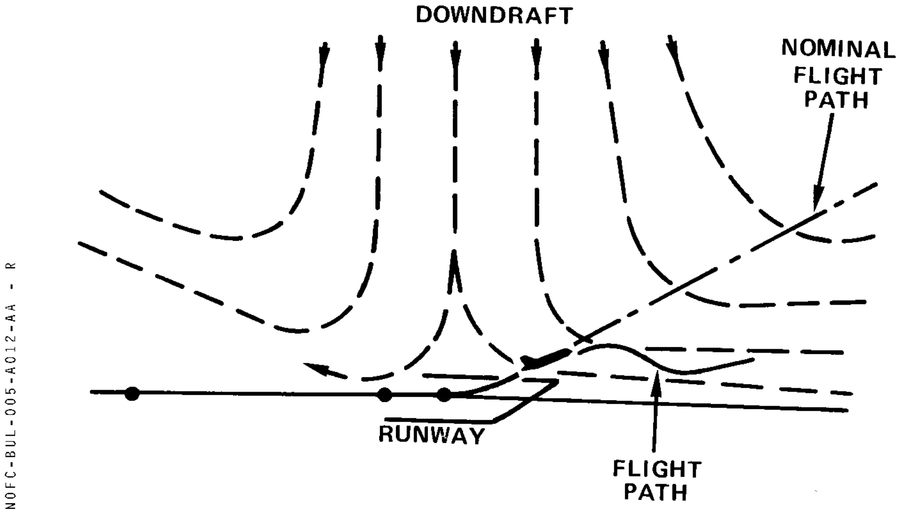
If the pilot does not fully appreciate the situation, he may attempt to regain the glide slope by reducing power and pushing the nose down.
But between C and D the headwind ceases, a strong downdraft is entered and the tailwind begins to increase. The skin rate occurs rapidily and ground impact may become difficult to avoid.

Consequences :

. a go-around initiated at point C or sooner would probably be successful since the A/C is fast and high at this point,

. gradual groundspeed decay shortly after point B coupled with rapidly increasing airspeed could have allowed detection of signs of impending downdraft.

TAKE OFF THROUGH MICROBURST



. airspeed decreases
. A / C nose begins to pitch down
. A / C drops below its nominal flight path.

Consequences :

. Initially the pilot may not fully appreciate the situation since he is taking off in increased performance shear conditions. Progression into the downburst core causes a violent and rapid loss of lift, followed by a high sink rate with very little loss of airspeed. Exiting the downburst core below the nominal flight path (after 20 to 40 seconds) is then followed by a low-level decreased performance tailwind shear.

. In this microburst example, the angle of attack is instantly decreased causing an immediate loss of lift.

5. CLIMB GRADIENT and ACCELERATION CAPABILITY

– This section presents an example of A / C ability to maintain an horizontal flight at a given airspeed, in case of tailwind shear or downdraft conditions by adjusting the thrust.

– In practice, windshear conditions will very often be a combination of horizontal and vertical shear components. This will make it necessary to establish a tradeoff between climb gradient and acceleration requirements.

a) Acceleration capability

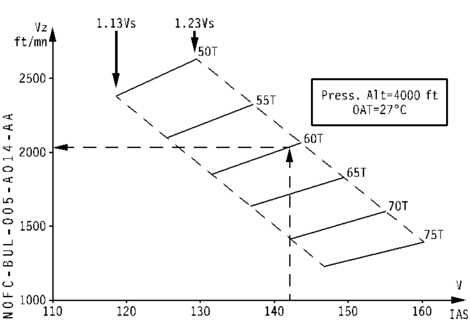
In case of tailwind shear, the aircraft oppose a level flight acceleration capability. For example, an A320 powered with CFM56-5A1 engines (a / c weight = 60 000 kg (132 300 lb), FLAPS 3, pressure altitude = 0 ft, OAT at ISA) is able to maintain an horizontal flight in a 4 kt / s decreased performance shear, keeping a constant airspeed and increasing ground speed of 4 kt/s.
If the horizontal shear exceeds the flight level acceleration, the airspeed will decrease and will descend unless pitch attitude is increased.

b) Climb gradient maintainability

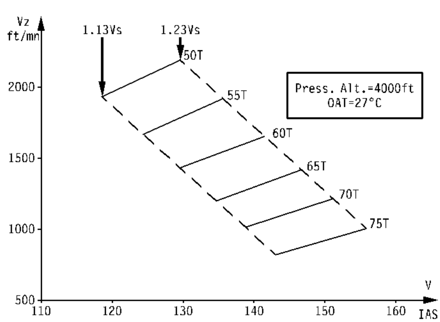
In downburst conditions, level flight will be maintained with the climb gradient maintainability. In the following example (CFM 56-5A1, a/c weight = 60 000 kg (132 300 lb) pressure altitude 4 000 ft, OAT = 27° C, V = 142 kts), the aircraft has the capability to maintain level flight in a 2 040 ft / mn downdraft without any airspeed change. If the downdraft exceeds this climb gradient capability, the A / C will descend unless pitch attitude is increased to adapt angle of attack.

For information, a typical example :

CFM 56-5A1



IAE V2500-A1



A318/A319/A320/A321 - FCOM BULLETIN

N° 07/2

DATE : APR 99

file in FCOM 3.08

SUBJECT : IAE V2500 N1 MODE

Note : this Bulletin is only valid for aircraft powered by IAE V2500 engine.

The FADEC NORMAL mode is EPR mode which requires various inputs including :
Thrust Lever Angle (TLA) altitude, mach number, ambient temperature, engine inlet total air temperature (T2) and the service bleed. If any of these inputs are not available, the FADEC automatically reverts to a reversionary which may be :

- N1 RATED mode
- N1 UNRATED mode (named DEGRADED mode on ECAM).

NI RATED MODE

DESCRIPTION

The N1 RATED MODE is a FADEC reversionary mode which occurs :

- either AUTOMATICALLY if P2 (engine inlet total pressure) and/or P5 (LP turbine exit total pressure) engine parameters are not available,
- or MANUALLY if the pilot presses the N1 MODE pushbutton.

The FADEC, in this mode, processes the N1 power management as a function of TLA, T2 and altitude, for the following ratings :

- MAX TO or GO AROUND
- MAX CONTINUOUS
- MAX CLIMB.

Additionally the FADEC provides the following data to the crew via ECAM E/W display :
- N1 rating limit corresponding to the selected Thrust Limit mode (CLB, MCT, TO)
- selected THRUST LIMIT mode as a function of TLA
- N1 TLA corresponding to the thrust lever position
- Actual N1

OPERATIONAL CONSEQUENCES

① Reversion from EPR → N1 RATED mode on the GROUND :
- This is a GO ITEM (please refer to MMEL 01-73-20)
- Autothrust control is lost and thus alpha-floor protection is not available
- Performance penalties must be applied (please refer to MMEL 02-73-20) :
  - for takeoff max weights and associated speeds
  - for single engine cruise, drift down net ceiling.
- Flexible takeoff is not permitted.

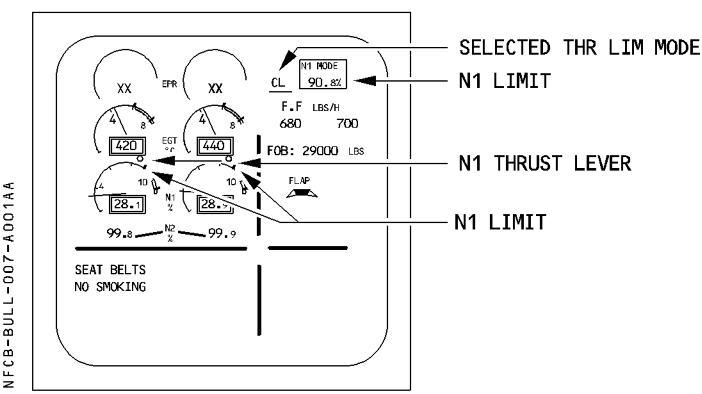
② Reversion from EPR → N1 RATED mode during T/O Phase
The thrust remains EQUIVALENT to the thrust initially obtained with EPR mode, up to 2500 ft above runway level.

③ Reversion from EPR → N1 RATED mode in FLIGHT :
A cockpit caution and audio message are triggered with the associated ECAM procedure "EPR MODE FAULT".

In addition, the ATHR will disengage and the alpha floor will be lost. If the thrust levers were in the CLB detent (MCT for single engine operation), the THRUST LOCK function will be activated. It will be deactivated as soon as a thrust lever is moved from the CLB (MCT) detent.

Note : No particular precautions are required when pressing the N1 MODE pushbutton.

The ECAM E / W display correct data on the N1 indicator, when N1 RATED MODE is active for both engine .



N1 UNRATED MODE

DESCRIPTION

The N1 UNRATED MODE reversion occurs in the event of the loss of the engine inlet total air temperature (T2) or the ambient temperature (ambient pressure engine sensor).

The N1 is defined as a function of TLA only and is limited by the FADEC to either the lower of maximum N1 or N1 redline (if T2 is available) or N1 redline (if T2 is not available).

The only data provided to the crew by the FADEC is :

N1 ACTUAL

There is a difference between N1 provided in EPR MODE or N1 in RATED MODE and UNRATED MODE, for a given TLA. As a consequence, switching from EPR to EPR to N1 UNRATED may result in a N1 change

- In case the reversion occurs when ATHR is engaged and thrust levers are out of a detent or subsquently moved out of a detent
- or when pressing the N1 MODE pushbutton.

OPERATIONAL CONSEQUENCES

1. If reversion to N1 UNRATED MODE occurs on the GROUND :
   This is a NO GO ITEM.
2. If reversion occurs in FLIGHT :

   A cockpit caution and audio message are triggered with an ECAM procedure. Please refer to FCOM 3.02.70, "EPR MODE FAULT" to have the detail of the corresponding ECAM procedure.

Additionally the ATHR will disengage and alpha-floor protection will be lost :

- If thrust levers were in CLB detent (or MCT notch with one engine inop), the THRUST LOCK function will be activated. Moving thrust levers or depressing the N1 MODE pushbutton will cause the THRUST LOCK system to be deactivated and N1 will follow TLA position.
- If thrust levers were not in CLB / MCT notches, the N1 change would occur immediately.

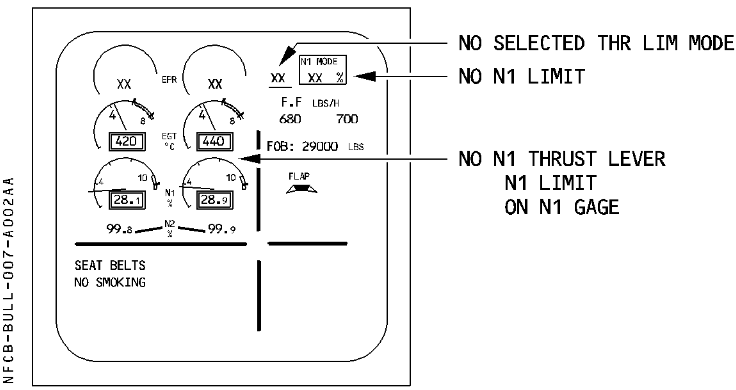
In the case both FADECs revert to N1 UNRATED MODE, in order to ensure a proper power management and satisfy N1 LIMIT values, N1 tables are provided in FCOM VOL 3 – 3.05.05 "Thrust ratings", N1 MCT, N1 MAX CLB, N1 MAX CRZ, N1 GO AROUND.
Furthermore SINGLE ENG DRIFT ON NET CEILING penalties will be also published there.

③ It would be more likely to have a MIXED CASE where a failure is experienced on one engine, while the other is working normal. If this occurs, the CAUTION / AUDIO / ECAM messages will be identical except for one additional message (NOT EXCEED N1 LIMIT) : indeed both N1 MODE pushbutton will have to be pressed so as to help the crew to properly adjust the ACTUAL N1 on the engine where the FADEC is in N1 UNRATED MODE, by using the data provided by the other FADEC (N1 ACTUAL, N1 LIMIT). As a consequence, the crew will have to adjust the thrust lever, on the failed side, to a position (which depends on flight conditions) so as to align its N1 ACTUAL to the other N1 ACTUAL provided on ECAM. In this case there will be a thrust lever misalignment.

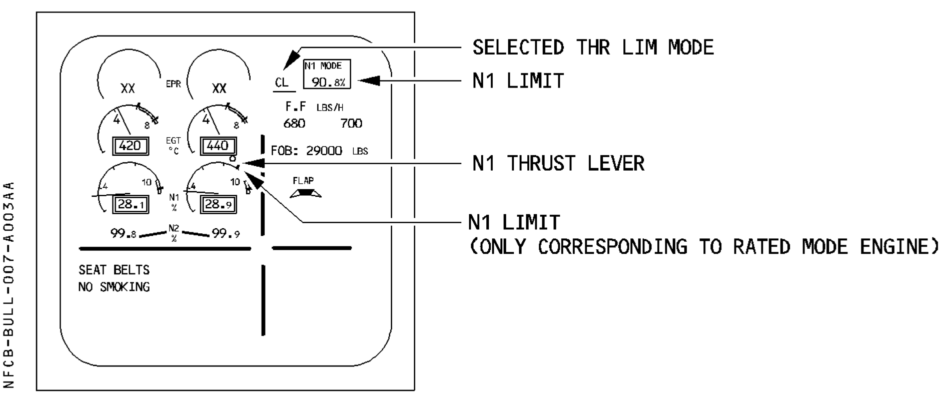
Single engine cruise drift down net ceiling penalties should also be used, in case that a subsequent engine failure occurs.

④ The ECAM E / W display indicates the following data on the N1 guage, depending upon 2 FADECs in N1 UNRATED mode, or 1 FADEC in N1 RATED and the other in N1 DERATED mode

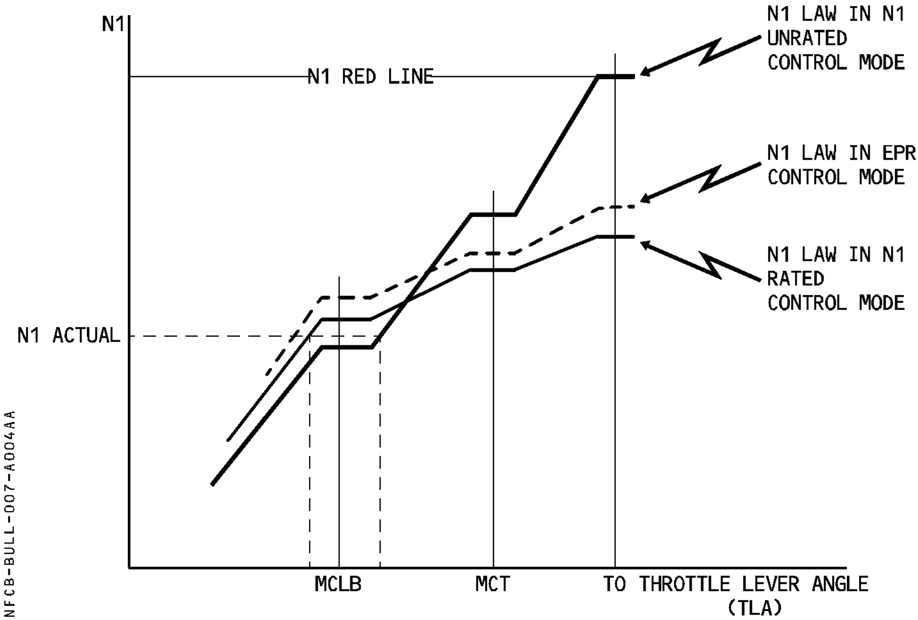
2 FADEC N1 DEGRADED MODE



MIXED CASE : Eng 1 Degraded, Eng 2 Rated mode



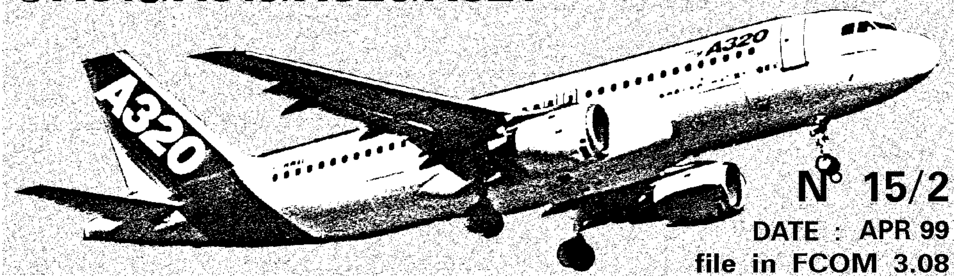
N1 COMMAND VERSUS THRUST LEVER POSITON RELATIONSHIP



This figure indicates that, in the MIXED case, the thrust lever position on both engines will be quite different in order to achieve the same N1 actual :

For example in order to achieve an N1 actual lower than MAX CLB.

- the thrust lever position on the side where FADEC is in UNRATED mode may be FORWARD of MAX CLB notch, while
- the thrust lever position on the side where FADEC is in RATED mode is systematically AFT of MAX CLB notch.



A318/A319/A320/A321 - FCOM BULLETIN

N° 15/2
DATE : APR 99
file in FCOM 3.08

SUBJECT : CABIN FANS

CABIN FANS

Several airlines have requested a procedure to reduce cockpit noise during transit i.e to switch off cabin fans.

SYSTEM

Cabin fans are used to recirculate cabin air into the mixing unit. This is to increase the volume of air which can be moved

- into the cabin.
- into the avionic ventilation system when the AIR COND inlet valve is open.

PROCEDURE

To reduce cockpit noise during transit, cabin fans can be switched to OFF provided avionic ventilation system is in normal configuration (BLOWER and EXTRACT pb not set at OVRD). Cabin fans should be selected ON when passengers are on board.

A318/A319/A320/A321 - FCOM BULLETIN

N° 22/3
DATE : MAY 01
file in FCOM 3.08

SUBJECT : AVOIDING TAIL STRIKES

Inadvertent tail strikes may occasionally occur, and may result in expensive structural damage.

Several tail strikes have been reported throughout service life.

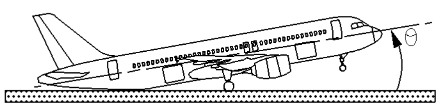
They are very often associated with such adverse conditions as crosswind, turbulence, windshear, etc.

A/C GEOMETRY LIMITS

Two limits need to be considered :

- The geometry limit corresponding to the main gear oleo fully extended (Θ_1)
- The geometry limit corresponding to the main gear oleo fully compressed (Θ_2).

NFCB-BULL-022-A001AA



	Pitch attitude Θ		
Main Gear Oleo Position	A319	A320	A321
Fully extended	15.5°	13.5°	11.2°
Fully compressed	13.9°	11.7°	9.7°

Note : On the A321, the installation of a TFTS antenna decreases these values.

CLEARANCE AT TOUCHDOWN

The following table provides the ground clearance in degrees for the A319, the A320, and the A321 at landing (all numbers are mean values).

Aircraft	Geometry limit at Touchdown	Pitch attitude at Vapp (VREF + 5) (1)	Pitch attitude at Touchdown (Vapp – 8) (2)	Clearance (3)
A319	15.5°	3.4°	7.7°	7.8°
A320	13.5°	3.3°	7.6°	5.9°
A321	11.2°	2.4°	6.6°	4.6°

Notes : (1) Flight path in approach = –3°

(2) Mean value of pitch attitude at touch down assuming a deceleration of 8 kt during flare (VAPP – 8), and a flight path of – 1° at touch down (approximately 3 ft/second).

(3) Clearance = Geometry limit - Pitch attitude at touchdown.

When the approach speed is decreased by 5 knots, clearance decreases by approximately 1.3° (attitude at touchdown increases by 1.3°).

TAIL STRIKE FACTOR AT TAKEOFF

Early rotation, over-rotation, excessive pitch rate, or a combination of these three factors are the main causes of tail strikes at takeoff.

EARLY ROTATION

Early rotation occurs when :

– A too low VR is computed;
– The rotation is initiated prior to VR.

- Erroneous VR computation may occur when the takeoff speeds are not cross-checked, or when incorrect loadsheet data is used. At hot-and-high elevation airfields, the error can be critical.
- Rotation initiated prior to VR due to :
  - Flaps improperly set for the calculated VR.
  - Bird or obstacle avoidance leading to early rotation.
  - Early rotation due to windshear, encountered during the takeoff roll. In such an event, the FAA recommends rotation 2000 feet before the end of the runway.

OVER-ROTATION OR EXCESSIVE PITCH RATE

These two causes are generally associated with a second factor in tail strike incidents (one engine-out, aircraft out of trim, additive inputs from both pilots, early rotation, etc.).

Certification requires demonstration of a safe takeoff at V_R-10 knots (2 engines) and V_R-5 knots (1 engine).
The pitch and the pitch rate, obtained during these tests, are for information purposes only, and are not certified limits.

Aircraft	Weight (kg)	CG	Config.	Rotation speed	θ° Per Sec	θ° at lift-off
A319 CFM	62 550	21.4 %	Conf 2	V_R-10 knots 2 engines	5.8°/s	12.5°
	63 440	21.3 %	Conf 2	V_R–5 knots 1 engine-out	5.9°/s	12.8°
A320	67 200	17.8%	Conf 2	V_R-10 knots 2 engines	5.8°/s	9.5°
	65 300	16.5%	Conf 2	V_R-5 knots 1 engine-out	5.4°/s	9.0°
A321 IAE	75 950	14.9 %	Conf 2	V_R–10 knots 2 engines	6.3°/s	8.5°
	73 720	15 %	Conf 2	V_R–5 knots 1 engine-out	5.4°/s	9.0°

Note : V_R represents the speed at aircraft rotation in order to obtain V_2 at 35 feet, in the event of an engine failure.

Normal rotation of 3°/second prevents a tail strike, unless the rotation is initiated at a speed which is far too low. This rotation is obtained in 5 to 6 seconds for an average 15° to 18° takeoff attitude.

TAIL STRIKE AT LANDING

Industry statistics show that tail strikes are more likely to occur at landing than at takeoff (2 to 1).

Although most of them are due to deviations from normal landing techniques, some are associated with such external conditions as turbulence and wind gradient.

DEVIATION FROM NORMAL LANDING TECHNIQUES

Deviations from normal landing techniques are the most common causes of tail strikes, the main reasons for this being :

a) Allowing speed to decrease well below Vapp before flare.

Flying at too low speed means high a AOA and high pitch attitude, thus reducing ground clearance. When reaching flare height, the pilot will have to significantly increase the pitch to reduce the sink rate. This may lead the pitch to go beyond the critical angle.

b) Prolonged hold off for a smooth touchdown

As the pitch attitude increases, the pilot needs to focus further ahead to assess the aircraft's position in relation to the ground. The attitude and distance relationship can lead to a pitch attitude increase beyond the critical angle.

c) Too high flare

A high flare can result in a combination of decreased airspeed and long float. Since both lead to increased pitch attitude, the result is reduced tail clearance.

d) Too high a sink rate, just prior reaching the flare height.

In case of a too high sink rate close to the ground, the pilot may attempt to avoid a firm touchdown by commanding a high pitch rate.
This action will significantly increase the pitch attitude and, as the resulting lift increase may be insufficient to significantly reduce the sink rate, a firm touchdown may occur. In addition, the high pitch rate may be difficult to control after touchdown, particularly in case of bounce.

e) Bouncing at touchdown

In case of bouncing at touchdown, the pilot may be tempted to increase the pitch attitude so as to ensure a smooth second touchdown. If the bounce results from a firm touchdown associated with a high pitch rate, it is important to control the pitch so that it does not further increase beyond the critical angle.

