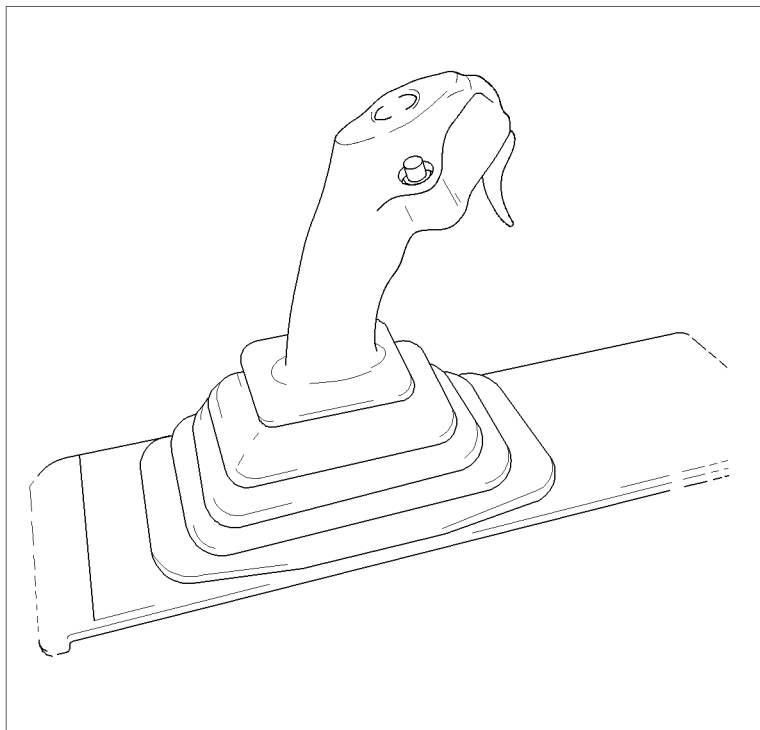


A319/A320/A321

FLIGHT CREW OPERATING MANUAL



FLIGHT OPERATIONS 3



00.00 CONTENTS

00.10 ORGANIZATION OF THE MANUAL

– FOREWORD	1
– COMMENTS – QUESTIONS – SUGGESTIONS	1
– CONTENT	2
– USE	2
– PAGINATION	3
– REVISIONS	4
– HOW TO INSERT A REVISION	4
– BEST WAY TO GET UPDATED DOCUMENTATION	5

00.20 LIST OF CODES

00.30 LIST OF NORMAL REVISIONS

00.35 RECORD OF TEMPORARY REVISIONS

00.36 LIST OF EFFECTIVE TEMPORARY REVISIONS

00.70 CROSS REFERENCE TABLE

00.75 HIGHLIGHTS

00.80 LIST OF EFFECTIVE PAGES

00.85 LIST OF MODIFICATIONS

FOREWORD

- R 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 :

R

AIRBUS - BP N°33
1 ROND POINT MAURICE BELLONTE
31707 BLAGNAC CEDEX - FRANCE
TELEX TLSBI7X or 530526F
FAX 33.5.61.93.44.65
ATTN. Flight Operations Support
- STL

FOR TECHNICAL OR
PROCEDURAL
CONTENT

AIRBUS - BP N°33
1 ROND POINT MAURICE BELLONTE
31707 BLAGNAC CEDEX - FRANCE
TELEX TLSBP7X or 530526F
FAX 33.5.61.93.28.06
ATTN. Technical Documentation Services
- SDC

FOR PRINTING AND
DISTRIBUTION

NFC5-03-0010-001-A001A

CONTENT

- R The Flight Crew Operating Manual is the support documentation for flight crew operations.
- R The Flight Crew Operating Manual provides operating crews with the technical, procedural
- R and performance characteristics of the A320 family aircraft to ensure a safe and efficient
- R operation during normal and/or abnormal/emergency situations on ground and in flight.
- R However, the Flight Crew Operating Manual is not intended to provide basic jet aircraft
- R piloting techniques or information that are considered as basic airmanship for trained flight
- R crews familiar with that type of aircraft and with its general handling characteristics.
- R The Flight Crew Operating Manual is intended :
- R – To be used directly as flight crew operating manual or to be the basis for elaboration of
- R the relevant parts of the “crew manual” by the operations department of the operator
- R in accordance with applicable requirements.
- R – To be used as a flight crew training manual (initial and refresher).
- R However, the Flight Crew Operating Manual is not intended to be used for teaching basic
- R 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 personnel 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.