APPROACH AND LANDING TECHNIQUES

A stabilized approach is essential for achieving successful landings. It is imperative that the flare height be reached at the appropriate airspeed and flight path angle. A/THR and FPV are effective aids to the pilot.

The Vapp should be determined with the wind corrections, given in FCOM/QRH, using FMGS functions.

As a reminder, when close to the ground, the wind intensity tends to decrease and the wind direction to turn (direction in degrees decreasing in northern latitudes).

Both effects may reduce the headwind component close to the ground, and the wind correction to Vapp is there to compensate this effect.

When close to the ground, high sink rates should be avoided, even in an attempt to maintain a close tracking of the glideslope. Priority should be given to attitude and sink rate. If a normal touch down distance is not possible, a go-around should be performed.

If the aircraft has reached the flare height at Vapp with a stabilized flight path angle, the normal SOP landing technique will lead to repetitive touchdown attitude and airspeed.

Assuming a 8 knots speed decrease during flare, and a − 1° flight path angle at touchdown, the pitch attitude will increase by approximately 4.5°.

During flare, the pilot should not concentrate on the airspeed, but only on the attitude with external cues.

Note : Airspeed indication during flare is influenced by the static error due to the ground effect.

The PNF should monitor the pitch attitude on the PFD and call "PITCH", whenever the following pitch value is reached :

For A319/A320 : 10°
For A321 : 7.5°

After touchdown, the pilot must "fly" the nosewheel smoothly, but without delay, on to the runway, remaining prepared to counteract any residual pitch up effect of the ground spoilers.

Note : The main part of the spoilers' pitch up effect is compensated by the flight control laws.

BOUNCING AT TOUCHDOWN

In case of a light bounce, maintain the pitch attitude and complete the landing, while keeping thrust at idle.

Do not allow the pitch attitude to increase, particularly following a firm touchdown with a high pitch rate.

In case of a high bounce, maintain the pitch attitude and initiate a go-around.
Do not try to avoid a second touchdown during the go-around. Should it happen, it would be soft enough to prevent damage to the aircraft, if pitch attitude is maintained.
Only when safely established in the go- around, retract flaps one step and the landing gear.
A landing should not be attempted immediately after a high bounce, as thrust may be required to soften the second touchdown, and the remaining runway length may be insufficient to stop the aircraft.

SUBJECT : ENGINE STARTING WITH APU IN CROSSWIND CONDITIONS

Note : This FCOM bulletin is valid only for A320 or A321 equipped with an old standard of ECB. The new ECB 304817-1 and 304817-2 prevent from the phenomenon described hereafter. Please refer to SIL 49-037 for more details.

INTRODUCTION

On the A320, the examination of failed engine starters showed that a relatively high proportion (25%) of failures was caused by crash re-engagement, i.e. the coupling of the starter to the engine at a speed in excess of the maximum allowed N2.

These crash re-engagements were thought to be caused by starter air pressure fluctuations during the wind-up phase of the engine start.

Investigations carried out have verified that the phenomenon can result on the downwind engine because from an interaction between the engine exhaust gas and the APU intake during a crosswind start when the upwind engine is started first.

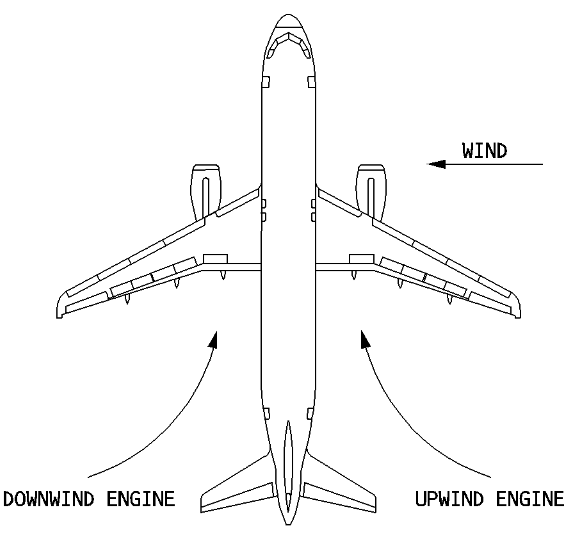


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Figure 1. Definition of terms

OPERATION OF THE APU BLEED SUPPLY SYSTEM

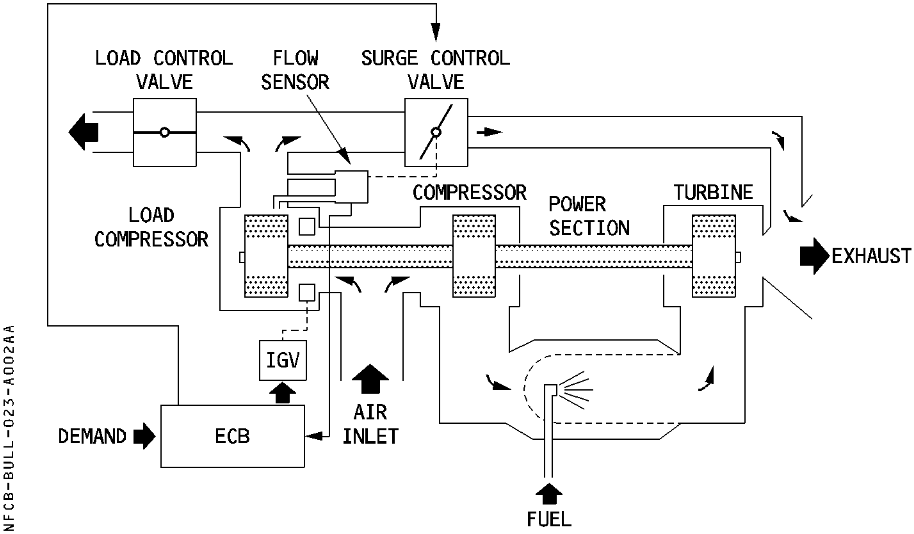


Figure 2. Schematic of the APU pneumatic system

The APU provides compressed air to the aircraft by directing part of the air sucked in by the APU air inlet through a load compressor which is driven by the power section of the APU. The load compressor delivers air to the aircraft systems (PACKS, engine starting system, anti icing system). It is protected against surge by a surge control valve which uses pressure sensors located downstream of the load compressor.

This surge control valve, controlled by the ECB, operates in case of sudden reduction of the flow demand and dumps overboard the excess air which the load compressor delivers.

The surge control valve logic includes a "kicker" function which kicks the surge valve wide open when the onset of a surge is detected. When this happens, the bleed pressure delivered to the aircraft essentially drops to zero instantaneously, then recovers progressively.
The whole cycle takes 10 to 15 seconds.

CROSSWIND EFFECTS DURING ENGINE START USING APU BLEED

Example :

- The wind blows from the right to the left of the aircraft, which means that engine 2 is the upwind engine and engine 1 is the downwind engine.

  With engine 2 started, its exhaust gases are pushed by the wind towards the APU air inlet.

- The turbulent flow is felt downstream of the load compressor and affects the pressure sensors (Pr/△p) used to control the surge control valve.

- The fluctuations can occasionally exceed the trigger threshold of the "kicker" function, which causes the load control valve to cycle.

- If the cycling occurs while engine 1 is being started, the pressure drop and recovery will cause the starter clutch to disengage then to re-engage and this may inflict damage to the starter of the type encountered with a crash re-engagement.

- The schematic in Figure 3 shows the range of wind direction within which the phenomenon can occur, according to our experience, if the windward engine is, for instance, engine 2.

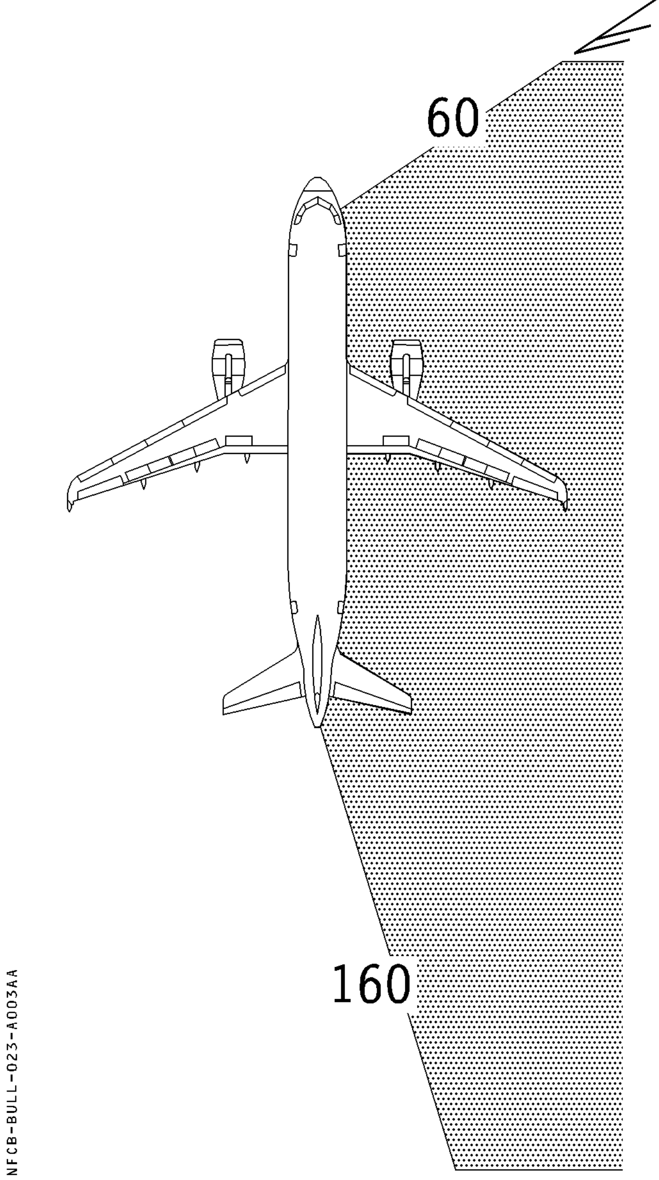


Figure 3. Critical crosswind range for the leeward engine

The same phenomenon could even occur without an engine running during very strong tailwind conditions. Pack cycling has been observed during strong tailwind conditions when the APU is used to supply air.

OPERATIONAL CONSEQUENCES

On the A320/CFM-56, the phenomenon described is likely to cause starter clutch failure or starter drive shaft failure if it occurs between 38% and 45% N2 during the engine start. It is possible that many of the starter failures recorded between entry into service and November 1991 could be attributed to this condition.

On the A320/V2500, a recent outbreak of starter failures due to crash re-engagement could be to the same cause.

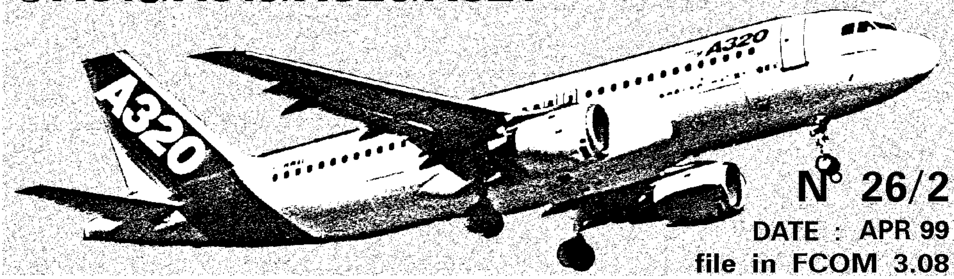
This phenomenon has occasionally been responsible for start aborts, due to starter pressure drop which causes a momentary reduction in N2 acceleration rate, and is detected by the FADEC as a hung start.

The phenomenon can also generate a cycling of the packs, which does not seem to have harmful consequences.

SOLUTION

A modified surge control value logic has been developped. These modifications have been done on the new standard of ECB. The aircraft and the APU can be modified with the ECB 304817-1 or the ECB 304817-2 (Please refer to SIL 49-037).

A318/A319/A320/A321 - FCOM BULLETIN



N° 26/2
DATE : APR 99
file in FCOM 3.08

SUBJECT : FQI ACCURACY

INTRODUCTION

The FQI system installed on Airbus aircraft use probes to measure the quantity of fuel in the different fuel tanks.

Each FQI probe consists of two fixed concentric tubes which form the plates of a capacitor. The dielectric of this capacitor is provided by air and fuel which have different dielectric constants. Therefore the capacitance of a vertically installed probe varies with the fuel level and gives an indication of fuel quantity in the tank.

FQI ACCURACY ON AIRBUS INDUSTRIE PRODUCTS

The accuracy of any measuring device such as the FQI system, is dependant on various parameters.

There are bias and random errors that can affect FQI system accuracy. Errors can involve tank manufacturing tolerances, FQI computer inaccuracies, error in density determination, probe-mounting tolerances, water that causes FQI over-reads, wing deflection, aircraft reference improperly taken into account.

The following figure gives, the Airbus Industrie standard specifications for FQI system accuracies on the A319/A320/A321

– **Accuracy : ± 1 % of max tank capacity ± 1 % of actual fuel quantity.**

- Supplier :
  - A319/A320 : Smiths and Intertechnique managed by **Smiths**
  - A321 : BFE Goodrich and Sextant managed by **BFE Goodrich.**
- New probes compared to A310/A300-600
- Density sensors measuring all in-tank fuel as opposed to up-lifted fuel only for A310/A300-600
- Attitude correction from IRS in addition to fuel surface probe cutting.

Each aircraft is checked on ground prior to delivery to be within the tolerances shown on the following graphs (Figure 1).

FAR/JAR 25.1337 requires that "each fuel quantity indicator is calibrated to read "zero" during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply..."
Tolerances are reduced when there is low level in the tanks in order to achieve an under-reading of the FQI as required by the regulations.

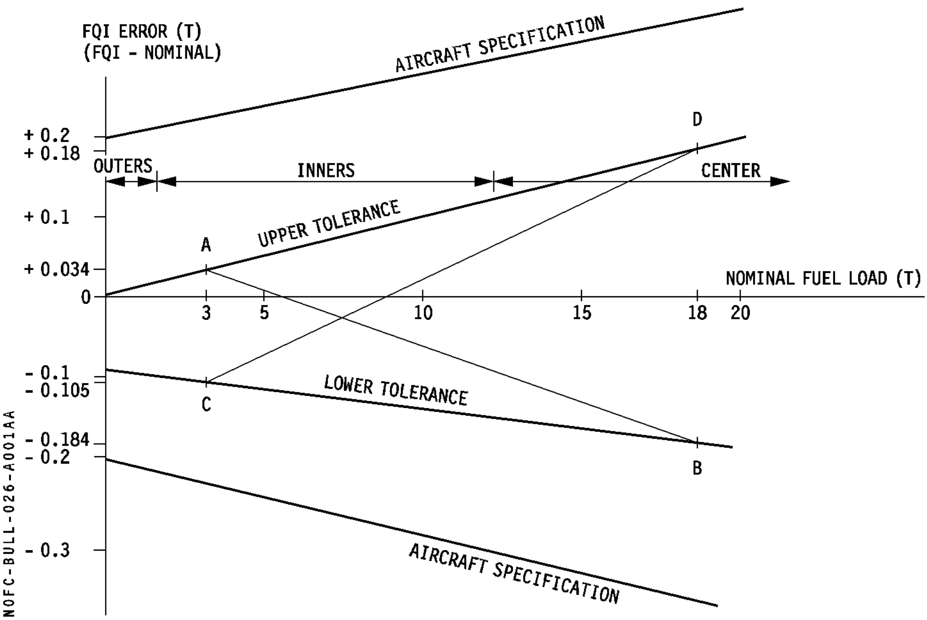


FIGURE 1

UNDERSTANDING FQI DISCREPANCIES

ON GROUND

Refueling personnel sometimes report discrepancies at the end of refueling, between the uplifted quantity based on FQI (total after refuel–total before refuel) and the uplifted quantity from the bowser (litres × measured density).
These discrepancies may be due to the following tolerance considerations.

Max discrepancy (△) = **Fuel load [per bowser]** – **Fuel added [FQI end – FQI start]**
= ± **FQI error** (end) ± **FQI error** (start) ± **Bowser Qty** and **Density error** + **APU fuel burn** (during refueling)

Example (A320-200) :

Actual FOB before refueling = 3 tonnes (6600 lbs)
Actual FOB after refueling = 18 tonnes (39600 lbs)

- **Bowser quantity and density error**

– Volume tolerance is generally lower than ± 0.5 %

– Density error due to both temperature accuracy and density reading : △d = ± 0.002. Or ± 0.25 % on tolerance at any fuel loading.

Total bowser quantity and density error = ± 15 000 × 0.75 % ≃ ± 115 kg. (253 lbs)

- **APU fuel used**

When comparing bowser data versus FQI data as indicated above, the reported discrepancy includes the fuel used by the APU between FQI readings before and after refueling.

Depending on external conditions and generator load, the APU fuel consumption on ground is between 100 (220) and 150 kg/h (330 lb/h). For a refueling time of 30 minutes, APU burn would be at least **50 kg (110 lb).**

- **FQI errors**

The three following cases should be considered.

1) Significant FQI system changes have been performed (FQI computer, probes change etc...) on the aircraft since delivery or its last FQI ground calibration.

   The FQI accuracy to be taken into consideration should be the one given by the aircraft specification i.e. ± 1 % of maximum tank capacity ± 1 % of actual fuel quantity.

Assuming a maximum fuel capacity of 19 tonnes (418 000 lb) :

FQI at start = 3 tonnes ± 220 kg (6600 lb ± 484 lb)
FQI at end = 18 tonnes ± 370 kg (39600 lb ± 814 lb)

△1 = ± 220 kg ± 370 kg ± 115 kg ± 50 kg (△1 = ± 484 lb ± 814 lb ± 253 lb ± 110 lb)

△ 1 max ≃ ± 755 kg (1661 lb)

2) No FQI system modification has been performed since the last FQI calibration. All FQI readings are within the ground tolerances (refer to Figure 1).

Maximum positive △ is obtained when FQI presents the maximum over-reading at start and the maximum under-reading after refuel, i.e. when the particular aircraft calibration curve runs from A to B.

Maximum positive △ = 15,000 – [(18,000 – 185) – (3,000 + 35)] + 115 + 50 = + 385 kg

Conversely, maximum negative △ is obtained when particular aircraft calibration curve runs from C to D.

Maximum negative △ = 15,000– [(18,000 + 180) – (3,000 – 105)] – 115 + 50 = –350 kg

△ 2 max ≃ ± 385 kg (847 lb)

3) Particular aircraft FQI calibration curve is available.
In this case, although the reported discrepancy can be of the same magnitude as △2 maximum given above, after correction of FQI reading according to the calibration curve, the remaining difference should be due to bowser error and APU burn only.

△ 3 max ≃ ± 165 kg (363 lb)

- **Conclusion**

  – When comparing bowser uplift versus FQI readings on ground, the maximum difference is :

  △1 max= [FQI over-read (start)] – [FQI under-read(end)] + bowser error + APU burn

  – Difference can be significant when FQI over/underreadings before and after refueling are very different.

  – An aircraft presenting a △ ≃ 0 does not confirm its FQI system is more accurate than another aircraft with a difference. It suggests (bowser error and APU burn not taken into account) that over/underreadings before and after refueling are very close but not necessarily equal to 0.

IN FLIGHT

As a routine, crews should check the fuel on board (FOB) plus fuel used (FU) against the block fuel during flight. This would detect fuel leaks and provide a more reliable basis of calculation in case of either FQI or FU failure during flight.

Discrepancies have been observed during routine checks. These discrepancies are made up from the three following inherent errors :

- BLOCK FUEL (error constant throughout flight)
- FU (error increasing during flight)
- FOB (error decreasing during flight).

Example : A320 with 18 tonnes

- BLOCK FUEL : 18 tonnes → error = ± 370 kg (814 lb)
- FOB : 3 tonnes → error = ± 220 kg (484 lb)
- FU : 15 tonnes → error = ± 225 kg (495 lb)

In an extreme case :

Block Fuel = FOB + FU ± 815 kg (1793 lb) + APU FU if any

and this with no system fault.

Consequently, it is important to know the FQI tolerances to understand discrepancies.

Notes

1) FU indication accuracy, which is an integration of the FF, is estimated to be better than ± 1.5 %. The error of the fuel flow (FF) meter is dependent upon fuel flow rate and temperature conditions. For normal cruise conditions, this error is around ± 1 %.

2) FQI errors for both Block Fuel and FOB are as per the specification because ground calibration curve is not applicable in flight. Block Fuel error, ground tolerances may be used if applicable (refer to 3.1). In this case, Block Fuel error is ± 185 kg (407 lb) instead of ± 370 kg (814 lb).
   If the particular ground calibration curve is known, there should not be any substantial error on Block Fuel.
   Possible discrepancy due to FOB and FU errors remains significant :

Block Fuel = FOB + FU ± 450 kg (990 lb) + APU FU if any

3) APU fuel used in flight, which is not recorded, is between 40 (88) and 100 kg/h (220 lb/h).

4) With the Flight Management and Guidance System (FMGS), FOB is also available on the appropriate page of the FMGS. FOB is computed by the FMGS using both FQI and FF data.

   In the event of a FQI failure, the FMGS will continue to display FOB by means of the last available FOB and by FF integration.

USE OF MANUAL MAGNETIC INDICATORS

It often happens that when a discrepancy has been detected either on ground or in flight as explained above, some airline procedures request to make a check of the FOB after refueling or after landing by means of the Manual Magnetic Indicators (MMI).

It has to be highlighted that MMI readings involve several measurements and interpolations (on rods, on clinometers, on charts) in addition to the MMI indication accuracy itself.

This is why the accuracy of a MMI reading is approximately ± **5 %** and thus **worse than FQI** system accuracy.

Therefore, MMI readings should not be used to check FQI system. They should only be used when the FQI system is inoperative.

REDUCING FQI DISCREPANCIES

FQI system accuracy continue to improve. Operational accuracy goals have been established by ARINC in cooperation with airframe and equipment manufacturers and in agreement with airline requirements.

The discrepancies described are inherent in the FQI system.

- **Both on-ground and in-flight reported discrepancies are generaly due to FQI errors on Block Fuel.**

  The Block Fuel maximum error should be reduced. This will depend on a responsible judgement based on knowledge of a particular aircraft FQI calibration curve ; i.e. assuming no FQI modification following aircraft delivery, this curve will be reasonably constant (on ground) and thus, for a given FQI reading, real Block Fuel can be deduced.

  This calibration may be done by any operator while it is not applicable to the correction of in-flight reading.

  A FQI calibration procedure is a maintenance function and will be introduced in the AMM in the future.

- FU (fuel used) is the primary parameter to determine fuel consumption (max error = ± 1.5 %). Nevertheless, on certain high-fuel-capacity aircraft, the FOB error (decreasing during flight) may become lower than FU error (increasing during flight) by end of flight.

  Example : A320 with 19 tonnes (41 800 lb) maximum capacity.

  - BLOCK FUEL = 18 tonnes (39 600 lb)
  - FOB = 3 tonnes ± $\frac{1}{100}$ (3 t + 19 t) = 3 t ± 220 kg

    (FOB = 6600 lb ± $\frac{1}{100}$ (6600 lb + 41800 lb) = 6600 lb ± 484 lb)
  - FU = 15 tonnes × (± 1.5 %) = 15 t ± 225 kg

    (FU = 33000 lb × (± 1.5 %) = 33000 ± 495 lb)

In this example, when FOB is less than 3 tonnes (6600 lb), FOB error may be assumed to be lower than FU error. Furthermore :

- If Block Fuel is confirmed as per a particular calibration curve :
  - When FOB > 3 tonnes (6600 lb) :
    Use FU parameter to determine both FOB and FU
  - When FOB < 3 tonnes (6600 lb) :
    Use FOB parameter to determine both FOB and FU

OPERATIONAL CONSIDERATIONS

Some economic aspects relating to FQI accuracy are approached here and should be considered when operating an aircraft.

TECHNICAL DELAYS

Incorrect application of MMI check, may cause a possible delay.

Knowing the FQI calibration curve helps to understand and reduce discrepancies.

EXTRA FUEL LOADED

- Crews uplift more fuel than required for a particular flight, as a contingengy factor, when they are unsure of the FQI accuracy.
- An under-reading FQI leads also to carrying extra fuel.
- 1 extra tonne will increase fuel consumption up to 1.2 %, depending on airframe and flight conditions.

PAYLOAD PENALTY

Extra fuel loaded due to uncertainty of FQI may lead to decreasing the payload.
Payload = TOW + TAXI fuel – OEW – Fuel loaded
TOW = Take-Off Weight
OEW = Operating Empty Weight

We have seen, that adding 130 kg (286 lb) of fuel can allow the payload to be increased by 870 kg (1914 lb) on a 4 hours flight.

- When the payload is **limited by MTOW** as TOW cannot be increased, **any extra fuel** will **decrease** and replace payload by the **same amount.** Also, **any defueling will significantly decrease the payload.**
- When the payload is limited by the max fuel capacity :
  - if the FQI under-reads, the payload could be increased
  - if the FQI over-reads, the payload should be decreased

For example, an inaccuracy of ± 130 kg (286 lb) on fuel can affect the payload by ±870 kg (1914 lb).

Again, knowing your FQI calibration curve allows to adjust the payload.

Note : *Although not approved by DGAC/JAA as it is a non compliance item, using the 2 % thermal expansion volume as extra-fuel could be authorized by national airworthiness authorities to increase max fuel capacity.*
In this case the FQI reading is limited somewhere above high level until fuel quantity falls below this value.

CONCLUSION

Airbus Industrie has always improved FQI systems, because it is essential for crews to have a reliable and accurate fuel quantity indication system.

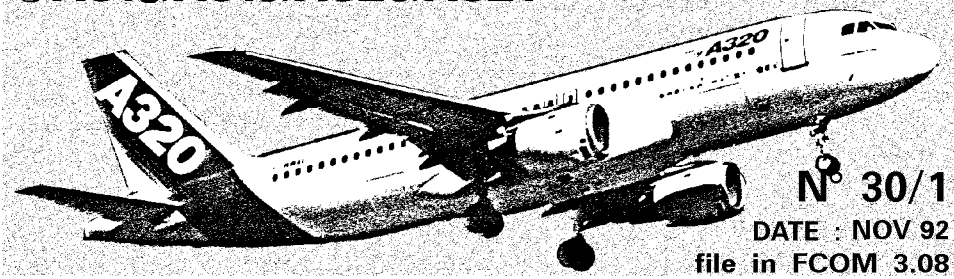
Taking into account the difficulty of measuring the weight of a liquid stored in complex-shaped tanks always moving, FQI system installed on Airbus aircraft has a good accuracy, well within specifications and international standards.

It is important on certain flights with certain aircraft fitted with a FQI system presenting large over-/underreadings, to know the particular FQI ground calibration curve.
Crews should know this curve and FQI tolerances in order to :

- understand and reduce FQI discrepancies
- avoid delays
- save fuel
- adjust the payload.

FQI calibration should be done when deemed necessary by each operator as this will be profitable for both operational and economic aspects.

A318/A319/A320/A321 - FCOM BULLETIN



N° 30/1

DATE : NOV 92
file in FCOM 3.08

SUBJECT : ELECTRONIC INTERFERENCE FROM PORTABLE EQUIPMENT CARRIED ON BY PASSENGERS

- Airlines often wonder whether they should allow passengers to operate electronic devices in the cabin without any limit.

  Federal Aviation Regulation (FAR) section 91.19 allows passengers to operate :

  " – Portable voice recorders
  – Hearing aids
  – Heart pacemakers
  – Electric shavers
  – Any other portable electronic device that the operator of the aircraft has determined will not cause interference with the navigation or communication system of the aircraft on which it is to be used."

  It is obvious that the myriad portable devices that now exists or that may be available in the future cannot be tested.

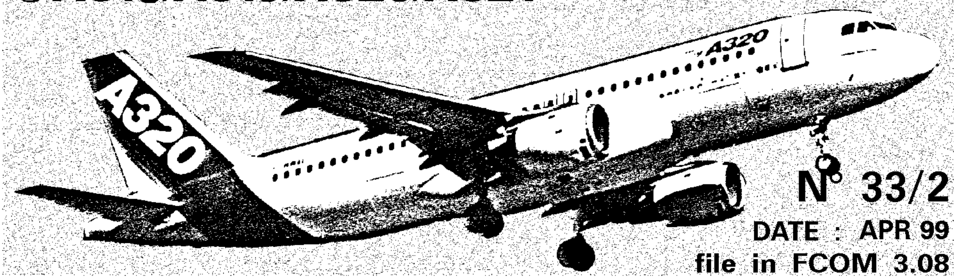
- As far as aircraft specific electrical flight controls and engine control computers on Airbus aircraft are concerned, there is no chance of their operation being affected by passenger-operated electronic devices, due to the high level of protection applied to these systems.

- Nevertheless, this question arises for navigation and communication receivers and is applicable to any aircraft.
  A study has been conducted by an RTCA (Radio Technical Commission for Aeronautics) special commitee.

- The conclusion is that the probability of a passenger-operated device interfering with the ILS localizer during a typical flight is about one in a million.
  Airbus Industrie recommendations is that no portable device should be used during take-off and landing.

- Concerning radio phones Airbus Industrie recommends to prohibit the use of those devices.

A318/A319/A320/A321 - FCOM BULLETIN



N° 33/2

DATE : APR 99

file in FCOM 3.08

SUBJECT : THRUST ACCELERATION IN A/THR MODES

These are specific thrust acceleration logics when A/THR is engaged in thrust or speed mode. The crew should be aware of each.

The purpose of the logic is to obtain adapted thrust variation to the whole flight envelope, depending on the current mode engaged, "G" load limitation, and vertical modes switching if any.

This is based on different logics which can be summarized as following :

1. LOGIC IN THRUST MODE "CLB" (ASSOCIATED WITH OP CLB/EXP CLB/CLB) :

1.1 WHEN AP IS ENGAGED

During thrust increased, the maximum acceleration rate is 20 %/sec until the N1 reaches N1 target minus 5 %. At that point, the acceleration logic is speed mode. This acceleration limit is defined to achieve a smooth and rapid transition without noticeable speed excursion. However normal acceleration rate is between 1.5 %/sec and 20%/sec.

When target N1 minus 5 % is reached, N1 rate becomes 1.5 %/sec until target N1 (Max Clb Thrust) is obtained.

Note : When decelerating (more than 10 knots between current speed and speed target), the N1 rate is maintained at 1.5 %/sec.

1.2 WHEN AP IS OFF

It has been revealed, that during manual flying with AP off, the rate limit up to 20 %/sec was not as optimum as with AP engaged. The reason for this is that during transition the system was using A/THR speed mode logic to obtain N1 rate limit of 20 %/sec MAX ; if the pilot did not fly the FD bars, established CLB thrust was not always obtained.
Consequently, the current system maintains the fixed value of 1.5 %/sec which represents the best value when following the FD bars.

Flight tests proved this logic (it means to provide maximum rate of 20 %/sec only if autopilot is engaged) to be the optimum compromise through the flight envelope.

WARNING : If FD bar commands are not smoothly followed or not followed at all, a speed excursion may occur, due to the fact that the change of attitude is not adapted to the thrust acceleration rate.
If required, additional manual thrust may be briefly added by the pilot during the transition.

2. LOGIC IN THRUST MODE "IDLE" (ASSOCIATED WITH OP DES/EXP DES/DES) :

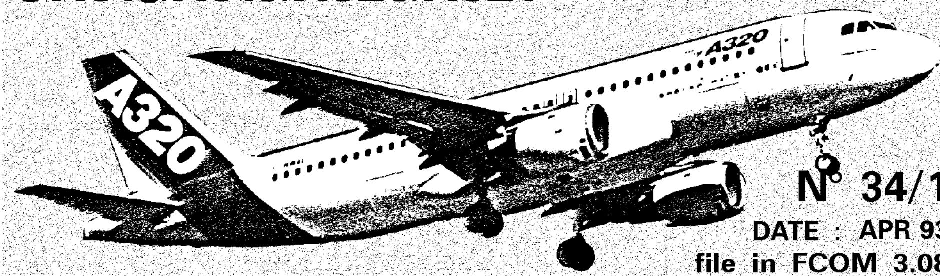
The N1 rate limit is 2 %/sec (IS8) and 1 %/sec (full standard). Both rates were selected to preclude speed excursion and improve passenger comfort (smooth attitude variation during transition).

3. LOGIC IN SPEED MODE :

The N1 rate limit is 20 %/sec MAX, however it can be lower depending upon the difference between the current speed and the target speed.

There is no difference in A/THR speed mode linked to AP ON or OFF. The speed hold is the same with AP ON or OFF.
When pilot is flying manually, a temporary speed loss can occur if an increased load factor is required. This authority is not possible with AP due to system.

A318/A319/A320/A321 - FCOM BULLETIN



N° 34/1
DATE : APR 93
file in FCOM 3.08

SUBJECT : AVOID DISORDER IN THE COCKPIT

REASON FOR ISSUE

The purpose of this FCOM Bulletin topic is to remind pilots of the importance of maintaining an orderly cockpit environment and highlight the hazards caused by misplaced objects.

BACKGROUND INFORMATION

Many hazards are caused by placing objects in improper places in the cockpit. The most common being the following.

- Coffee cups placed on the glareshield or pedestal, unexpected turbulence or unintentional knocking by the crew may cause fluid to be spilled onto the cockpit control panels causing damage to the equipment which may have an immediate effect on the flight or at best lead to an early and expensive overhaul of the equipment.
- Books placed on the glareshield. These may fall off and operate some switches/ pushbuttons or even damage equipment.
- Books placed on the pedestal. These may cause switches or pushbuttons to be activated, especially if they have to be pushed around while operating other controls.
  At worst the rudder trim might be activated or even a fuel lever pushed off, at best a radio selection could be deselected.

RECOMMENDATIONS

It is highly recommended that all objects are placed and stored at their designated place in the cockpit.
Cups should be placed in the cupholders provided.
Books should be kept in the library space provided and put back as soon as you have finished using them.
A rubbish sack should be provided behind the crew seating and used for all rubbish.
Meal trays should be collected by flight attendants as soon as possible, or be placed on the floor behind the crew when finished.

A318/A319/A320/A321 - FCOM BULLETIN

N° 36/2

DATE : APR 99

file in FCOM 3.08

SUBJECT : RADIO ALTIMETER ANOMALIES DURING ADVERSE WEATHER CONDITIONS.

INTRODUCTION

All radio altimeters are very sensitive to adverse weather conditions.

Reflections from hail clouds or heavy precipitation located between the ground and the aircraft, may cause the radio altimeter to indicate a false height value momentarily.
These erroneous indications are also transmitted to other systems which may induce spurious warnings or unexpected AP/FD guidance.

Example :
Under heavy rain condition at 2 600 ft, at least one of the radio altimeter delivered a height indication of 480 ft during 13 seconds.
The warning "L/G gear not down" was displayed.
No other anomaly was reported until landing.

EXPLANATION

ORIGIN

A radio altimeter measures the shortest distance between the aircraft and the closest obstacles below it.
During adverse weather conditions, returns can be generated due to reflection on hail clouds or heavy rain. The energy which is reflected depends directly upon the hail or rain density.
If the energy received by the radio altimeter is powerful enough, it will be validated and a height lower than the distance to the ground will be measured and sent to system users.
If the return is too weak, the measurement will be validated but the increased noise level may hide the return from the ground and thus no height indication would be provided.

CHARACTERISTICS

This phenomenon is rare. Typical weather conditions which trigger these effects are not frequent and generally isolated.
It is less likely with increased height.
Due to the physical nature of the hail and rain and the radio altimeter characteristics, the radio altimeter indication will only be influenced if the distance between the a/c and the clouds is equal or greater than 300 ft for rain and 80 ft for hail.
Both radio altimeters are likely to be affected simultaneously.

OPERATIONAL CONSIDERATIONS

If both radio altimeters are affected simultaneously the crew may experience :

- If the value is greater than 150 ft :
  – spurious auto call out
  – spurious ECAM or GPWS warnings
- If the value ranges between 150 ft and 80 ft :
  * During automatic approach
    – degradation of the guidance, glide slope is no longer flown, excessive deviation may occur.
    – variation of the longitudinal pitch and/or vertical speed leading to GPWS warning.
  * During manual approach :
    – no adverse effect could be reproduced during simulation but GPWS or auto call out warning might be spuriously triggered.

CONCLUSION AND OPERATIONAL RECOMMENDATIONS

Very few cases of spurious radio altimeter indications have been reported to Airbus. Radio altimeter sensitivity issues have been tuned to the limits of improvement. There is no practical solution to cure the phenomenon without reducing system performance to an unsatisfactory level. Crews need to be aware that erroneous radio altimeter behavior is rare, but can occur during severe weather conditions. During approach and landing, crews need to consider this phenomenon.

The weather radar may be used to detect heavy rain or hail.

The interpretation of the color codes is as follows :

Black rainfall rate	less than	0.7 mm/hr
Green rainfall rate	between	0.7 and 4 mm/hr
Yellow rainfall rate	between	4 and 12 mm/hr
Red rainfall rate	greater than	12 mm/hr

As an example stormy tropical shower rate can be as high as 500 mm/hr and uppest limit for hail may reach 4700 mm/hr.

A318/A319/A320/A321 - FCOM BULLETIN

N° 37/1
DATE : JUN 93
file in FCOM 3.08

SUBJECT : FMGS NAVIGATION DATA BASE

REASON FOR ISSUE AND SCOPE

The aim of this FCOM Bulletin is to highlight the importance of the Navigation Data Base accuracy and therefore the importance of its update and its correctness.
As any NAV data base discrepancy or false coding may induce navigation errors and lateral or vertical misguidances, this FCOM Bulletin provides flight crews with operational recommendations.

INCORRECT NAV DATA BASE CASES

NAVIGATION DATA BASE DISCREPANCIES

- Numerous in service events have been reported during the last few years, which are caused by 3 different types of Navigation Data Base discrepancies :
  - Nav data base not updated on time,
  - Incorrect coding or impossibility of coding of published procedures.
  - Coding errors.

NAV DATA BASE NOT UPDATED ON TIME

When a Nav Data Base is not updated on time, this may lead to incorrect position or misguidance :

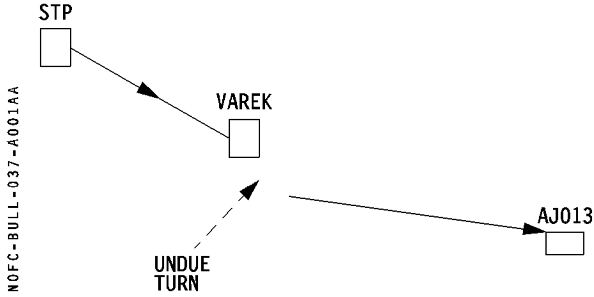
- 1st example
  STAR MEN2 (LFBO) was modified but not incorporated in the Nav D.B. As a result the STAR displayed on the ND was not the published one.

- 2nd example
  TRANS between STAR VAREK and NDB03 was not coded at Ajaccio (LFKJ). Misguidance was the consequence.

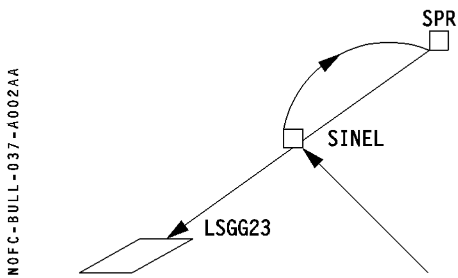
NAV DATA BASE INCORRECT CODING

Incorrect coding in the NAV D.B. induces misguidance in SID or STAR :

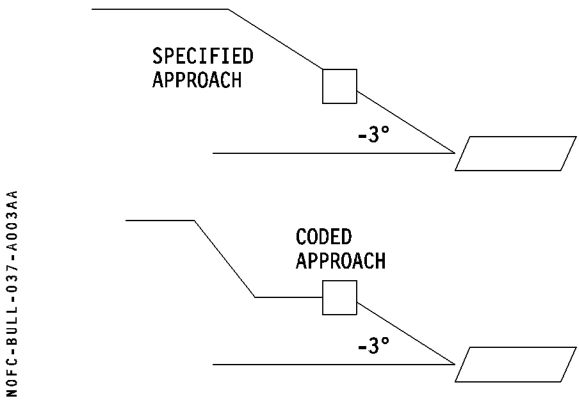
- 1st example
  STAR VAREK at Ajaccio (LFKJ).
  The leg STP-VAREK was coded as a TF (track to fix) and the following leg was coded as a CF (course to fix). Due to the imprecision of the magnetic variation in the area, both legs were not lined up and the a/c had to turn, after VAREK WPT, to capture the next leg.



- 2nd example
  STAR PERIK 1 and GORON 1 AT Genova (LSGG).
  These STARs end at WPT SINEL located in the middle of the APPR 23.
  This creates a F-PLN discontinuity and the procedure is not flyable. The Nav D.B. error is linked to both coding and procedure concept.



– 3rd example
  On several non precision approaches, the final descent angle is coded for the last leg only instead of the last 2 legs. Again this creates a level off segment which does not exist.



CODING ERRORS

Coding errors generally have very similar effects on the FMGS system and may induce position errors as well as misguidance.

– 1st example
  Erroneous position of runway threshold at LFMT RWY 32R inducing a lateral offset during non precision approach

– 2nd example
  ILS/DME coded as an ILS only preventing autotuning of the DME in approach (IWW and IGG at EGKK).

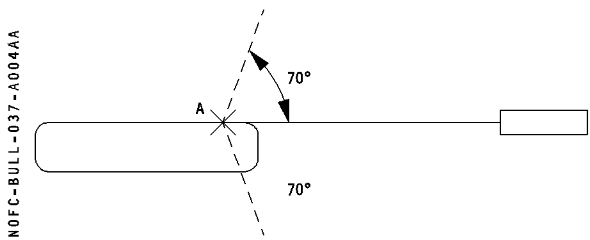
PROBLEMS LINKED TO ARINC 424 SPECIFICATION

If an item is not specified in the ARINC 424, it will not be part of the Nav D.B.

For example :
No specific field reserved for THR RED/ACC ALT. As a result, it is not possible to link such information to a company route (e.g noise abatement). Defaulted value is provided instead.

SYSTEMATIC CODING OF HF LEG IN PROCEDURES

When a Final Approach procedure displays a Holding Pattern, this pattern is systematically coded in the APPR VIA or STAR as an HF leg ; this means that this holding is always taken into account in the F-PLN, assuming one turn ; in certain cases, this is realistic but in most circumstances, it is not.



If the HF leg is of no use, it corrupts all predictions and performance computations. Furthermore if a holding pattern is ATC required, by then the crew has all means to insert it into the F-PLN, and be then provided with realistic estimates.

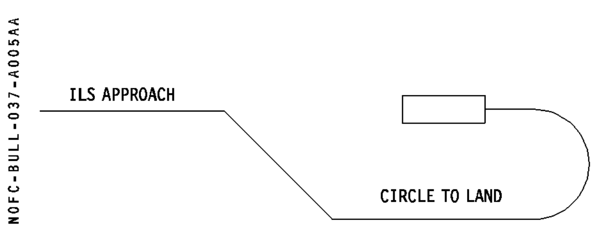
As a consequence, realistic coding of procedure turns should be requested.

CIRCLE TO LAND

At many airports approaches are defined only in one direction ; while the landing runway may be in the other direction.

If the weather is poor, a defined instrument approach is carried out down to circle to land MDA, and then a circle to land trajectory is flown.

Circle to Land feature is not part of current ARINC specification ; this forces the crews to improvise in order to get a realistic trajectory on the ND, and to get proper predictions on CDU.



RECOMMENDATIONS

In order to control and correct NAVIGATION Data Base all pilots are encouraged to report to their flight operations any misbehaviour which may have been induced by an incorrect data base.

This can be done during normal operations :

* during preflight by checking the consistency of the MCDU F-PLN versus ATC F-PLN. Refer to current FCOM ;
* in flight by performing the navigation accuracy assessment on a regular basis as described in the FCOM procedures and techniques chapter, or VOL 4.

CONCLUSION

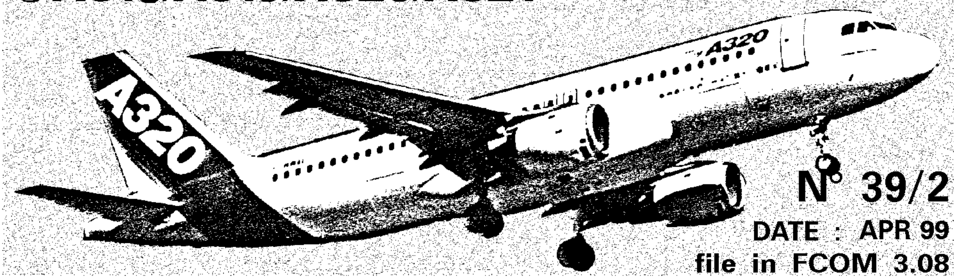
Tomorrow, the increasing number of RNAV approaches will require faultless Nav Data Base procedures since it will not always be possible to monitor the guidance by using raw data.

On a short term basis, the Nav Data Base improvement is a matter of step by step error detection which mainly requires pilot attention during preflight and in flight.

On a longer term basis, the Nav Data Base improvement requires decisions and actions of concerned agencies/ authorities and Nav Data Base manufacturers.

It has to be reminded that the aircraft constructor has no control over the data base used by each operator.

A318/A319/A320/A321 - FCOM BULLETIN



N° 39/2
DATE : APR 99
file in FCOM 3.08

SUBJECT : SPECIFIC FEATURES OF THE FMGS FULL STANDARD

Note : This FCOM bulletin is only valid for aircraft equipped with FMGS full standard.

The FMGS full standard was introduced in 1992. During the first months of service, questions have been raised on particularities of the system.

1. ALTITUDE PREDICTIONS NOT ACCURATE ON GROUND

Predicted altitudes indicated on the F-PLN A page are not accurate until take off ; an error of a few hundred feet may be noticed on predicted altitudes at all waypoints until lift off.

Explanation

The predictions are computed using simplified model for the take off run. This causes a minor error on the altitude predictions. Predictions are continuously updated during the take off roll and once airborne, they are accurate.

2. SPURIOUS "FMS1/FMS2 SPD TGT DIFF" MSG

When changing of CRZ FL using the FCU altitude knob, the message "FMS1/FMS2 SPD TGT DIFF" may come up.

Explanation

The new FCU altitude is sent by the master FMGC to the slave, therefore predictions are not computed at the same time on both FMGCs ; a speed target difference may occur during a very short period, triggering the message.

Procedure

Disregard the message.

3. "IRS ONLY NAVIGATION" MSG TRIGGERED AT DESCENT PHASE SWITCHING

When the A/C is in IRS ONLY NAV mode, the message "IRS ONLY NAVIGATION" is triggered when the a/c starts the descent.