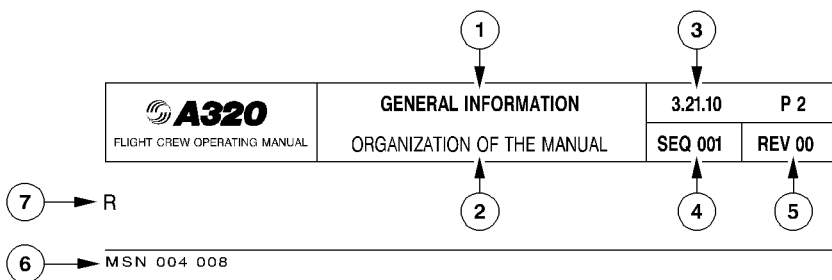
- Where a paragraph or schematic is preceded by the heading **FOR INFO** the details given are considered to be "nice to know". Knowledge of these items is not required for the type rating qualification.
- ECAM warnings and cautions are summarized in a table at the end of each chapter of volume 1. Numeric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

OPTIONAL EQUIPMENT

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

PAGINATION

NFC5-03-0010-003-A001AA



- 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 filing 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.

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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+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+26999+28218) = (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)

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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)
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)

LIST OF CODES

SEQ 001

REV 36

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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
0114	Mod : (20024+24613+25410) = (20024+24105+24613+25410)
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)

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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
0150	Mod : (22013+28479) = (22013+28916)+IAE = CFM
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)
0167	Mod : (22013+28479) = (22013+28916) = (25951+28479) = (25951+28916)

LIST OF CODES

SEQ 001

REV 36

R
R

CODE	DESIGNATION
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
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

R
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CODE	DESIGNATION
0207	Mod : (25404+28160+28479) = (25404+28160+28916)
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)
0238	STD = Mod : (28160+28413) = (28160+28917) = (28160+28413+28917)
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)

LIST OF CODES

SEQ 001

REV 36

CODE	DESIGNATION
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)
0277	Mod : 28238 = (27846+28238) = (27846+28238+28479) = (27846+28238+28916) = (27846+28238+28702)
0279	Mod : (21678+22013+26017) = (21678+22013+25410+26017)
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)
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)

LIST OF CODES

SEQ 001

REV 36

CODE	DESIGNATION
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)
0358	Mod : 22013 = 23108 = 23109 = 23408 = 23871 = 24105 = (23108+23109) = (23108+23109+23408)
0359	Mod : 23699 = 24281 = (23698+23699) = (23698+24281) = (23699+24281)

CODE	DESIGNATION
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)
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)
0393	Mod : (21678+22013) = (21678+24105) = (21678+28160) =(21678+30020)
0394	Mod : (21678+22013) = (21678+24105) = (21678+28160)
0395	Mod : 31897 = 32929 = (31897+32333+32929)
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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LIST OF CODES

SEQ 001

REV 36

CODE	DESIGNATION
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)

LIST OF CODES

SEQ 001

REV 36

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CODE	DESIGNATION
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)
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)
0470	0470 Mod : (25404+28479) = (25404+25410+26017+28916) = (25404+28160+28916+28917)+CFM = IAE
0471	Mod : (22013+25404+28916) = (22013+25404+28479)+CFM = IAE
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)
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)
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)
0507	Mod : (20170+20343) = (20172+20343) = (20343+21858) = (20343+26044) = (20170+31276) = (20172+31276) = (21858+31276) = (26044+31276)
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)
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)
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)
0511	Mod : 24105 = (24105+31364+31906) = (24105+31365+31905)
0512	Mod : (21678+22013+25404+26017+26377+32090) = (21678+22013+25404+26017+26999+32090)
0513	STD = Mod : 31896+32332
0514	Mod : 27455 = (27455+31896+32332)
0515	Mod : 25800 = (25800+31896+32332)
0516	STD = Mod : (31897+32332)
0517	STD = Mod : 31896+32332+CFM 56-5-A1 = A3 = A4 = A5 = B4 = B5 = B6
0518	Mod : (22013+27620) = (23672+27620) = (24105+27620) = (24581+27620) = (24785+27620) = (25108+27620)
0519	Mod : 31896 = 32475 = (31896+32332+32475)
0520	Mod : (25800+31896) = (25800+32475) = (25800+31896+32332+32475)
0521	Mod : 31896 = 32475 = (31896+32332+32475)
0522	STD = Mod : (31896+32332) = (31897+32333)
0523	Mod : 31896 = 31897 = 32475 = (31896+32332+32475)
0524	Mod : (20057+20067+20069+20071) = (20057+20067+20062+20816+27063)
0525	Mod : (20067+20069+20071+21708) = (20067+20069+20816+21708+27063)
0526	Mod : 20057+20067+20069+20071+21708

LIST OF CODES

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)

LIST OF CODES

SEQ 001

REV 36

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

[illegible]

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	00-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

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

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

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

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.