Explanation

The system logic is triggered when the FMGS navigation mode has been in inertial only for more than 10 minutes in cruise or when the a/c is transitionning to descent phase without radio updating.
If the FMGS is in IRS only navigation mode at descent phase switching, the message is immediately triggered, reminding the crew that the A/C is operating without radio position.

Procedure

Perform a NAV ACCY CHECK.

4. VERTICAL DEVIATION DIFFERENT ON BOTH SIDES

In descent or approach the vertical deviation (V DEV) indicated on the PFD and PROG page may differ on side 1 and 2.

Explanation

The vertical deviation (V DEV) is computed independently on side 1 and 2 ; if FM 1/2 position ground speed or other data used for V DEV computation differ slightly from side 1 and 2, a small difference of V DEV will be observed during descent and/or approach.

5. INCREASE OF VERTICAL SPEED IN DES MODE

The vertical speed may increase noticeably for a short period of time during descent with DES mode engaged. The V/S regains the normal value when intercepting the path.

Explanation

When the A/C is above path and an increase of speed target is required manually or automatically, the V/S will increase temporarily until the vertical profile is intercepted.

6. VLS COMPUTATION

6.1 The VLS computed by the FMGS uses the same algorithm and performance table as the FAC. Nevertheless some differences may be observed due to the fact that the FAC computes the VLS from flight parameters and the precision of the computation provides an accuracy of ± 3 kt (PFD VLS).

6.2 In CONF3, the performance table used to compute the VLS assumes the gear up although the table provided in the QRH and VOL2 assume gear down. A VLS difference of 2 kt can be observed between performance table and FAC/FMGS in CONF3.

7. A/C POSITION INVALID

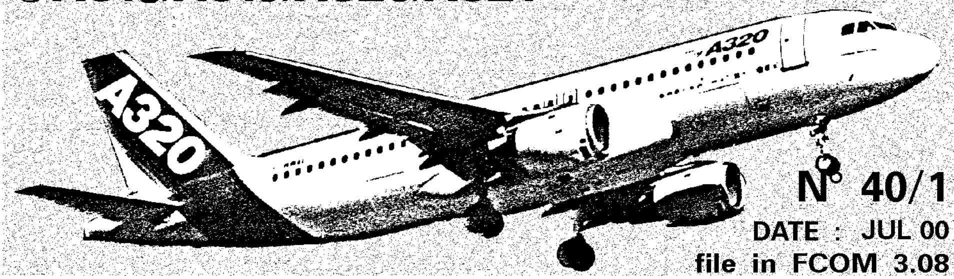
When a fast realignment is performed, the message A/C POSITION INVALID is triggered. The message disappears when the realignment is completed.

Explanation

During an IRS alignment, the ADIRS send no data to the FMGS and the FMGS cannot process any position.

The POS MONITOR page is empty and the msg "A/C POSITION INVALID" is automatically triggered. Once the IRS are realigned, the ADIRS provide data to the FM and a mix IRS position is recomputed ; the message disappears.

A318/A319/A320/A321 - FCOM BULLETIN



N° 40/1

DATE : JUL 00

file in FCOM 3.08

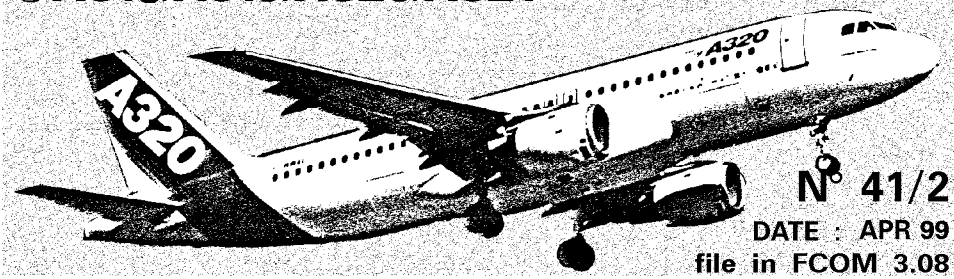
SUBJECT : STOWAGE OF THIRD OCCUPANT SEAT

It has been reported that a Copilot was injured when he tried to stow the observer seat, while remaining seated at the controls. This emphasizes the need to remind everyone of the correct way to stow the observer seat.

First of all, the crew should ask the observer to stow their seat when they leave.

If the observer seat is not stowed, it is possible to unlatch its horizontal part by kicking the underside of the seat. Once the seat is in the vertical position, it can be stowed by using the unlatch control, without any risk of finger pinching. The unlatch control is closer to the Captain's side and can more easily be reached by the Captain than by the Copilot.

A318/A319/A320/A321 - FCOM BULLETIN



N° 41/2
DATE : APR 99
file in FCOM 3.08

SUBJECT : VMO / MMO DETERMINATION

GENERAL

VMO / MMO determination

VMO (the design cruising speed) is the maximum operating speed that the crew may fly within the normal flight envelope. It is not authorized to fly intentionnally above this limit.

VD is the design dive speed. VMO and VD must comply with load requirements (gust loads, manoeuvering loads). For example, the aircraft must be able to sustain a load factor of 2.5 up to VD. The range between VMO/VD considers normal reaction time to the crew to use standard recovery techniques for returning the aircraft to normal attitude at a speed of VMO/MMO.

The A319/A320/A321 are protected by the High Speed Protection law which automatically makes the recovery if VMO is exceeded (between VMO and VMO + 6) as shown in the following table.

HIGH SPEED / MACH TABLE

MD = .89	VD = 381 kt	VD = VMO + 31kt
MMO + 0.04	VMO + 20 kt	Structural inspection required. (AMM. 05.51.17)
MMO + 0.01	VMO + 6 kt	Upper limit for entry into HSP
MMO + 0.006	VMO + 4 kt	Overspeed warning
MMO = .82	VMO = 350 kt	Max operating SPEED/MACH and lower limit for entry into HSP
MMO – 0.006	VMO – 3 kt	Max upper speed range in DES mode.
MMO – 0.02	VMO – 10 kt	Managed speed target limit (ECON mode)

Depending upon the speed trend, the autopilot will disconnect at or below VMO + 6 kt / MMO + 0.01 and an automatic pitching up will allow VMO to be regained.

Per design, in DES mode or OP DES mode, autopilot authority is limited to 0.1 g compared to 0.15 g in EXPEDITE. This limitation was required by the launching customers for passenger's comfort.
Due to the load factor limitation, some flight paths or environment conditions depending on their magnitude, may not be counteracted by the autopilot leading to VMO / MMO overshoot.

A short exceedance of few knots above VMO has no consequences on the aircraft.
Nevertheless, an intentional exceedance is not authorized :

- by regulation.
- Because above VMO / MMO the HSP (high speed protection) may be activated automatically. Any pilot input to recover the target speed may be added to the HSP order, leading to a load factor incompatible with passenger's comfort.

For this reason, it is recommended to be smooth on the stick when manually recovering from a VMO / MMO exceedance. In order to prevent this exceedance during descent, a procedure has been described in FCOM 4.05.60.

A318/A319/A320/A321 - FCOM BULLETIN

N° 43/2
DATE : APR 99
file in FCOM 3.08

SUBJECT : OPERATION OF FLEETS WITH/WITHOUT CPIP

INTRODUCTION

In order to continuously improve the man/machine interface, Airbus developed continuous product improvement programmes (CPIP), the modifications of which are available for retrofit and are commonly introduced on all new A320/A321 and on A319.
This FCOM bulletin details the differences which crews should be aware of.

DEFINITION

Basic aircraft :
The A320 equipped with full standard FMGS without CPIP (continuous production improvement programme) nor ENERGY MANAGEMENT.

Advanced standard :

The A319/A320/A321 with CPIP 1+2+3, LOW ENERGY warning and ENERGY MANAGEMENT. This standard is basic on the A319/A321 and A320 in current production and can be retrofitted to all A320.

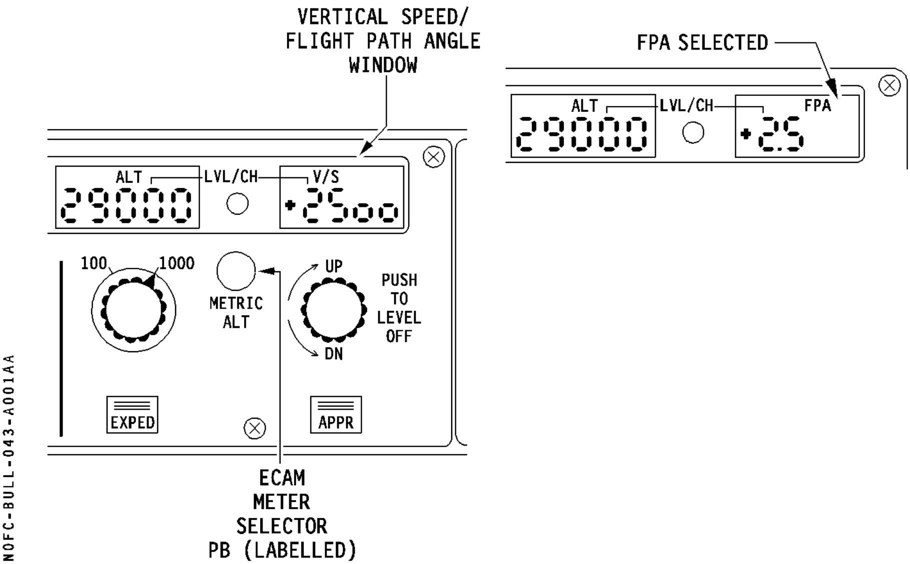
MODIFICATION DESCRIPTION

CPIP1 (FCU MODIFICATION)

- Altitude selection change inhibited during push/pull action. This modification prevents any change of altitude during mode engagement.
- HDG and V/S preselection time increased from 10 to 45 seconds.
- V/S/FPA click differentiation for rapid selection :
  1 click = 1° FPA
  2 clicks = 100 ft/min V/S

CPIP2 (FCU MODIFICATION)

- V/S/FPA "push to level off" function.
  When pushing the V/S/FPA selector knob, V/S/FPA target is set to zero.
- 4 digits for V/S target.
  The V/S and FPA target are displayed in the window as followed :
  V/S : 4 digits
  FPA : 2 digits
- HDG/TRK target is synchronized when switching from HDG to TRK or vice versa.
- SPD/MACH, HDG/TRK, METRIC ALT switching pushbuttons are labelled.



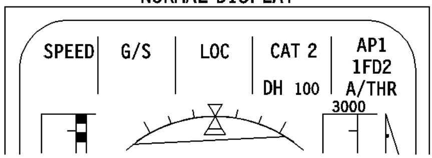
LOW ENERGY WARNING (FAC and FWC modification)

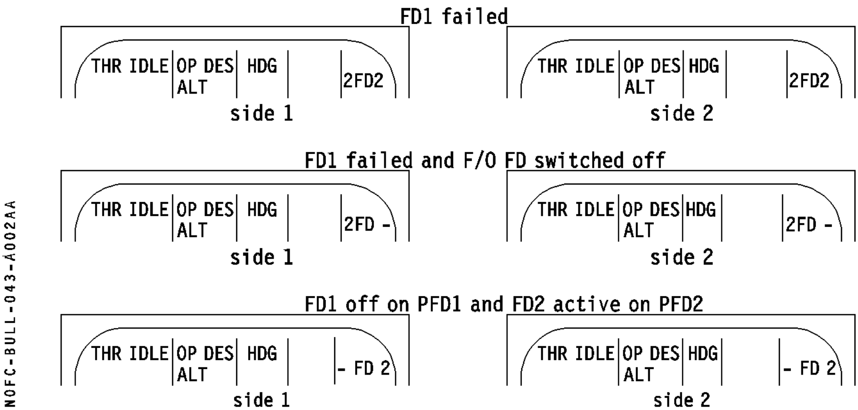
The low energy warning consists of an aural warning "speed speed speed" triggered every 5 seconds. This warning is available when conf $\geq$ 2 and 100 ft < RA < 2000 ft ; it indicates that the energy level is not sufficient to recover to a positive flight path angle with only pitch command. The thrust must be increased. This warning is generated before the alpha floor is triggered.

CPIP3 : FMA IMPROVEMENTS (DMC AND FWC MODIFICATION)

– Engagement status of both FDs are displayed on both PFDs :

NORMAL DISPLAY



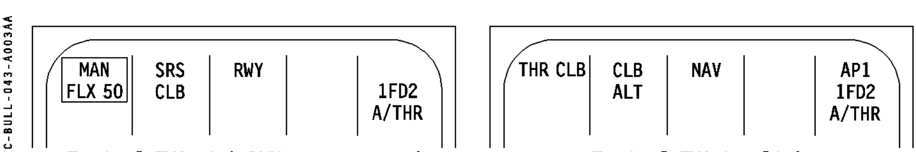


– A/THR annunciations are changed as follows :

* White colour and MAN label when the thrust levers are set manually in the corresponding detent. e.g. MAN TOGA, MAN FLEX, MAN MCT.
  MAN THR when the thrust levers are set above the applicable detent. The A/THR is armed (A/THR blue on FMA).

* LVR white (or amber) label whenever the thrust levers are not in the correct detent : (e.g. LVR CLB, LVR MCT, LVR ASYM)

* THR green label when the Thrust mode is active :
  THR CLB, THR MCT, THR IDLE.



Typical FMA with RWY mose engaged

Typical FMA in climb

– All AP/FD modes are displayed as abbreviations (no dashes) : (e.g. NAV, ALT CRZ, ALT CSTR).

– V/S or FPA target are displayed in the FMA : e.g. V/S:+0800

– Message and msg colours are changed as follows :
"MORE DRAG" white message instead of "AIRBRAKES"
"CHECK APP SEL" white message instead of "CHECK APP GUIDANCE"
"SET MANAGED SPD" white message instead of "SET AUTO SPEED"
"SET GREEN DOT SPD" white message instead of "SET VFTO"

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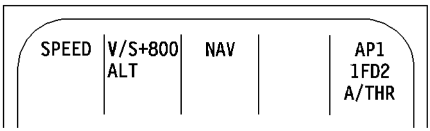


ENERGY MANAGEMENT IMPROVEMENT

(FAC, FWC, DMC, FADEC modification)

The ENERGY MANAGEMENT package is related to A/THR logic modification and additional ECAM announcements. The package eases the normal procedure of A/THR disconnection and improves the crew information on the current thrust setting.

A/THR disconnection using the instinctive disconnect pushbutton

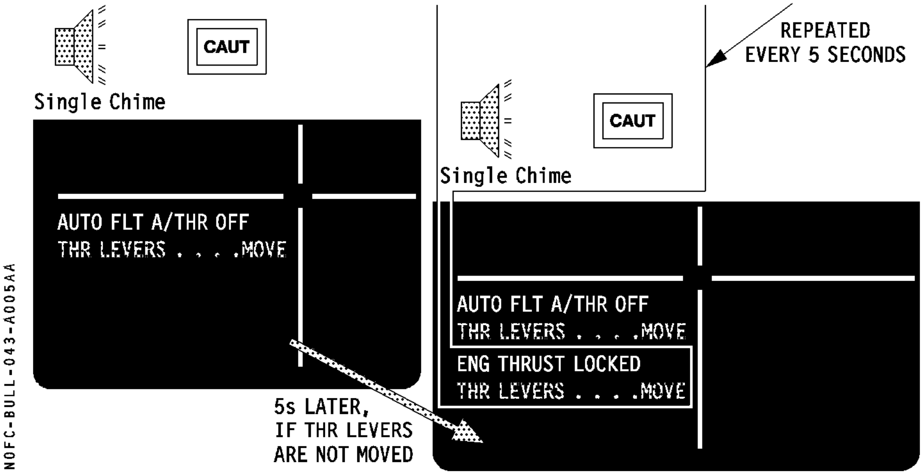
When the instinctive disconnect pushbutton is depressed :

* Thrust is immediately set to the thrust corresponding to the thrust lever position. (Thrust lock no longer effective).

* A gong sounds and the master CAUTION light illuminates for 3 seconds.

* AUTO FLT A/THR OFF is displayed on the ECAM for 9 seconds maximum.

A/THR disconnection due to a failure or an action on the ATHR FCU P/B when illuminated green :



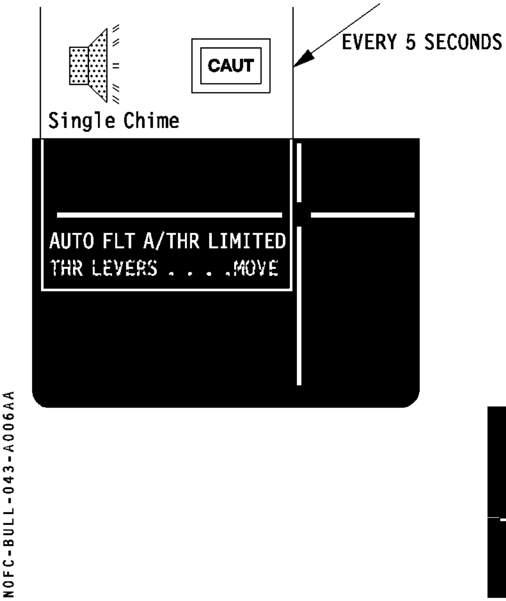
- THRUST LOCK is active until the thrust levers are moved out of corresponding detent (or alpha floor activates).
- Annunciation is enhanced as follows :
  - * Repetitive gong and master CAUTION light
  - * THR LK amber displayed on both PFDs
  - * AUTO FLT A/THR OFF displayed on ECAM
  - * Blue "THR LEVERS.....MOVE displayed on ECAM
  - * With a five second delay, flashing "ENG THRUST LOCKED"

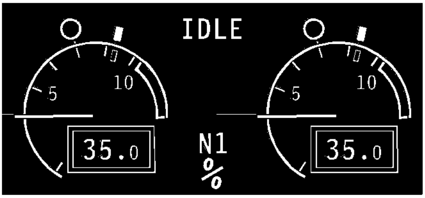
Thrust levers set below CL detent :

* Repetitive gong and master CAUTION light

* "AUTO FLT A/THR LIMITED" and "THR LEVER...MOVE" displayed on ECAM.

* LVR CLB displayed on FMA





IDLE announcement on ECAM.

When thrust is set automatically or manually at IDLE thrust, IDLE legend flashes green for 10 seconds then steady on ECAM EWD (adjacent to N1/EPR scale).

OPERATIONAL CONSIDERATIONS

- **FCU Modification (CPIP1 and CPIP2)**

The introduction of FCU modifications does not significantly modify the published procedures :

– V/S push to level off function
V/S = 0.0 selection may still apply ; the "push to level off" function is a easier action. In both cases, the crew must crosscheck with FMA.

– Different digits for V/S and FPA
The procedure which consists of crosschecking (and announcing) V/S or FPA value obtained on PFD remains mandatory.

– Synchronisation of HDG/TRK target
This allows the switching from HDG to TRK or vice versa with bank angle.
Airbus still recommends the switching with wings level.

LOW ENERGY WARNING

This feature provides an advanced warning to the crew before alpha floor is triggered. Standard procedures are unchanged and flight envelope remains the same.
Alpha floor and alpha protection are identical.

CPIP3

The announciations of the FMA are self explanatory. The procedure remains the same :

– Any mode change is to be checked and announced.
– When a new target is selected and activated through the FCU, the resulting guidance has to be checked on the PFD.

ENERGY MANAGEMENT

The main feature of the ENERGY management is the suppression of the thrust lock when the A/THR instinctive disconnect pushbutton is used.

The A/THR disconnection technique remains unchanged (described in Vol 3 Suppl Techniques 3-04-70), and may be summarized as follows :

– When A/THR is to be disconnected :
  * Move the thrust levers out of the applicable detent, to the current or desired thrust level
  * Depress the instinctive disconnected pb.

The new ECAM features facilitate the crew action but do not modify the procedures.

A318/A319/A320/A321 - FCOM BULLETIN

N° 44/2

DATE : APR 99

file in FCOM 3.08

SUBJECT : A320 IAE AUTOLAND LONG FLARE

Note : This Bulletin is only valid for aircraft equipped with FMGS full standard and powered with IAE engines.

REASON FOR ISSUE

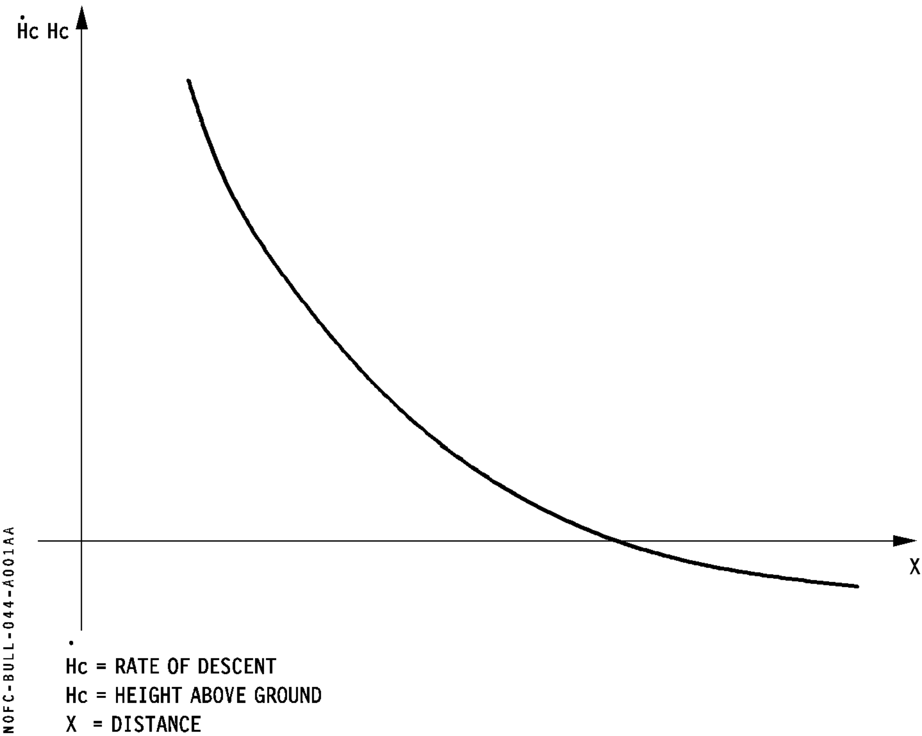
There has been long flares experienced at some airfields during autolands with A320 fitted with IAE engines.

AUTOLAND FLARE MODE

All Airbus aircraft use a similar flare mode for autoland. Flare Mode is initiated at a given radio altitude (RA) which can be either advanced or delayed by the rate of descent (ROD) – measured as a rate of change of radio altitude. The A320, flare mode is engaged at a mean RA of 43 ft, but it may occur as early as 50 ft.

Once the flare mode is engaged, the flare is commenced by an open-loop (pre-command) elevator input which is modified slightly according to the CG. The flare is continued with an additional closed-loop signal, and the aircraft tries to satisfy a profile with a given ROD and RA which both vary with distance (or time). The ROD is calculated as a rate of change of RA. See Figure 1.

The pitch demand given by the flare pre-command is modified by pitch demands for both the error between desired and actual RA and the desired and actual rate of change of RA to bring the pitch to zero ; the intent is to reduce both as a function of distance (or time) so that the aircraft touches down with a reasonable rate of descent in a reasonable distance.



$\dot{H}c$ = RATE OF DESCENT
Hc = HEIGHT ABOVE GROUND
X = DISTANCE

This flare is effectively what a pilot does during manual flare. As the ground approaches a pitch input is introduced to reduce the ROD ; the size of the input varies according to perception of the rate at which the ground is approaching.

CERTIFICATION REQUIREMENTS

The certification requirements for autoland are complex and impose many requirements on the system. Among performance requirements are limits on touch down vertical speed and distance from runway threshold. The ultimate limits on these parameters are a probability of less than one in a million (10^{-6}) of exceeding a touchdown velocity (Vz) of 10 ft/sec, and a landing distance less than 60 m or more than 900 m from runway threshold. There are also limits on lateral deviation from the centre-line at touchdown and throughout the roll-out and on bank and slip angle at touchdown. Flight test demonstrations and simulations must cover the full range of GW's, CG's, and winds.

There is no certification requirement to prove that the autoland system will work at all conceivable airports ; flight test demonstrations are done at any airport that is equipped with a Cat II capable ILS. However, simulations have to cover certain specific unusual runway profiles in addition to a standard (flat) profile. Runway slopes of ± 0.8% have to be considered, as well as a step of 20 ft occuring just before the threshold, and a rising slope of 12.5% occuring before the runway but terminating in a flat surface 60 m before the runway threshold. There is no requirement to consider them all at the same time. Both CFM and IAE versions of the A320 met all the certification requirements for autoland.

Landing distance calculations are also performed for autoland, and there is no specific autoland landing distance requirement if the calculated autoland distance is less than the certified manual landing distance. This is the case for both versions of the A320. The landing distance calculation for autoland uses a realistic airborne distance obtained from the flight test demonstrations – a mean distance plus 3 sigma variation – which is then added to a ground distance obtained from the manual landing tests but calculated for touchdown speeds obtained during the autoland tests.

Although a smaller factor is added to the combined air and ground distances – 15% instead of 67% – the same overall safety margin is considered to be achieved. Certified landing distance is always calculated using maximum braking and that airborne distances used to calculate manual landing distances are short and based on a speed of VLS (VREF) at 50 ft with the thrust levers reduced to idle at 50 ft.

DIFFERENCE BETWEEN IAE and CFM VERSIONS

The A320 fitted with CFM engines was the first to be certified. There are some small aerodynamic differences between the IAE and CFM aircraft (flap setting and different nacelle shape), it was necessary to develop a separate flare law for the A320-IAE. It was decided to take the opportunity to improve the autoland by reducing the touchdown vertical speed. This lead to a slight increase in touchdown distance. Figure 2 illustrates the difference in performance for the 2 aircraft. The values given are mean values for specific conditions ; there will be some scatter about these values.

	α **Location of impact point from runway threshold**	**Vz at impact**
CFM	454 m	– 3.1 ft/s
IAE	503 m	– 2.7 ft/s

The A320-CFM usually has a slightly higher vertical speed at touchdown, and the A320-IAE often has a longer landing distance, although both always remain within the cerfication limits when predicted scatter is taken into account. The desired improvement of a softer autoland touchdown with the A320-IAE was fully achieved while staying within the cerfication requirements.

IAE AUTOLAND FLARE

To achieve the desired reduction in touchdown Vz, the precommand open-loop elevator input was strengthened. The RA signal filtering has also changed, and although the profile of ROD versus RA was not modified, a more gradual round out is achieved with the different filtering of RA signal. This effectively softens the aircraft reaction to an error between the desired (value according to the profile) and actual values of RA and rate of change of RA.

The transition to the flare will occur at the same height – between 40 and 50 ft. The initial pitch change will be more positive ; thus, the ROD is reduced more rapidly with a slightly higher attitude during the initial part of the flare. When compared to some other autoland systems, the flare may last longer, the nose attitude at touchdown may be higher, the airspeed at touchdown may be lower ; but the touchdown will usually be softer !

EFFECT OF HIGH RATE OF DESCENT

A higher than usual rate of descent in the last part of the approach will cause the flare mode to engage earlier and thus the flare will be started earlier than is usual. This is similar to the reaction of a pilot doing a manual landing, with a high rate of descent at flare initiation.

EFFECT OF RUNWAY PROFILE

Variations in runway profile affect all autoland systems. In the case of the A320-IAE, a rising slope before the runway can cause the flare to be engaged at about 50 ft (instead of the mean value of 43 ft), and the aircraft may temporarily level out at about 20 ft with a relatively high nose-up attitude of about 10° before the pitch attitude is reduced and the descent is continued gently down to the runway. If, in addition, the runway has a negative slope, the descent will be further prolongued. However, the aircraft will always be seeking to re-establish itself on its flare profile. Some airfields may combine both situations.

In general, those systems designed to have higher touchdown vertical speeds will be susceptable to firm landings on up sloping runways whereas those systems which have soft touchdowns will be more susceptable to having long flares on descending runways.

A flare is a dynamic maneuver, and no two flares are ever exactly the same. The RA signal is filtered to avoid irregular variations, and the aircraft pitch reaction is limited in order to prevent over-reaction in the event of erroneous variations in signal. This limiting has been strengthened in order to satisfy the demands of the European certification authorities, and therefore modern systems are slightly more sluggish to respond to variations in RA signal which restricts the ability to cope with large variations in runway profile.

Although a flare may be prolonged, this does not necessarily mean that the touchdown distance is excessive.

The mean flare duration (from 50 ft to touchdown) recorded during certification flight test demonstrations was 8.1 sec for A320-IAE and 7.1 sec for A320-CFM with maximum flare durations of 10.5 sec (CFM) and 12 sec (IAE) on the two types.

A318/A319/A320/A321 - FCOM BULLETIN

N° 46/2
DATE : APR 99
file in FCOM 3.08

SUBJECT : CHARACTERISTIC AND PROTECTION SPEEDS

INTRODUCTION

The different speeds displayed to the crew on the main cockpit interfaces : PFD, MCDU, ND are computed by the FACs, the FMGCs and the ADIRS.

PFD	MCDU PERF PAGE
FAC COMPUTATION Computed on current aircraft status and configuration.	FMGC COMPUTATION Computed for take off, go around and landing.
VLS F S "O" Green Dot $V\alpha prot$ $V\alpha max$ Vsw (stall warning speed)	VLS of the selected landing configuration. F S "O" Green Dot

Each FAC computes its own speeds which are displayed on the relevant PFD.

FAC 1 on side 1
FAC 2 on side 2

Each FMGC computes its own speeds displayed on the relevant MCDU :

FMGC 1 on side 1
FMGC 2 on side 2

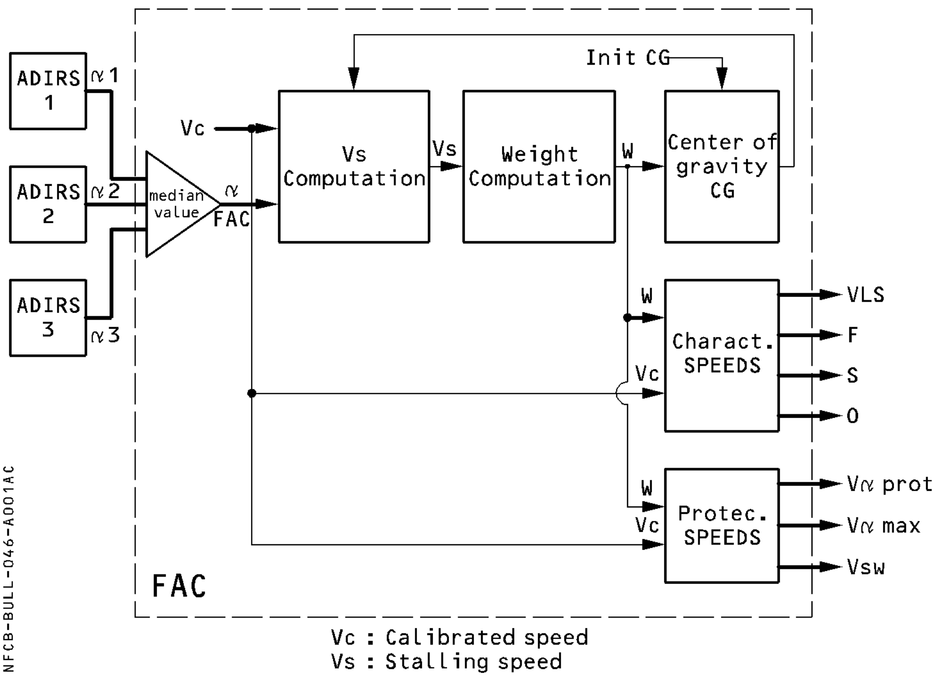
The algorithms used to compute the characteristic speeds are the same in both FAC and FMGC but as the inputs are different, the resulting values may differ.

CHARACTERISTICS SPEEDS COMPUTED BY THE FAC

The FAC computes its characteristic speeds with 2 main inputs from ADIRS (Angle of Attack (α) and calibrated airspeed (Vc)). It also uses THS position, SFCC data and FADEC data.

From these inputs, the FAC computes a stall speed Vs which is used to determine the aircraft weight.

The following sketch gives the basic architecture for FAC speed computation.

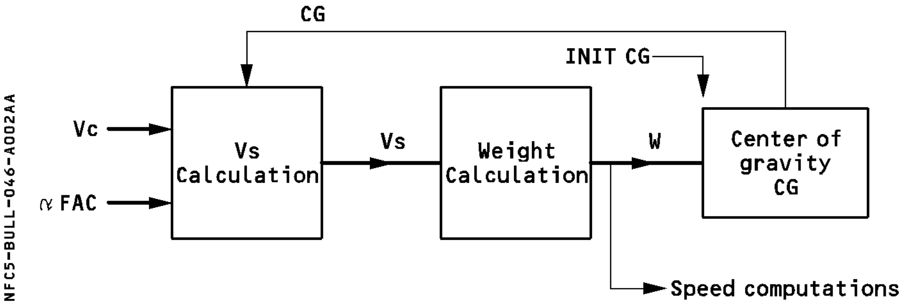


AOA DETERMINATION

The angle of attack value used to compute the characteristic speeds is the mean value of the 3 AOAs (Vote).

Accuracy of the AOAs is a paramount factor in the weight calculation.
0.3 degree of error in the AOA results in a 3 ton error in weight.

WEIGHT COMPUTATION



The weight is computed provided the following conditions are met.

- Aircraft altitude below 14600 ft and speed (Vc) below 240 kt
- Bank angle less than 5°
- Speedbrakes retracted
- No dynamic maneuver (vertical load factor lower than 1.07 g)
- No change of aircraft configuration and not in conf full.

When one of these conditions is not met, the last calculated weight value is considered and updated for the fuel consumption based on actual engine N1.

CHARACTERISTIC SPEEDS COMPUTATION

A320

VLS is computed from Weight and Vc and corrected for the current CG.

- If the current CG is forward of 15 %, 15 % CG is used to compute the speeds.
- If the current CG is between 15 % and 25 %, the speeds are computed using an interpolation between 15 % and 25 % CG.
- If the current CG is aft of 25 %, 25 % CG is used for speed computation.
  F, S, and Green dot are independent of CG.

A319-A321

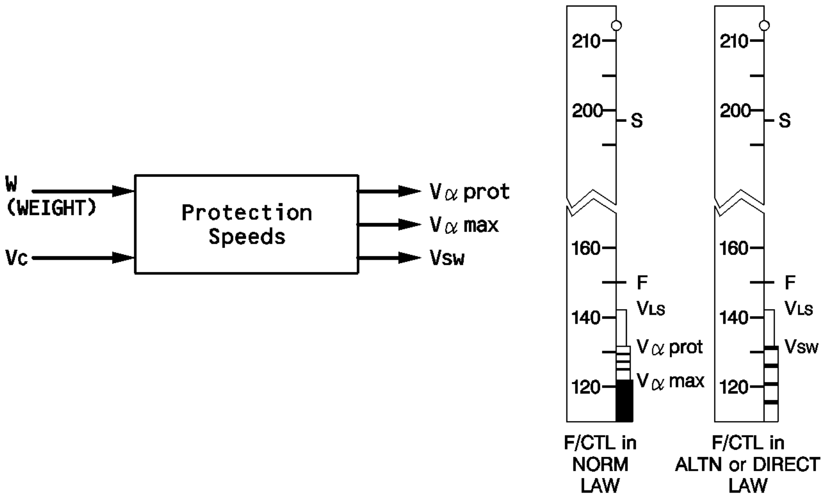
VLS, F, S and Green Dot are computed for a forward CG. No CG correction is applied for A319/A320 VLS as it has a negligible effect.

PROTECTION SPEEDS CALCULATED BY THE FAC

Vαprot and Vαmax are displayed in normal law.

The FAC does not trigger alpha prot and alpha max protection.
(The alpha prot and alpha max protection are activated by the ELAC).

V_{SW}, the stall warning speed is computed by the FAC in ALTN or DIRECT law. At V_{SW} speed, an audio warning (crickets – STALL synthetic voice) is triggered.



NFC5-BULL-046-A003AA

TOLERANCE OF FAC COMPUTED SPEEDS

Due to the data accuracy used to compute the characteristic speeds, and specifically the AOA accuracy, the precision of the computation is specified to be within 2.5 %.

During acceptance flight, the tolerances are as following :

Clean aircraft	Green Dot	± 5 kt
	VLS	± 4 kt
	Vαprot	± 5 kt
	Vαmax	± 5 kt
Conf full	VLS	± 3 kt
	Vαprot	± 5 kt
	Vαmax	± 5 kt

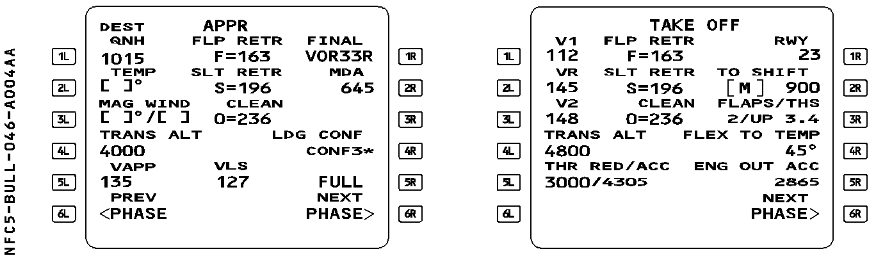
CHARACTERISTICS SPEEDS COMPUTED BY THE FMGC

Characteristic speeds computed by the FMGC are based on a predicted GW, CG (and selected configuration for landing) at a given time at landing for example.

GW and CG values are computed from entered ZFW and ZFWCG corrected for the predicted FOB and CG variation.

When the Approach phase is activated, the characteristic speeds are recomputed using the actual weight and CG.

The performance model used to compute the characteristic speeds, is accurate enough to provide speed errors of less than ± 2 kt from the certified speeds.



THE MOST FREQUENT QUESTIONS ON SPEED COMPUTATION

– **Why are the characteristic speeds computed by the FAC subject to inaccuracy greater than FMGC computation ?**

  Answer :

  The precision of the AOA measurement is usually the cause of speed differences.
  An error of 0.3 ° in AOA measurement causes a weight inaccuracy close to 3 tons.

– **Is the FMGC computation more accurate than the FAC computation ?**

  Answer :

  Algorithms are the same but the initial data are different.
  The FAC computes current dynamic speeds.
  The FMGS computes characteristic speeds for given phases (and configuration for landing).
  Usually, the FMGC characteristic speeds for landing are more accurate due to the tolerance of FAC inputs, if the ZFW was correct initially.

  Note : To determine the GW at landing, the FMGC uses the ZFW entered by the crew and adds the fuel on board.

  A significant difference between PFD and MCDU characteristic speeds may also indicate an error in the ZFW as entered by the crew.

– **Why are there two characteristic speed calculations ?**

Answer :

· The computation done by the FAC is independent of any manually entered data and provides permanent speed values displayed on the PFD.

· During approach, the comparison of characteristic speeds allows the crew to detect any speed discrepancy which may affect approach and final phases;

– **When a difference exists between computed speeds from FAC and FMGC, what are the best speeds to be relied on ?**

Answer :

Whenever differences are observed, Airbus recommends to rely on QRH values.
Refer to FCOM 4.06.20 p 7.

SUBJECT : GROUND SPEED MINI FUNCTION

GENERAL

When an approach is flown in managed speed mode, the crew will notice that the target speed (magenta) displayed on the PFD, is variable during the approach.
This approach target speed, also called IAS target, is computed in the FMGS using the "ground speed mini function".

The purpose of the Ground speed mini function is to take advantage of the aircraft inertia, when the wind conditions vary during the approach. The aircraft flies a target speed during the approach and the energy of the aircraft is maintained above a minimum level ensuring standard aerodynamic margins over stall.

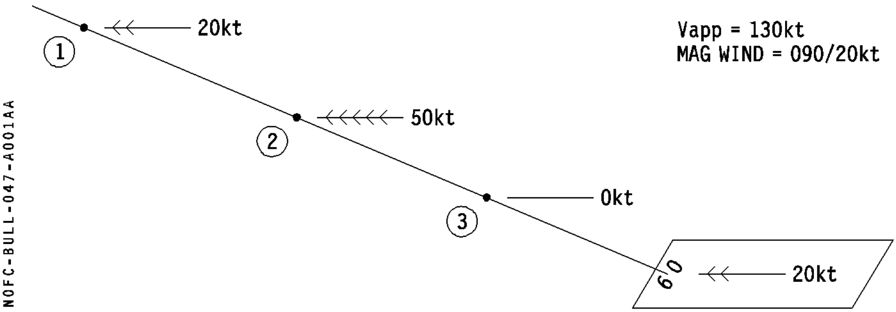
If the A/THR is active in SPEED mode, it will automatically follow the IAS target, ensuring efficient thrust management during the approach.

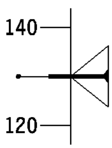
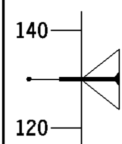
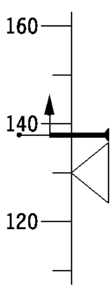
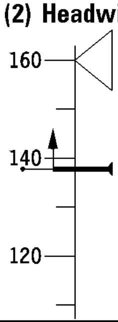
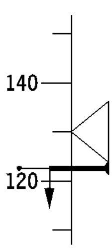
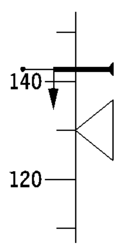
PRINCIPLE

The minimum energy level is based upon the ground speed the aircraft should have at touchdown, when landing at VAPP with the expected wind. It is called "GROUND SPD MINI".

During the approach, the FMGS continuously computes the IAS target to keep the ground speed at or above the "Ground Speed Mini", based upon the actual winds.
This IAS target is limited to VAPP
The IAS target is displayed on the PFD speed scale in magenta, when approach phase and managed speed are active. It is independent of the AP/FD and/or the A/THR engagements.

The following examples provide a comparison between the ground speed mini function versus the conventional selected speed hold function, in terms of speed target, and thrust management during an approach where winds are varying.



Conventional selected speed hold function	GS mini function
(1) Headwind 20 kt  N1 = 55% Speed Target 130 kt	**(1) Headwind 20 kt**  N1 = 55% IAS target 130 kt
(2) Headwind increases to 50 kt  * Current speed increases * Speed Trend is going up. * Thrust will be reduced to IDLE in order to match the speed target which remains unchanged.	**(2) Headwind increases to 50 kt**  * IAS target and current speed increases. * Speed trend is going up. * Thrust will be increased
(3) Headwind decreases to 0 kt  * Current Speed drops down * Speed Trend goes down. * Thrust is initially low and can be close to IDLE. ===> A/C energy is low. Thrust has to be significantly increased.	**(3) Headwind decreases to 0 kt**  * Current speed drops down from a higher speed. * Target speed drops down to VAPP * Speed trend goes down. * Thrust is initially high. ===> A/C energy is high. Thrust has to be smoothly reduced.

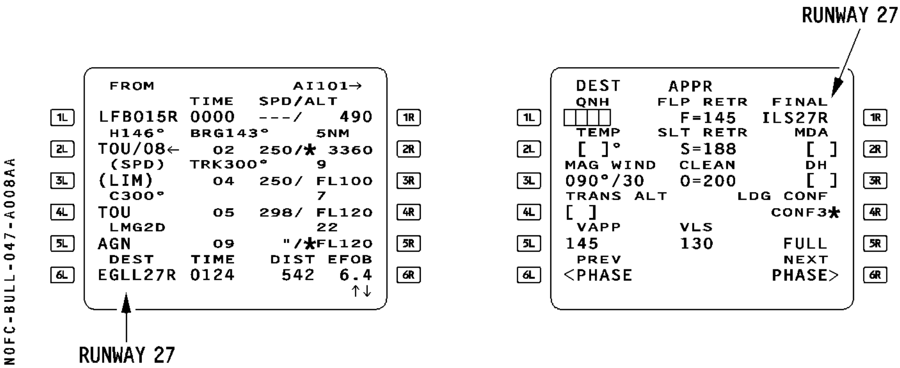
Ground speed mini function provides all the information necessary to manage the thrust smoothly and efficiently during the approach, in the event of gusts or horizontal windshears.

BASIC COMPUTATION

Wind is a key factor in the ground speed mini function.

TOWER WIND

It is the MAG WIND entered in the PERF approach page. It is the average wind as provided by the ATIS or the tower. Gusts are not inserted ; they are taken into account during ground speed mini computation.



TOWER HEADWIND COMPONENT

Component of the MAG WIND relative to the FMS runway axis.
The FMS Runway axis is the landing runway axis entered in the F-PLN and indicated on the PERF APPR page.

CURRENT WIND COMPONENT

Component of the actual wind measured by ADIRS, relative to the aircraft axis.

The three following formulae explain how the approach speed target (IAS target) is computed using the ground speed mini function. Note that this computation is different for the A320 and the A319, A321 or A320 with the modification which reduces VAPP (mod 25225).

VAPP COMPUTATION

	VAPP COMPUTATION
A320	VAPP = VLS + 5 kt + $\frac{1}{3}$ OF THE TOWER HEADWIND COMPONENT
A320 with Mod 25225 A319 / A321	VAPP = VLS + MAX (5, $\frac{1}{3}$ OF THE TOWER HEADWIND COMPONENT)

Wind correction limit : mini 0 kt, maxi 15 kt

VAPP may be changed manually by the crew if desired.

The 5 knots increment to VLS is an Airworthiness requirement when autoland is used. (CAT2 – CAT3)

Tower headwind component is counted positively.

In case of a tower tailwind, the wind correction is zero and VAPP = VLS + 5.

GROUND SPEED MINI COMPUTATION

The ground speed mini value is not displayed to the crew, but it is of interest to understand its principle.

GS mini = VAPP – TWR HEADWIND COMPONENT

- The TWR HEADWIND COMPONENT is counted positively.
- Its minimum value is 10 knots
- If the TWR HEADWIND COMPONENT is below 10 knots or if there is a TWR TAILWIND COMPONENT, GS mini = VAPP –10

APPROACH SPEED TARGET COMPUTATION (IAS target)

Approach speed target, also called IAS target is computed as the higher of :

- VAPP
- GS mini plus current wind component

IAS target = MAX(VAPP, GS mini + CURRENT WIND COMPONENT)

CURRENT HEADWIND COMPONENT is counted positively. CURRENT TAILWIND COMPONENT is counted negatively.
No max value limitation exists.

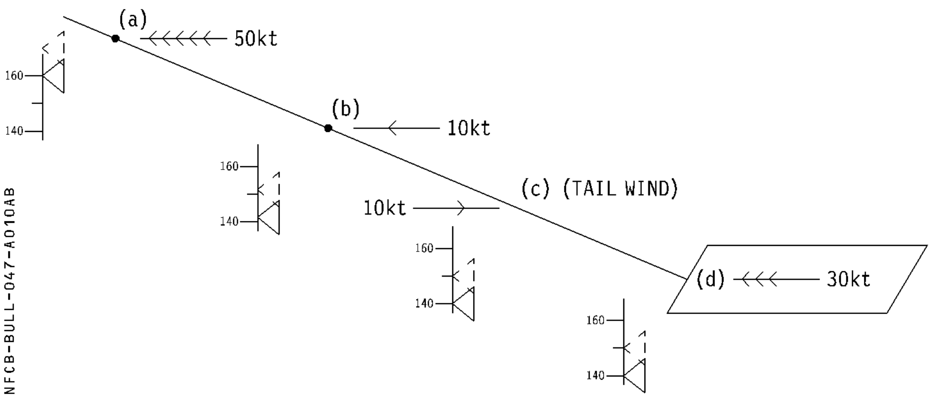
EXAMPLES

NORMAL APPROACH

- Approach on Runway 09 - FMS Runway 09
- TWR wind on PERF APPR page : 090/30
- VLS = 130 kt

COMPUTATION	A320 (basic configuration)	A320 (with Mod 25225) A319 – A321
VAPP	VAPP = 130 + 5 + $\frac{1}{3}$ of 30 = 145 kt	VAPP = 130 + MAX (5, $\frac{1}{3}$ of 30) = 140 kt
GS Mini	GS Mini = 145 – 30 = 115 kt	GS Mini = 140 – 30 = 110 kt

Current wind in Approach	IAS target (<) A320 (basic configuration)	IAS target (◁) A320 (with Mod 25225) A319, A321
(a) 090/50 (b) 090/10 (c) 270/10 (d) 090/30	MAX (VAPP, 115 + 50) = 165 kt MAX (VAPP, 115 + 10) = 145 kt MAX (VAPP, 115 − 10) = 145 kt MAX (VAPP, 115 + 30) = 145 kt	MAX (VAPP, 110 + 50) = 160 kt MAX (VAPP, 110 + 10) = 140 kt MAX (VAPP, 110 − 10) = 140 kt MAX (VAPP, 110 + 30) = 140 kt



CIRCLING APPROACH

The crew will insert (Primary F. PLN) the instrument approach to be flown to MDA. The secondary flight plan should contain final approach for the landing runway with the associated wind information.

During the circling maneuver, the crew must activate the secondary in order to provide valid ground speed mini information.

Example :

Instrument Approach on RWY 27
Circling Approach to RWY 09

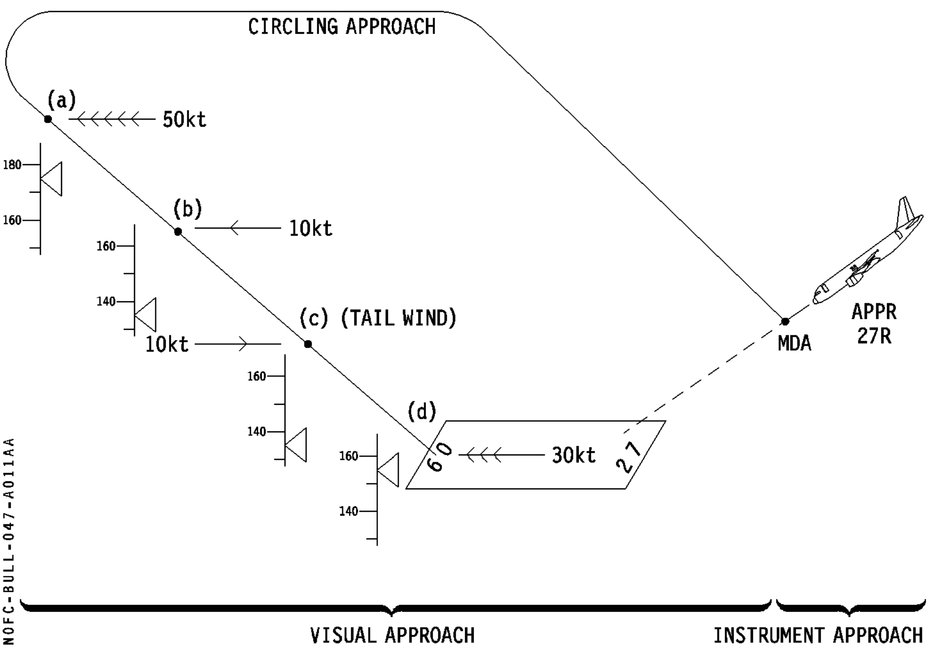
Winds a) 090/50 kt
b) 090/10 kt
c) 270/10 kt
d) 090/30 kt (TWR wind on PERF APPR)
VLS = 130 kt

The 3 formulae give the following results :

1. VAPP = 130 + 5 + Zero* = 135 kt for A320 basic configuration
= 130 + MAX (5kt, Zero*) = 135 kt for A320 with Mod 25225, A319, A321
* wind is considered as tail wind because RWY 27 is selected in the F-PLN.

2. GS Mini = 135 – 10 = 125 kt (10 kt default wind value)

3. IAS target = MAX (135, 125 + current headwind component).



The IAS target is function of the runway which is selected in the active flight plan.

Let us consider that the aircraft is actually on Final Approach onto Runway 09, the approach target speed in final will vary as follows in case Runway 27 or Runway 09 are inserted in the FMS F-PLN :

	A320 (basic configuration)	A320 (Mod 25225) A319, A321
Runway 27 selected in the F-PLN	Runway 09 selected in the F-PLN	Runway 09 selected in the F-PLN
VAPP = 135 kt GS MINI = 125 kt	VAPP = 145 kt GS MINI = 115 kt	VAPP = 140 kt GS Mini = 110 kt

SELECTED RUNWAY IN F-PLN	VAPP VALUE (PERF APPR PAGE)	GS MINI	ENCOUNTERED WINDS	IAS TARGET IN FINAL FOR RUWAY 09
(1) RUNWAY 09 A320	145 kt	115 kt	(a) 090/50	165 kt
			(b) 090/10	145 kt
			(c) 270/10	145 kt
			(d) 090/30	145 kt
(1) RUNWAY 27 A320 (Mod 25225) A319, A321	140 kt	110 kt	(a) 090/50	160 kt
			(b) 090/10	140 kt
			(c) 270/10	140 kt
			(d) 090/30	140 kt
(2) RUNWAY 27	135 kt	125 kt	(a) 090/50	175 kt
			(b) 090/10	135 kt
			(c) 270/10	135 kt
			(d) 090/30	155 kt

CONCLUSION

If the landing runway inserted in the FMGS F.PLN is different from the actual landing runway, MANAGED APPROACH SPD shall not be used since the resulting targets may be significantly too high. (This rule applies wherever the FMS landing runway axis is different by 30° to the actual landing runway axis).
In this case, select the approach speed directly on the FCU.

A318/A319/A320/A321 - FCOM BULLETIN

N° 48/2
DATE : APR 99
file in FCOM 3.08

This FCOM Bulletin supersedes the FCOM Bulletin n° 18.
Item A of Bulletin n° 18 has been incorporated in FCOM Vol. 3.
Item C is no longer applicable.

SUBJECT : MMEL AND MEL USE

REASON FOR ISSUE

To provide Airbus operators with a simple explanation of the relationship between the MMEL and MELs, and how to use an MEL.

PURPOSE OF THE MMEL

The main purpose of the MMEL is to **permit the dispatch** of an airplane with pieces of equipment or functions inoperative, when a failure has been detected in the previous flight or in transit, and to avoid as much as possible delays and cancellations.
The MMEL is issued by Airbus Industrie and approved by DGAC for non US operators and issued and approved by FAA for US operators.

FROM THE MMEL TO AN MEL

Regulation requires that each operator prepares and keeps current an MEL using the MMEL as a guide line. **The MMEL cannot in any case be used as an MEL.**
A MEL cannot be less restrictive than the MMEL and should **cover all the items depending on National Regulations.** In particular, conditions indicated "as required by regulations" in the MMEL should be fully identified in the MEL.
The MEL is agreed/approved by National Authorities.

CONTENTS OF THE MEL

An airline's MEL should contain the following information :

- The list, agreed/approved by National Authorities of all pieces of equipment or functions which may be inoperative for dispatch.
  This list is established using the DGAC approved section 01 of the MMEL.
- The operational procedures extracted from the MMEL Section 02
- The maintenance procedures extracted from the MMEL Section 03 and / or from the AMM. (Aircraft Maintenance Manual).
- The list of the ECAM warnings, associated with the corresponding MEL entry point, extracted from the MMEL Section 00.

HOW TO USE AN MEL

When a failure is identified, the crew must enter in the airline's MEL **to determine if a subsequent dispatch is allowed and under which conditions.**

- The agreed/approved section of the MEL indicates the conditions which must be fulfilled for dispatch.
  All items are listed following ATA (Air Transport Association) classification (see below).
  All items not listed in this section are NO-GO (dispatch prohibited) except equipment or functions which are obviously not affecting airworthiness or flight safety.
- If an (o) is associated with the item, an operational procedure must be applied.

  On ground and / or in flight, crew actions are required and described in the operational procedures section of the MEL.
- If an (m) is associated with the item, a maintenance procedure must be applied.

  Before dispatch, maintenance actions are required and described in the maintenance procedures section of the MEL or in the AMM.
  If approved by National Authorities, other personnel may be qualified and authorized to perform certain functions. Procedures requiring specialized knowledge or skill, or requiring the use of tools or test equipment should be accomplished by maintenance personnel.

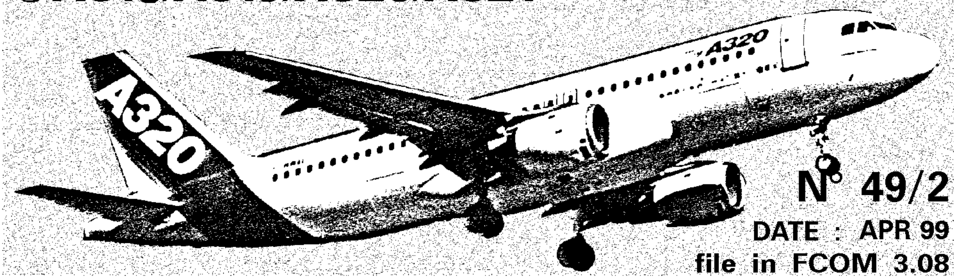
ATA 100 FORMAT

The ATA (Air Transport Association) format is the official reference for the classification of airplanes systems and / or functions.

This is achieved using 6 digits (ex : 21-23-00 ELECTRONICS RACKS AIR EXTRACTION).

The two first digits for the ATA chapter (ex : 21 – AIR CONDITIONING), and remaining digits for system and function classification in the ATA chapter.

A318/A319/A320/A321 - FCOM BULLETIN



N° 49/2

DATE : APR 99

file in FCOM 3.08

SUBJECT : ILS1/ILS2 GLIDESLOPE DISCREPANCY ON SPECIFIC TYPE OF ILS

Note : This FCOM Bulletin is only valid for aircraft equipped with ILS Allied Signal receivers standard anterior to RIA 35A standard (mod 23315).

SITUATION

A discrepancy has been determined on aircraft equipped with Allied Signal ILS receivers at specific ILS ground station type. This is due to a combination of Allied Signal ILS performance degradation associated to specific dual carrier frequency ILS transmitter.

TECHNICAL EXPLANATION

When the Allied signal ILS receiver ages, the oscillator frequency controlled by a crystal starts drifting. As a consequence, the glide slope intermediate frequency is distorted. This induces a change of the glide slope signal amplitudes and generates an incorrect glide slope indication to the crew.
Due to the specific dual carrier frequency ILS, it always generates a fly up indication on the corresponding PFD.

This fly up indication results in flying a higher than normal glide slope.
Since receivers do not age in the same way, the second ILS usually provides a normal indication.

OPERATIONAL CONSEQUENCES

All consequences of this ILS malfunction were assessed and results are considered as minor either during manual or automatic landing.

* When the crew flies the ILS affected by this discrepancy, the aircraft is guided on a higher than normal glide slope but the touch down zone is not modified.
* Aircraft landing performance are not affected by this discrepancy.

In the most adverse cases, the crew would receive the following warnings : excessive deviation alert followed by autoland warning if the aircraft is below 200 ft.

When encountering this discrepancy, the crew shall apply the normal procedure as described in FCOM 4.05.70 or SOP 3.03.18).

Airworthiness review meeting agreed with the technical explanations and the effectiveness of the current procedures.

This discrepancy is addressed by Airbus Industrie service bulletin A320-34-1056 and Allied Signal service bulletin RIA-35A-34-95.

A318/A319/A320/A321 - FCOM BULLETIN

N° 50/2

DATE : APR 99

file in FCOM 3.08

SUBJECT : PUBLICATION OF SOME ATTENDANT INFORMATION BULLETINS

EMERGENCY LIGHTING SYSTEM

REASON FOR ISSUE :

Some cases of exit signs not illuminating during takeoff, landing and on ground have been reported.
In normal operation with the "EMER EXIT LT" switch 4WL (25VU) in "ARM" position and the "NO SMOKING" switch 190RH (25VU) in auto position the exit signs extinguish only when the "NO SMOKING" signs extinguish at landing gear retraction and illuminate again at landing gear extention.

Investigation revealed that the emergency power supply unit could remain frozen after power transfer.

PROCEDURE :

During taxi and before landing check exit signs for proper illumination.
If one or more exit signs are not illuminated, perform a reset of the emergency power supply by :

I) From attendant panel
   - Press the "EMERGENCY" push button 120RH once on flight attendant panel.
   - Wait approximately 4 seconds
   - Press the "EMERGENCY" push button 120RH again to recover normal configuration.

or

II) From the cockpit
   - Select the "EMER EXIT LT" switch on panel 25VU to "ON" position
   - Select the "EMER EXIT LT" switch to "ARM" position.

If normal operation is not recovered, maintenance action is due before the next flight unless the dispatch is authorized by the MEL.

DELIBERATE INHIBITION OF AMBIENT LAVATORY SMOKE DETECTORS

(A/C WITH MOD 22561)

EXPLANATION :

When the smoke detector grill is removed and foreing objects like tissue paper or plastic bags are packed around the detector (see graphic overleaf), the result will have a serious impact on the detection system. The detector may not be able to "sample" the air.

PROCEDURE :

The cabin crew is recomended to inspect the lavatory smoke detectors for tampering before every flight. If foreign bodies or sign of tampering are found, line maintenance should be informed.

VACUUM TOILET RINSE VALVE LEAKAGE (A/C WITH MOD 26145)

EXPLANATION

An increase in vacuum toilet rinse value leakage has been experienced. Leakage at the vacuum toilet rinse valve in the forward lavatory may lead to water flooding in the cockpit with possible water spillage in the avionic bay.

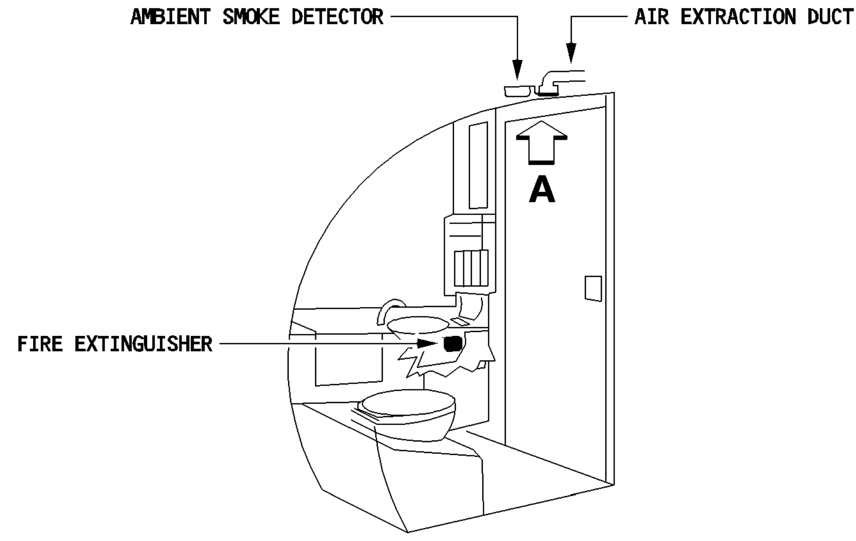
ACTION

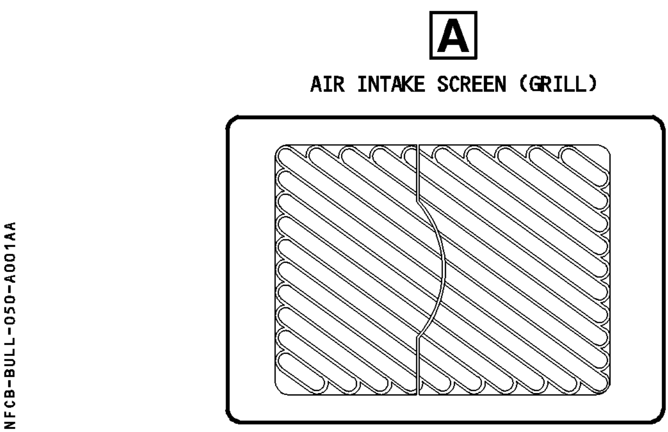
Airbus Industrie has initiated a modification consisting of the introduction of an improved rinse valve.

PROCEDURE

Pending the introduction of the improved rinse valve, it is recommended that the cabin crew perform a toilet flush in each lavatory before the first flight of the day. This should minimize the effect of possible overnight deposit inside the valve by draining the content.

The cabin crew should advise the maintenance if abnormal water accumulation is found.





This grill is a cover for the ambient smoke detector and the air extraction duct. The view shown is how the grill would appear when looked at from below.
This grill can be removed. Foreign objects (tissues, plastic bags) have been found packed around the ambient smoke detector.

A318/A319/A320/A321 - FCOM BULLETIN

N° 51/2

DATE : APR 99

file in FCOM 3.08

SUBJECT : ERRONEOUS AIRSPEED/ALTITUDE INDICATIONS

BACKGROUND

Two recent fatal accidents on non-Airbus aircraft and several reported incidents attributed to unreliable speed and/or altitude indications have prompted the need to improve flight crew awareness to identify and tackle failures described in this bulletin.

Most failures modes of the airspeed/altitude system are detected by the ADIRS and lead to the loss of the corresponding cockpit indications and the triggering of the associated ECAM drills.

However, there may be some cases where the airspeed or altitude output is erroneous without being recognized as such by the ADIRS. In these cases the cockpit indications are apparently normal but false and pilots must rely on their basic flying skills to identify the faulty source and take the required corrective actions. When only one source provides erroneous data, the straightforward cross check of the parameters provided by the 3 ADR's allows the faulty system to be identified. This identification becomes more difficult in extreme situations when two, or even all three, sources provide erroneous infomation.

This FCOM Bulletin provides the following information :

1 – Recall of pitot/static system layout

2 – Situations which may lead to erroneous airspeed/altitude indications

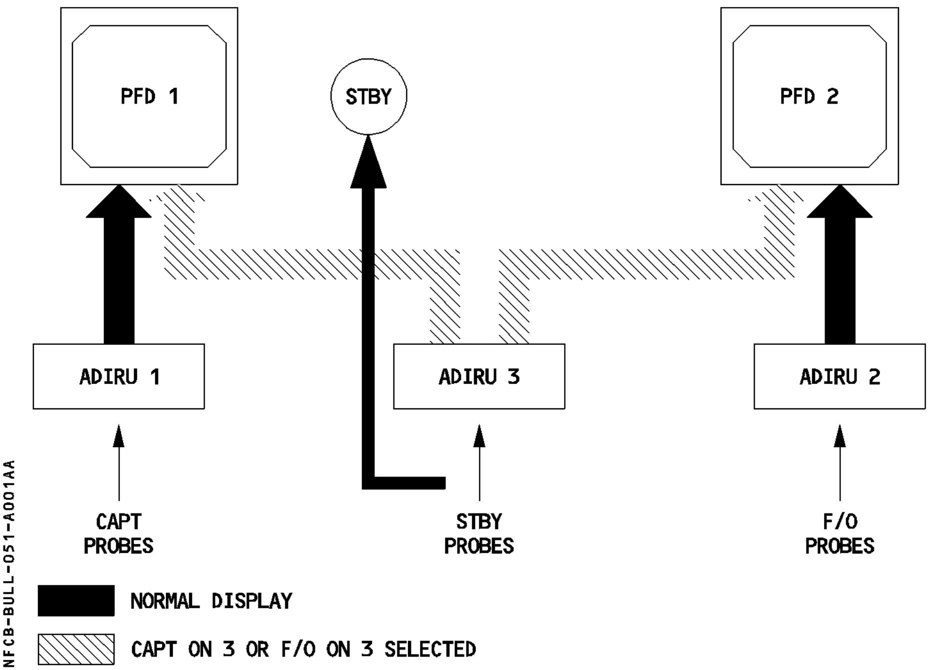
3 – Consequences of various failure cases

4 – Recall of AI recommended operational procedures

DISPLAY ARCHITECTURE

The CAPT side pitot and static probes supply the ADIRU 1 which is used, normally, for display on CAPT PFD.
The F/O side pitot and static probes supply the ADIRU 2 which is used, normally, for display on F/O PFD.

The STBY pitot and static probes supply the ADIRU 3, which can be used for display on either PFD in case of failure. They also supply directly the stand-by instruments.



MAIN REASONS FOR ERRONEOUS AIRSPEED-ALTITUDE DATA

The most probable reason for erroneous airspeed and altitude information is obstructed pitot tubes or static sources. Depending on the level of obstruction, the symptoms visible to the flight crew will be different but on all cases the data provided by the obstructed probe will be false. Since it is highly unlikely that the probes on an aircraft be obstructed at the same time, by the same amount and in the same way, the first indication available to flight crews of erroneous airspeed-altitude data will most probably be a discrepancy between the various sources.

CONSEQUENCES OF OBSTRUCTED PITOT TUBES OR STATIC PORTS

All aircraft systems using anemometric data have built-in fault accommodation logics. The fault accommodation logics are not the same for the various systems but all rely on voting principles whereby when one source diverges from the average value it is automatically rejected and the system continues to operate normally with the remaining two sources. This principle applies to flight controls and flight guidance systems.

Normal situtation

Each ELAC receives the speed information from all ADIRU.
It compares the 3 values.
Pressure altitude information is not used by the ELAC.

Each FAC (Flight Augmentation Computer) receives the speed information from all ADIRU.
It compares the 3 values.
Same check is performed by the FMGC on speed and altitude information.

If one ADR output is erroneous and the two remaining ADR are correct :

The ELAC, the FAC and/or the FMGC eliminate it without any cockpit effect (no caution, normal operation is continued), except that one display is wrong and CATIII dual can no more be available on the FMA.

If two ADR outputs are erroneous but different, and the remaining ADR is correct, or if all three are erroneous but different :

The autopilot and the autothrust are disconnected (whichever autopilot is engaged).
The ELAC triggers the F/CTL ADR DISAGREE ECAM caution.
It reverts to Alternate law (without high and low speed protection).
On both PFD, "SPD LIM" flag is shown, no V_{LS}, no V_{SW} and no V_{MAX} is displayed.

This situation is latched until an ELAC reset is performed on the ground without any hydraulic pressure.

However, when one ADR is correct but the other two ADR provide the same erroneous output or when all three ADR provide consistent and erroneous data, the systems will reject the "good" ADR and will continue to operate normally using the two "bad" ADR. This condition can be met when, for example, two or all three pitot tubes are obstructed at the same time, by the same amount and in the same way. Flight through cloud of volcanic ash, takeoff with two pitots obstructed by foreign matter (mud, insects).

The human being (the pilot) tends to use the same type of "fault accommodation" principles to detect an erroneous IAS/altitude indication. Flight crews will tend to reject the outlier information if the two other outputs are consistent. This choice is, in the great majority of cases, correct, but all flight crews should be aware of very extreme and unlikely situations where two (or even three) speed/altitude indications can be consistent and wrong.

BEWARE OF INSTINCTIVELY REJECTING AN OUTLIER ADR

The following chart provides a, non-exhaustive, list of the consequences on the airspeed and altitude indications of various cases of partially or totally obstructed pitot tubes and static ports. It should be noted that the cases described below cover extreme situtations (e.g totally obstructed or unobstructed drain holes) and that there could be multiple intermediate configurations with similar, but not identical, consequences.

FAILURE CASE	CONSEQUENCES
Water accumulated due to heavy rain Drain holes unosbtructed	Transient speed drop until water drains IAS fluctuations IAS step drop and gradual return to normal
Water accumulated due to heavy rain Drain holes obstructed	Permanent speed drop
Ice accretion due to pitot heat failure or transient pitot blocked due to severe icing Unobstructed drain holes	Total pressure leaks towards static pressure IAS drop until obstruction cleared/fluctuation if transient erratic ATHR if transient
Ice accretion due to pitot heat failure or pitot obstruction due to foreign objects Obstructed drain holes	Total pressure blocked Constant IAS in level flight until obstruction cleared In climb IAS increases In descent IAS decreases Abnormal AP/FD/ATHR behavior : a) AP/FD pitch up in OPN CLB to hold target IAS b) AP/FD pitch down in OPN DES to hold target IAS
Total obstruction of static ports on ground	Static pressure blocked at airfield level Normal indications during T/O roll After lift-off altitude remains constant IAS decreases after lift-off IAS decreases when aircraft climbs IAS increases when aircraft descends

From the information given in the preceeding chart, it is clear that no single rule can be given to identify conclusively all possible cases of erroneous airspeed/altitude indications. However, any case of erroneous speed/altitude indications will always be associated to one (or more) of the following cues :

a) Fluctuations of airspeed indications
b) Abnormal correlation of the basic flight parameters (IAS, pitch attitude, thrust, climb rate)
   – IAS increasing with large nose-up pitch attitude
   – IAS decreasing with large nose down pitch attitude
   – IAS decreasing with nose down pitch attitude and aircraft descending

c) Abnormal AP/FD/ATHR behavior
d) Undue stall warning or overspeed warnings
d) Reduction of aerodynamic noise with increasing IAS
e) Increase of aerodynamic noise with decreasing IAS

RECOMMENDED PROCEDURES

The procedures described below are intended to provide flight crews with general guidelines to be applied in case of suspected erroneous airspeed/altitude indications.

FOLLOW ECAM ACTIONS If failure undetected : CROSS-CHECK ALL IAS/ALTITUDE SOURCES : ADRl, ADR2, ADR3 AND STAND-BY INSTRUMENTS

If it is obvious that the outlier is wrong, select the corresponding ADR OFF and reconfigure the PFD indications accordingly by applying the ECAM drill which will be displayed automatically.

Flight crews should however be aware that in very extreme circumstances, it may happen that two, or even all three ADR may provide identical and erroneous data. Therefore the suspect ADR should only be switched OFF if it is positively confirmed that the two other ADR are correct. If in doubt :

DISCONNECT AP, FD AND ATHR FLY TARGET PITCH ATTITUDE AND THRUST SETTING

The immediate pitch attitude and thrust values given in the QRH should be considered as "Memory Items" since they ensure safe aircraft control and flight path during the time necessary for the crew to refer to the QRH. These target pitch attitude and thrust value ensure that the aircraft will climb what ever the flight phase and aircraft configuration (weight and slat/flaps).
Once the target pitch attitude and thrust values have been stabilized, the expanded data of the QRH (Flight with Unreliable Speed Indication) should be followed to determine the precise pitch attitude and power setting required as a function of the aircraft's weight, configuration and desired speed.

After applying the QRH procedure and when the aircraft is stable, the flight crew should try to identify the faulty ADR (one or more). Once the discrepant ADR has (or have) been positively identified, it (they) should be switched OFF. This will trigger the corresponding ECAM warnings and the associated drills which should be followed to address all the consequences on the various aircraft systems.

A318/A319/A320/A321 - FCOM BULLETIN

N° 52/1

DATE : OCT 99

file in FCOM 3.08

SUBJECT : EGPWS DATABASE

Purpose

Airbus Industrie has received some reports of EGPWS warnings that were unduly triggered due to airport data missing from the database.
It is the Airlines responsibility to identify the airport(s) where the terrain data is missing from the database. During operation around such airports, the enhanced function must be switched off (TERR pushbutton OFF on overhead panel) when the aircraft position is less than 15NM from the runway.

The purpose of this bulletin is to provide the operators and the flight crews with additional information regarding the EGPWS database and the EGPWS system reaction when the airport/terrain data is not included in the database.
The FCOM 3.01.34 and the Aircraft Flight Manual (AFM) refer, providing limitations of the system.

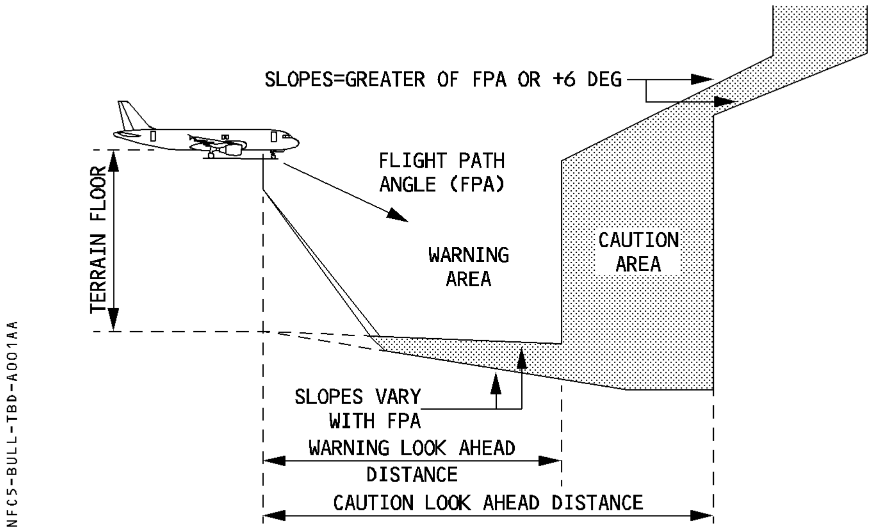
1. The Enhanced GPWS functions

The purpose of the Enhanced Ground Proximity Warning System (EGPWS) is to alert the crew of potential hazardous conditions with regards to Controlled Flight into Terrain (CFIT).

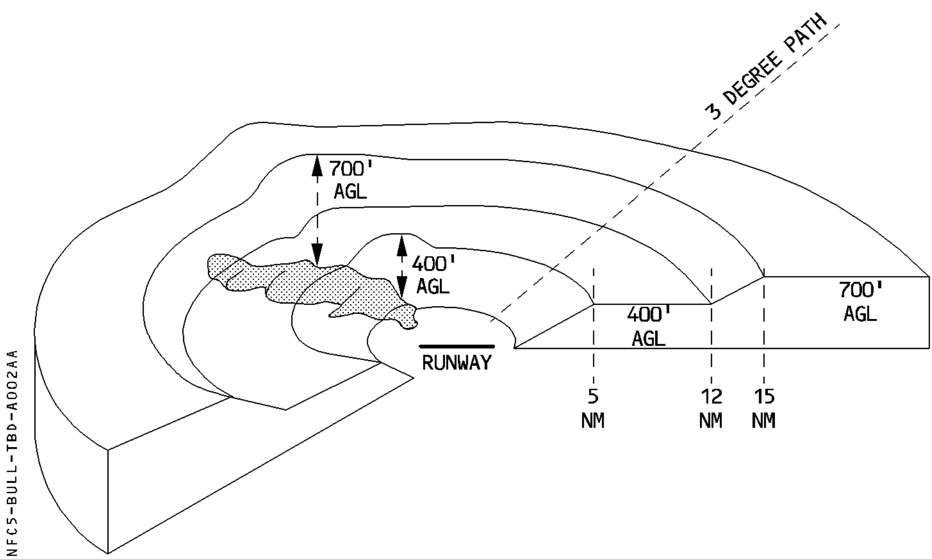
Two enhanced functions have been added to the basic modes of the GPWS. These functions are the following :

– Terrain Awareness and Display (TAD)
– Terrain clearance Floor (TCF)

- The Terrain Awareness and Display (TAD) function compares the aircraft FMS position with the local terrain in the database. It also computes two envelope boundaries ahead of the aircraft. When terrain data conflicts with one of these envelopes, specific aural and visual alerts are triggered.
  This function also provides terrain data display on the Navigation Display (ND)



- The Terrain Clearance Floor (TCF) function computes a terrain clearance envelope around the airport runway. It is based on current aircraft location, nearest runway center point position included in the database and radio height. When the aircraft enters this envelope, an alert "TOO LOW TERRAIN" is produced even if the aircraft is in landing configuration. This alert protects against an attempt to land where there is no airfield. This can be the case for example when descending by mistake on a wrong vertical path during a non-precision approach. This function operates during any flight phase.



2. The EGPWS database

The terrain database divides the Earth surface into grid cells. These cells are recorded upon the WGS-84 geographic coordinate system for longitude and latitude data. Each cell records the highest terrain altitude in the respective terrain area.
The resolution of the grid varies upon the geographic location, ranging from :

- 0.25 NM x 0.25 NM
- 0.5 NM x 0.5 NM
- 1 NM x 1 NM
- 2 NM x 2 NM
- 5 NM x 5 NM

The highest resolution (0.25NMx0.25NM) is used around the airports. This is to avoid producing alerts during normal procedures (the terrain database has to reflect as closely as possible the actual terrain). The lowest resolution (5NMx5NM) is used outside airports where such a coarse terrain database cannot interfere with normal en-route trajectories. The database also contains the position of the airport runway center point. This concerns all hard surface runways (wathever the surface type is) longer than or equal to 3500 ft.

Additionally, the database gives the possibility of incorporating data regarding man-made obstacles in the vicinity of the major airports.

3. EGPWS reaction when airport data is missing from the database.

When an airport/terrain data is not yet covered by the database, the TCF envelope cannot be defined. The system uses the lowest map resolution (5NMx5NM) as no airport is detected. Therefore, early and unexpected TAD cautions and warnings are triggered. The red EGPWS legend of the GPWS/G/S pushbutton comes on, the aural warnings "TERRAIN AHEAD" and "TERRAIN AHEAD, PULL-UP" sound and the terrain image pops up on the Navigation Display. When within 15NM, it is recommended to switch off the enhanced functions (EGPWS TERR pushbutton switched to OFF on overhead panel) for operations from/to runways not incorporated in the database (FCOM 3.01.34 refers).

4. The EGPWS database update

The database update is under the responsibility of the vendor.
The vendor may use one or more sources of data for a particular airport :

1) Data from in-country government and/or regulatory agencies.
2) Data from airlines that have surveyed an airport while establishing layout, approach/departure procedures, etc.
3) Data from commercial vendors who also produce data sets for FMS and other navigational systems.
4) Data from commercial and military surveying agencies that make such information publicly available.
5) Airport layout and physical properties from high-resolution maps and/or digitized data sources.
6) Airport layout and physical properties from imagery.

Some difficulties may be encountered in some areas to compile and validate airport data

For an official indication of the latest EGPWS database, as well as a list of covered airports, please review the manufacturer document, EGPWS Terrain Database Airport Coverage list. This document can be acquired by contacting.

Christine STAHL, Database Manager,
Allied Signal – 1500 NE 36th Street
REDMOND WA USA 98073
Telephone : (1)(425) 885-8847
Fax : (1)(425) 885-2994
Email : christine.stahl@allied.signal.com
Internet : WWW.egpws.com

5. Conclusion

The enhanced functions of the EGPWS are not reliable when operating around airports which are not included in the database. In this case, these functions must be switched off (TERR pushbutton off on the overhead panel).
It is the airlines responsibility to identify with the database manufacturer the airports where terrain data is missing.

Airbus Industrie strongly recommends to the airline to report to the database manufacturer and to their local airworthiness authorities any EGPWS warning occurence due to airport data missing from the database. It is also recommended that airlines request that their national authorities publish the necessary data in order that the database manufacturer can extend the database coverage to all operated airports.

A318/A319/A320/A321 - FCOM BULLETIN

N° 53/2

DATE : JUL 01

file in FCOM 3.08

R This FCOM BULLETIN supersedes the bulletin N° 53/1 dated OCT 00

SUBJECT : USE OF FINAL APP MODE AND NAV DATABASE VALIDATION.

1. BACKGROUND

The purpose of this FCOM Bulletin is to highlight SOP recommendations for the use of the FINAL APP mode.

The current body of published Instrument Approach Procedures (IAP) includes "old style" procedures in overlay to radio navaid based procedures, which cannot always be coded in the navigation database in a suitable manner for satisfactory FMGS guidance in approach.

Note : RNAV procedures are in general designed and coded for optimum FMGS guidance in FINAL APP mode.

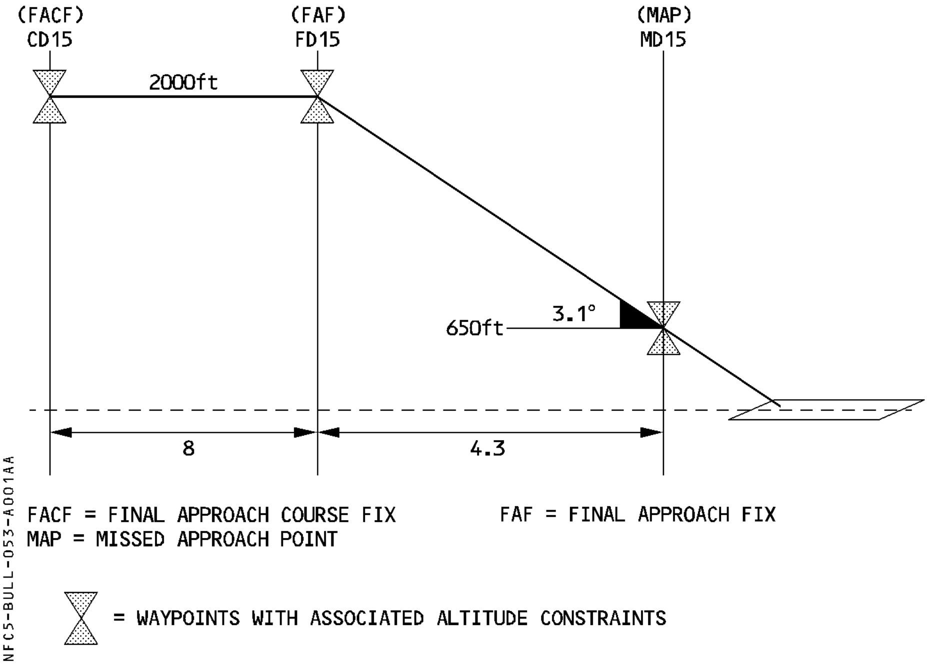
A validation of the navigation database should ensure that the IAP is of a type eligible and is correctly coded so that the aircraft in FINAL APP mode will fly a constant flight path angle from FAF to the runway with the required obstacle margins.

Different methods or processes can be used to validate the IAP coded in the navigation database, or to ensure crews do not attempt to use FINAL APP when not authorized.

One method is to fly each approach in a simulator or with the aircraft in VMC conditions.
An IAP that is regularly and correctly flown in FINAL APP mode can be considered as validated.
Airbus Industrie Flight Operations Support gives another method of validation in the document "Navigation Database Validation for FINAL APP mode use".
This method requires dedicated software to read the navigation database diskette. The listing of the coded IAP is then assessed by comparison with the approach chart.
Airlines should provide crews with a list of IAP approved for use of FINAL APP mode, or remove the IAP that are not validated from the navigation database.

R **2. IAP AND CODING REQUIREMENTS**

In addition to the navigation database validation, the crew is expected to perform a FM F-PLN check prior starting the appraoch.
To perform this check, including the check of the vertical flight path on MCDU, before starting the approach, the flight crew needs to have some basic knowledge of approach coding requirements.
To illustrate our purpose, the following drawings show the coding of an IAP with the MAP before the runway and the associated MCDU display.



	UTC	SPD /	ALT
....	......	......	......
C144°			
CD15L	......	......*	2000
C144°	TRK144°	8	
FD15L	......	......*	2000
C144°		4	-3.1°
MD15L	......	......	650
....			

The final approach consists in a sequence of at least two waypoints but more often of 3 or 4 waypoints.
In the above example the 3 waypoints are the FACF, the FAF and the MAP. Sometimes the MAP is located at the runway threshold or after the runway threshold. We will see that it is important for the crew to identify the position of the MAP.
Sometimes a Step Down Fix (SDF) is added on the approach final descent between the FAF and the MAP.
The SDF is not necessarily identical to the waypoints published on the approach chart. The identification of the waypoints shown on MCDU are often different from the identification shown on the approach chart.

The lateral F-PLN

The FACF and the FAF must be aligned with the approach course.
If the FACF and the FAF are collocated, the course change at the FAF should be small. A sharp turn would prevent the aircraft from over flying the FAF and the final descent would start before the FAF not being established on the final approach course.
Distances and courses must be coded between the waypoints.

R Approach procedures including a PI-CF Leg (PROC T displayed between 2 waypoints on
R MCDU F-PLN page) are not authorized with AP or FD managed guidance. It must be flown
R using published approach chart and raw data.

The vertical F-PLN

An altitude constraint must be coded at each waypoint.
An AT or ABOVE constraint can be use for a SDF.
When the **MAP is located at or before runway threshold a FPA (≠ 0°) must be coded at the MAP or the runway threshold (RW).**

R *Note : The MAP of RNAV approaches must be located at the runway threshold.*

When the **MAP is located after the runway threshold a FPA = 0° must be coded at the MAP.**
A FPA (≠ 0°) must be coded for each SDF lying on the final approach descent.

3. FLIGHT CREW PROCEDURES

The SOP of FCOM 3.03.19 for Non Precision Approach are applicable. The following recommendations are given here to highlight specific aspects of the vertical navigation when FINAL APP mode is being used.
As applicable, the crew should first check that the approach is approved by the Airline for FINAL APP mode use, unless the Airline option is to remove from the navigation database the IAP that are not validated.

3.1 Approach F-PLN verification

Before starting the approach, the crew will check the FMS F-PLN, on MCDU and ND in PLAN mode with CSTR displayed, starting from the beginning of the STAR down to the runway and the missed approach procedure, and verify the profile against the published IAP chart.

For the final approach procedure, the crew should check :

- The approach course
- The waypoints and associated altitude constraints
- R The IAP must not include a Procedure Turn (PROC T indicated on MCDU)
- The distance from FAF to RW or to MAP
- The approach angle (shown on the MCDU line above related waypoints)
  - **If MAP after runway threshold : FPA = 0° at MAP**
  - **If MAP before or at runway threshold : FPA ≠ 0° at MAP**
  - **For each Step Down Fix a FPA ≠ 0° must be defined**
- The altitude at MAP or runway threshold
  - If crossing altitude at MAP is not shown on the approach chart, check consistency with the distance to the runway and the approach angle.

3.2 Limitations to approach F-PLN modifications

When performing an IAP with use of NAV and FINAL APP modes, modifications of the active F-PLN extracted from the navigation data base can be made provided the following limitations are observed :

1. F-PLN modifications

- No lateral modification of F-PLN from FACF (inclusive) to RW or MAP.
  Modification before FACF is permitted provided the resulting change of flight path course will not be so large to prevent the aircraft from being laterally stabilized on the final approach course before reaching the FAF.
- No altitude constraint modification from FACF to MAP. Even in case of very low OAT, no altitude correction can be entered by this means. This may require defining a minimum OAT so that the vertical flight path will clear the obstacles with the required margin. This minimum OAT should be given to the crew when appropriate. In the future, for RNAV approaches, minimum OAT will be published on the approach chart itself.
- When the FAF is the TO waypoint, the FROM waypoint must not be cleared in an attempt to perform a DIR TO/INTERCEPT
- To take benefit of managed speed and to have a correct location of the DECEL point, it is recommended to enter Vapp as a SPD CSTR at FAF.

2. DIR TO...

- DIR TO FACF is permitted provided resulting change of flight path course at FACF is not so large to prevent the aircraft from being laterally stabilized on the final approach course before reaching the FAF.
- DIR TO FAF is permitted provided the resulting change of flight path course at FAF is small.

3. Lateral F-PLN interception in HDG/TRK

- F-PLN must be intercepted before FACF and the interception angle should not be so large to prevent the aircraft from being laterally stabilized on the final approach course before reaching the FAF.
  or
- before FAF at the latest provided the interception angle is small.

CAUTION

- Before arming NAV, check correct "TO" waypoint is displayed on ND.
- The intercept path in HDG/TRK must not cause premature sequencing of FAF. FAF should be sequenced in NAV mode when established on final approach course.

4 Vertical F-PLN interception

- The crew should manage the descent so that the vertical F-PLN is intercepted before FAF at the latest.

3.3 Approach monitoring

Except for RNAV IAP, the approach navaids should be tuned and the associated raw data displayed and actively monitored. This active monitoring should include the vertical navigation with use of altimeter reading versus DME distances or equivalent.
For RNAV IAP the vertical navigation can be monitored using the distance to the RW or the MAP displayed on ND and the altimeter reading.
After passing the FAF when stabilized on final descent, the crew should check that the X-TRK and V-DEV are correct, and that the FPV is consistent.

When APPR is selected on FCU, the crew shall verify :

- Correct FMA display (APP NAV green, FINAL blue)
- Correct TO waypoint on ND
- Blue descent arrow at FAF and correct F-PLN
- Correct Vertical Flight Path deviation indication

When passing the FAF, the crew shall verify :

- Correct altitude indication
- Correct FMA display (FINAL APP green)
- Correct TO waypoint on ND
- Correct blue track on ND, armed for Missed Approach
- That the aircraft starts the descent and follows the correct lateral and vertical flight path

If HIGH ACCUR is lost during the approach but active radio navaid monitoring confirms correct navigation, the approach can be continued in FINAL APP mode. Otherwise the crew should revert to TRK/FPA mode to fly the aircraft with navaids raw data.

The IAP shall be discontinued when one of the following warning occurs :

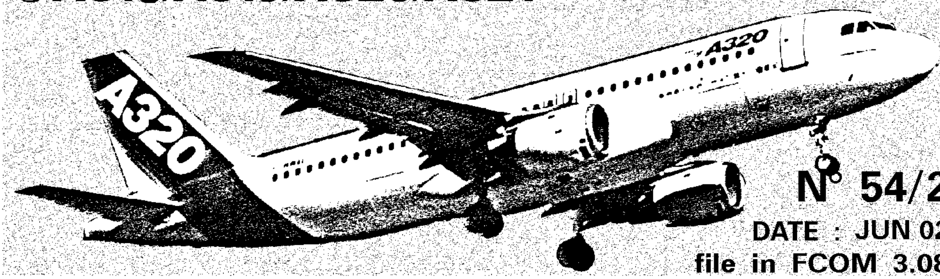
- GPS PRIMARY LOST if GPS accuracy is required
- NAV ACCUR DOWNGRAD during a RNAV approach
- FM/GPS POS DISAGREE if GPS installed and not deselected, and no navaid raw data is available to revert to selected modes.
- FM1/FM2 POS DIFF except if navaid raw data is available to revert to selected modes.

3.4 Crew Reporting

The crew must report any lateral or vertical NAV guidance anomaly to the Flight Operations. The report must be fully documented for further investigation and corrective actions :

- Approach designation and airport
- A/C type, MSN, GW, wind/temp
- Navigation database cycle
- Pilot selections, FMA, ND, MCDU displays
- Description of anomaly, flight path
- DFDR/QAR reading

A318/A319/A320/A321 - FCOM BULLETIN



N° 54/2

DATE : JUN 02

file in FCOM 3.08

SUBJECT : AIRCRAFT HANDLING IN FINAL APPROACH

General

The purpose of this FCOM Bulletin is to highlight certain aspects of aircraft handling during final approach, and to illustrate that the feedback received from in service experience merits further attention.

Although approach in turbulence is part of this discussion, windshear in approach is not addressed here. For more details on the subjects of "Windshear in Approach" and "Operations in Windshear or Downburst Conditions", refer to the FCOM 3.04.91.

Approach Stabilization Criteria

The first prerequisite for a successful final approach and landing is to laterally, vertically, and longitudinally stabilize the aircraft on the final approach flight path.

This signifies that the :

- Aircraft is established on the :
  - Final approach course, and only minor heading corrections are necessary (except for indirect approaches) to correct the effect of external conditions, acting on the roll axis ;
  - Final approach vertical flight path, and only minor pitch corrections are necessary to correct the effect of external conditions ;
- Engines are spooled up with the thrust (at least out of idle) necessary to maintain the VAPP target at the required flight path angle.

Airbus policy requires that stabilized conditions be reached at 1,000 feet HAT in IMC, and 500 feet HAT in VMC, and that they be kept down to the flare height.

In turbulent conditions, there may be heading, pitch, and thrust corrections of such a magnitude that it could be difficult to determine when to consider the approach stabilization criteria as being lost. Thrust corrections, in particular with the A/THR ON, could lead engines to temporarily reduce thrust to idle, which would not be desirable close to the ground.

The PNF callout for excessive deviation is certainly an indication for the PF to decide/determine if the approach becomes destabilized. However, the answer to this question is generally a matter of pilot judgement. The pilot must assess whether or not it is possible to return to nominal conditions early enough : That is, at the latest before flare initiation. If the pilot judges that it will not be possible to start the flare at the correct height with the correct attitude, sink rate, and thrust, or if the pilot starts to feel "out of the loop", then it is time to perform a go-around.

PNF Callout

In approach, the PNF is expected to monitor the PFD and to make a callout when some parameters are exceeded.

The Airbus FCOM SOP (3.03.18 and 3.03.19) states that a callout should be made, if :

- Speed becomes lower than the speed target – 5 knots, or greater than the speed target + 10 knots.
- Pitch attitude becomes lower than 0° (2.5° nose down for the A320 family), or greater than 10° nose up.
- Bank angle becomes greater than 7°.
- Descent rate becomes greater than 1000 feet/min.
- Excessive LOC or GLIDE deviation occurs (3.03.18 only).

The suitable PF response would be to immediately take appropriate actions to control the exceeded parameter and evaluate whether stabilized conditions will be recovered early enough. Otherwise, a go-around must be initiated. The PF should acknowledge the PNF callout so that crew coordination remains effective.

Aircraft Handling of the Longitudinal Axis

The pilot's objective, with respect to the longitudinal axis, is to control airspeed and the vertical flight path. For thrust and speed control, use of FMGS managed speed is recommended, in order to benefit from the minimum GS function. Due to the fact that, statistically speaking, A/THR provides the best protection, its use is recommended even in turbulent conditions, unless thrust variations become excessive.

A/THR response to airspeed variations is the result of a design compromise between performance and comfort so that, in some turbulent conditions, the pilot may find it to be too slow or lagging. In particular, the pilot may find it uncomfortable to have the engines at idle, while approaching flare height with a decreasing speed. To reduce the engines' response time in this kind of situation, it is possible, above 100 feet RA, to move the thrust levers slightly beyond the CL detent to temporarily disengage the A/THR. As soon the speed target is recovered, and before the thrust becomes too high, the pilot should move the thrust levers back to the CL detent to resume A/THR operations.

Note : Moving thrust levers above the CL detent, when below 100 feet, will result in A/THR disconnection (Refer to the FCOM, 1.22.30 - page 62).

In the final approach, use of the speedbrakes, when available, is not recommended due to their destabilizing effect. The drag, in CONF 3 or CONF FULL with the Landing Gear down, is normally sufficient to cope with all kinds of situations, including a tailwind landing.

The pilot's objective, with respect to vertical navigation, is to maintain a constant flight path angle down to the runway threshold, using the vertical deviation indication of an ILS, the FMGS VDEV indication, the indication of an external lighting system, or visual cues. However, when approaching flare height, the pilot's primary objective should be to progressively shift to pitch attitude and sink rate.

The vertical speed reduction that can be achieved during flare may be insufficient to avoid a hard landing, if the sink rate is too high prior to starting the flare. The aircraft may touch down with an excessive residual vertical speed and pitch rate, which may lead to bouncing and exposure to tail strike. (Refer to FCOM Bulletin N° 22 on Tail Strike Avoidance).

The pilot should also consider that the flare height might vary slightly from one aircraft type to another, depending on aircraft inertia. In the event of turbulence and wind gradient, pitch monitoring is of primary importance when close to the ground. The pilot should react promptly to any uncommanded pitch down tendency to avoid ducking under, with a risk of premature touchdown.

If the vertical speed and the pitch attitude become the primary objective, the touchdown point might occur slightly further ahead on the runway, thereby reducing the available stopping distance. In the large majority of landings, and based on the pilot's judgement, this effect should be acceptable. However, in case of doubt, it is always best to perform a go-around.

Aircraft Handling on the Lateral Axis

Generally speaking, lateral handling of fly-by-wire aircraft is conventional. But, in very gusty conditions, it is necessary to recall the principle of the flight control law in roll. With the sidestick, the pilot can order a roll rate up to a maximum of 15°/second. However, the aerodynamic capacity of the roll surfaces, when fully deflected, is much higher : That is, up to about 40°/second. This means that, if the aircraft is flying through turbulence that produces a roll rate of 25°/second to the right, the aircraft still has the capacity to roll to the left at a rate of 15°/second, with full sidestick command. This is more than what is necessary in the worst conditions.

The sidestick's ergonomical design is such that the stop at full deflection is easily reached. This may give the pilot the impression that the aircraft is limited in roll authority, because there is a time delay before the pilot feels the result of his/her action. In conventional aircraft, due to the control wheel inertia, the pilot needs considerably more time to reach the flight control stop.

The fly-by-wire system counteracts the effects of gust, even with the sidestick in the neutral position ; the pilot's task is to give overall corrective orders. In other words, the pilot should smoothen and filter inputs and should resist moving the sidestick from one stop to the other.

Every sidestick input is a roll rate demand, superimposed on the roll corrections already initiated by the fly-by-wire system. The pilot should only apply "longer-term" corrections as needed.

Before flare height, heading corrections should only be made with roll. As small bank angles are possible and acceptable close to the ground, only small heading changes can be envisaged. Otherwise, a go-around should be initiated.

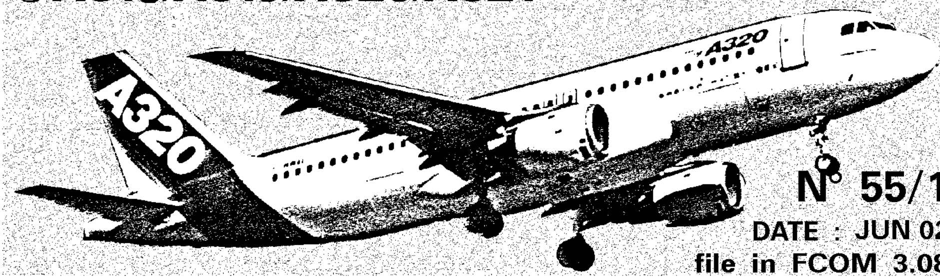
Use of rudder, combined with roll inputs, should be avoided, since this may significantly increase the pilot's lateral handling tasks. Rudder use should be limited to the "de-crab" maneuver in case of crosswind, while maintaining the wings level, with the sidestick in the roll axis.
(Refer to the FCOM's SOP, for Crosswind Landing Techniques).

Summary

In summary, the following are the main points addressed by this Bulletin :

- Strictly observe the approach stabilization criteria to decide whether to land, or to perform a go-around.
- Be prompt to react to any pitch down at low height, to avoid ducking under.
- Reach flare height with the correct pitch attitude and sink rate.
- In turbulent conditions, use of the A/THR is recommended, unless it becomes impractical.
- Refrain from excessive sidestick roll activity ; order "longer-term" roll corrections.
- Restrict used of rudder to "de-crabbing" in crosswind.

A318/A319/A320/A321 - FCOM BULLETIN



N° 55/1

DATE : JUN 02

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SUBJECT : USE OF RUDDER ON TRANSPORT CATEGORY AIRPLANES

REASON FOR ISSUE

On February 8th, 2002, the National Transportation Safety Board (NTSB), in cooperation with the French "Bureau Enquetes Accidents (BEA)", issued recommendations that aircraft manufacturers re-emphasize the structural certification requirements for the rudder and vertical stabilizer, showing how some maneuvers can result in exceeding design limits and even lead to structural failure.

The purpose of this FCOM Bulletin is to re-emphasize proper operational use of the rudder, highlighting certification requirements and rudder control design characteristics.

YAW CONTROL

General

In flight, yaw control is provided by the rudder, and directional stability is provided by the vertical stabilizer.

The rudder and vertical stabilizer are sized to meet the two following objectives :

- Provide sufficient lateral control of the aircraft during crosswind takeoffs and landings, within the published crosswind limits (refer to FCOM's Operating Limitations chapter 3.01.20) ;
- Provide positive aircraft control under conditions of engine failure and maximum asymmetric thrust, at any speed above Vmcg (minimum control speed on ground).

The vertical stabilizer and the rudder must be capable of generating sufficient yawing moments to maintain directional control of the aircraft.

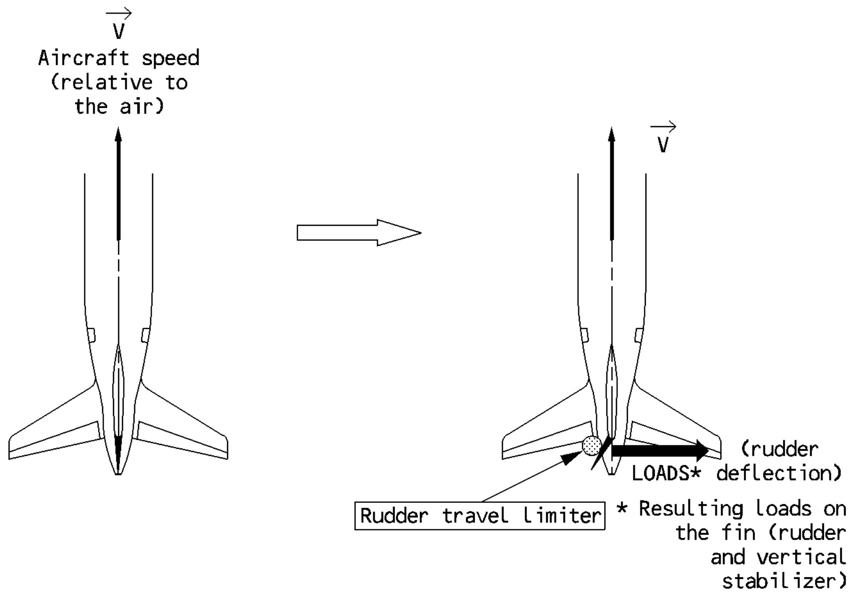
The rudder deflection, necessary to achieve these yawing moments, and the resulting sideslip angles can place significant aerodynamic loads on the rudder and on the vertical stabilizer.

Both vertical stabilizer and rudder are designed to sustain loads as prescribed in the JAR / FAR 25 certification requirements which define several lateral loading conditions (maneuver, gust loads and asymmetrical loads due to engine failure) leading to a required level of structural strength.

Certification requirements

For certification in accordance with JAR / FAR 25.351, loads on the stabilizer and the rudder are defined, considering yawing maneuvers as shown below, for a range of speeds from VMC (minimum control speed) to VD/MD (maximum design speed), from sea level up to maximum altitude, and over the full range of aircraft weights and Center of Gravity limits :

1 - With the aircraft in unaccelerated and stabilized straight flight, the rudder pedal is suddenly displaced to the maximum available deflection at the current aircraft speed.



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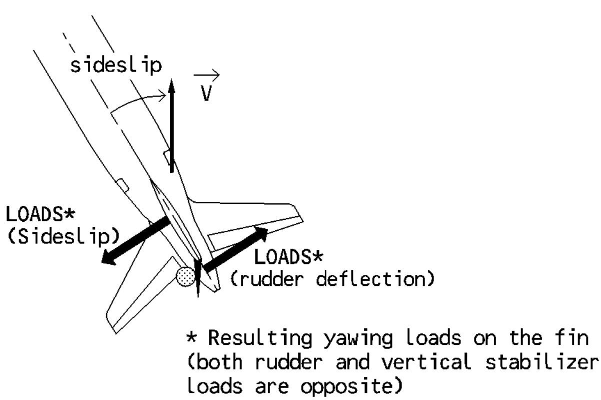
2 - With the rudder deflected as shown above, the aircraft yaws to the resulting overswing sideslip angle, and then stabilizes at a somewhat smaller steady-state slideslip angle.



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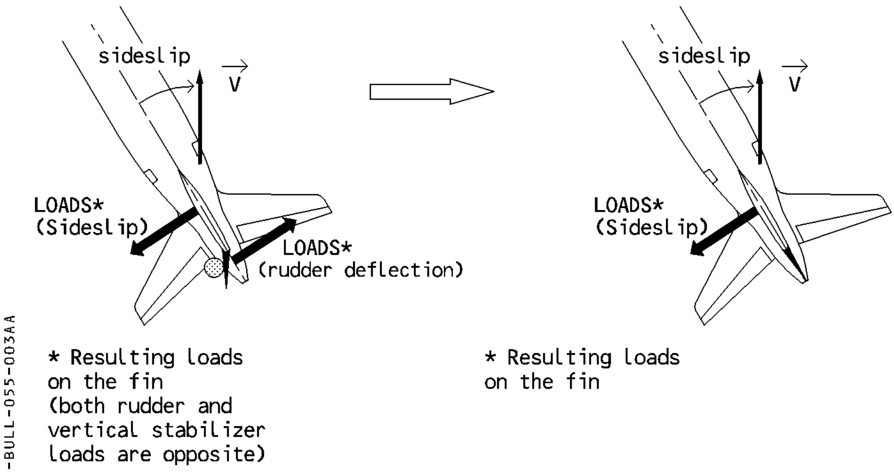
3 - With the airplane yawed to the steady-state (static) sideslip angle corresponding to the above rudder deflection, the certification regulations assume that the rudder pedal is released to neutral.

Note : *Because the aircraft has natural yaw stability, returning the rudder to neutral will also result in returning the sideslip angle to neutral*



Certification yawing maneuver design

JAR/FAR 25 requires the above yawing maneuver to be analyzed over the full range of specified conditions. The most severe loads imposed on the vertical stabilizer and rudder are identified.

The same analysis is performed for lateral gusts, rolling maneuvers and asymmetrical engine failure conditions. The most severe of all these cases and associated loads provides the design basis for the vertical stabilizer and rudder.

The above loads define the limit loads according to JAR / FAR 25 requirements. These loads correspond to the maximum loads that may be expected in service.

According to JAR / FAR 25 requirements, the ultimate loads are defined as the limit loads multiplied by a prescribed safety factor of 1.5 unless otherwise specified.

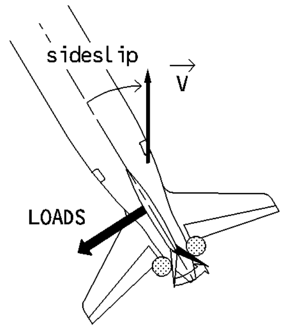
The aircraft structure must be able to sustain limit loads without detrimental permanent deformation and ultimate loads without failure for at least 3 seconds.

Higher loads could lead to structural failure.

CAUTION

Sudden commanded full, or nearly full, opposite rudder movement against a sideslip can generate loads that exceed the limit loads and possibly the ultimate loads and can result in structural failure.

This is true even at speeds below the maximum design maneuvering speed, VA.



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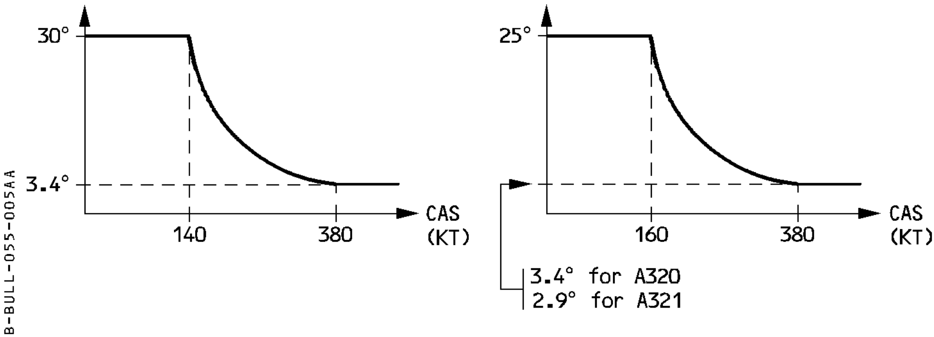
Certification regulations do not consider the loads imposed on the structure when there is a sudden full, or nearly full, rudder movement that is opposite to the sideslip.

Rudder control

The rudder surface is controlled by 3 actuators, commanded by a cable run from rudder pedals, to which the flight control input (yaw damping and turn coordination functions coming from the ELACs and the FACs) are added.

The rudder travel limiter, controlled by the FACs, is designed to progressively reduce the available total rudder travel depending on aircraft speed.
This provides sufficient yaw control within the entire flight envelope, including engine failure and maximum asymmetric thrust, limiting the lateral loads on the stabilizer and rudder so that they remain within the certification limits.

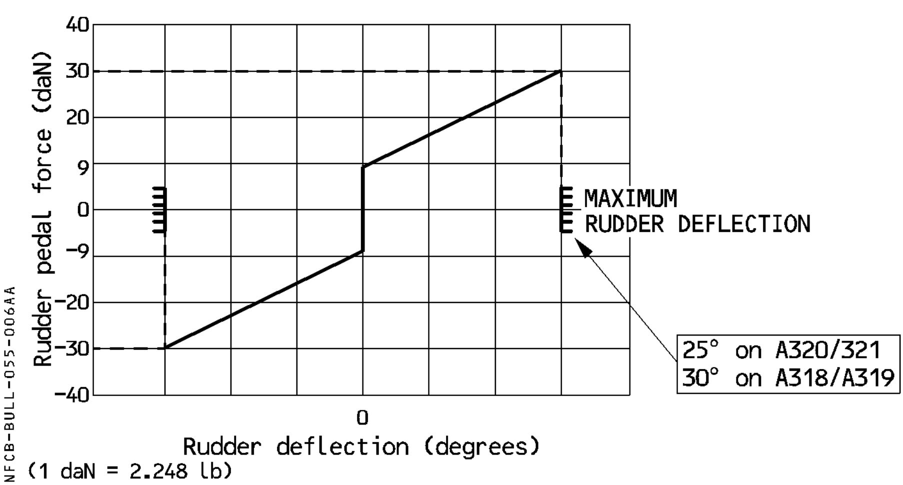
Rudder travel is limited as a function of the aircraft speed, as shown below :



A318/A319 A320/A321

- At low speeds, the rudder deflection required to maneuver the aircraft in yaw is large, and so are the resulting pedal displacement and forces ;
- At high speeds, the rudder authority is limited but the gearing between the pedals and the rudder does not change. Therefore, less force will be required to achieve maximum available rudder deflection.

As speed increases, the rudder deflection required by any yaw maneuver (eg, engine failure and maximum asymmetric thrust) decreases, and consequently, so do rudder pedal displacement and associated forces.
Rudder pedal displacement is almost linearly proportional to rudder deflection.



Thus, to explain the two preceding graphs :

The rudder pedal displacement and the resulting pedal forces required to achieve a given rudder deflection are independent from aircraft speed.

- To start moving the rudder pedals from the neutral position, a minimum force of +/-9 daN must be applied ("breakout force").
- At low speeds, i.e. up to approximately 150 kt, maximum available rudder deflection (25° for the A320/A321 and 30° for the A318/A319) is obtained by moving the rudder pedals to their maximum travel which represents a 30 daN force applied on the pedals.
- At higher speeds, for example at 350 kt, the maximum available rudder deflection is reduced to approximately 4 degrees. It is consequently obtained with less rudder pedal displacement which represents approximately a 13 daN force applied on the pedals (approximately 40 % of the maximum force to reach full pedal travel).

Operational recommendations

In order to avoid exceeding structural loads on the rudder and vertical stabilizer, the following recommendations must be observed.

1. THE RUDDER IS DESIGNED TO CONTROL THE AIRCRAFT, IN THE FOLLOWING CIRCUMSTANCES :

1.1 In normal operations, for lateral control :

- During the takeoff roll, when on ground, especially in crosswind conditions ;
- During landing flare with crosswind, for decrab purposes.
- During the landing roll, when on ground.

In these circumstances, large and even rapid rudder inputs may be necessary to maintain control of the aircraft.
Rudder corrections should always be applied as necessary to obtain the appropriate aircraft response.

On Airbus aircraft, the rudder control system includes a turn coordination function to achieve acceptable turn coordination.

1.2 To counteract thrust asymmetry :

Full rudder authority can be used to compensate for the yawing moment of asymmetric thrust.

Note : At high speed (i.e. slats retracted), thrust asymmetry (eg. due to an engine failure) has relatively small effect on yaw control of the aircraft.
The amount of rudder required to counter an engine failure and center the sideslip is small.

1.3 In some other abnormal situations :

The rudder may also be used in such abnormal situations as :

- Loss of both yaw damper systems. The rudder may be used as deemed necessary, for turn coordination to prevent excessive sideslip.
- Rudder trim runaway. The rudder may be used to return the rudder to neutral.
- Landing with abnormal landing gear position. The rudder can be used for directional control on ground.

In all of the above mentioned normal or abnormal circumstances, proper rudder maneuvers will not affect the aircraft's structural integrity.

Note : In the event of a rudder travel limit system failure, refer to the relevant RUDDER TRAVEL LIMIT FAULT procedure.

2. THE RUDDER SHOULD NOT BE USED :

- To induce roll, or
- To counter roll, induced by any type of turbulence.

Whatever the airborne flight condition may be, aggressive, full or nearly full, opposite rudder pedal inputs must not be applied. Such inputs can lead to loads higher than the limit, and can result in structural damage or failure.

The rudder travel limiter system is not designed to prevent structural damage or failure in the event of such rudder system inputs.

Note : Rudder pedal reversals must never be incorporated into airline policy, including so-called "aircraft defensive maneuvers" to disable or incapacitate hijackers.

As far as dutch roll is concerned, yaw damper action and natural aircraft damping are sufficient to adequately dampen dutch roll oscillations. The rudder should not be used to complement the yaw damper.

Note : Even if both yaw damper systems are lost, the rudder should not be used to dampen the dutch roll. Refer to the YAW DAMPER FAULT procedure.

3. SPECIAL CASES

Recovery techniques from upset situations

Proper use of the rudder, particularly during maneuvers intended to address upset recovery, are emphasized in the Airbus Training Program, supported by the industry-produced 1998 "UPSET RECOVERY TRAINING AID".