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

-----REASONS OF CHANGE-----

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-----

- 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-----

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.

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.

318/319/320/321 FCOM				VOL.3		(FLIGHT OPERATIONS)		-REV 036	
				LIST OF EFFECTIVE		PAGES (LEP) -			
M V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	-----EFFECTIVITY-----
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	

318/319/320/321 FCOM				VOL.3 (FLIGHT OPERATIONS)				LIST OF EFFECTIVE PAGES (LEP) -				-REV 036	
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					

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

318/319/320/321 FCOM				VOL.3 (FLIGHT OPERATIONS)			LIST OF EFFECTIVE PAGES (LEP) -		-REV 036
M V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	-----EFFECTIVITY-----
M V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	-----EFFECTIVITY-----

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			

318/319/320/321 FCOM				VOL.3		(FLIGHT OPERATIONS)				LIST OF EFFECTIVE PAGES (LEP) -		-REV 036	
M V CH SEC				---PAGE--		SEQ		--REV--		----VALIDATION CRITERIA----		-----EFFECTIVITY-----	
M V CH SEC				---PAGE--		SEQ		--REV--		----VALIDATION CRITERIA----		-----EFFECTIVITY-----	

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						

318/319/320/321 FCOM				VOL.3 (FLIGHT OPERATIONS)				-REV 036			
				LIST OF EFFECTIVE				PAGES (LEP) -			
M	V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	----	EFFECTIVITY-----
M	V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	----	EFFECTIVITY-----

	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)			

318/319/320/321 FCOM				VOL.3		(FLIGHT OPERATIONS)		-REV 036	
				LIST OF EFFECTIVE		PAGES (LEP) -			
M V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	-----EFFECTIVITY-----
M V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	-----EFFECTIVITY-----

	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	

318/319/320/321 FCOM				VOL.3 (FLIGHT OPERATIONS)				-REV 036	
				LIST OF EFFECTIVE				PAGES (LEP) -	
M V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	-----EFFECTIVITY-----
M V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	-----EFFECTIVITY-----

	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	

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

318/319/320/321 FCOM				VOL.3 (FLIGHT OPERATIONS)				-REV 036			
				LIST OF EFFECTIVE				PAGES (LEP) -			
M	V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	----	-----EFFECTIVITY-----
M	V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	----	-----EFFECTIVITY-----

		3	03	06	011	001	REV035				ALL
		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			

318/319/320/321 FCOM				VOL.3		(FLIGHT OPERATIONS)		LIST OF EFFECTIVE PAGES (LEP) -		-REV 036
M V CH SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION	CRITERIA-----	-----	EFFECTIVITY-----	
M V CH SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION	CRITERIA-----	-----	EFFECTIVITY-----	

R 3 03 17	003		100	REV036		CODE:0189			ALL	
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)				

318/319/320/321 FCOM				VOL.3		(FLIGHT OPERATIONS)		-REV 036	
						LIST OF EFFECTIVE		PAGES (LEP) -	
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			

318/319/320/321 FCOM				VOL.3 (FLIGHT OPERATIONS)				-REV 036			
				LIST OF EFFECTIVE				PAGES (LEP) -			
M V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	----	-----EFFECTIVITY-----	
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				

318/319/320/321 FCOM				VOL.3 (FLIGHT OPERATIONS)				-REV 036		
				LIST OF EFFECTIVE				PAGES (LEP) -		
M	V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	-----EFFECTIVITY-----
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		

318/319/320/321 FCOM				VOL.3		(FLIGHT OPERATIONS)		-REV 036	
						LIST OF EFFECTIVE		PAGES (LEP) -	
M V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	-----EFFECTIVITY-----
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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			

318/319/320/321 FCOM				VOL.3 (FLIGHT OPERATIONS)				LIST OF EFFECTIVE PAGES (LEP) -		-REV 036	
M V	CH	SEC	---	PAGE--	SEQ	--REV--	----	VALIDATION CRITERIA-----	----	-----EFFECTIVITY-----	----
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-----
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	MP SB	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 ACCURACY 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 MP SB	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 HARNESSSES 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 ^o) 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	

M V T	REV	MOD	MP	S B	TITLE	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-DEACTIVATION 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	

M V T	REV	MOD	MP SB	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	MP	S B	T I T L E	V A L I D I T Y
.	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 00-SSF	
.	035A	27276	.....		FLIGHT CONTROLS-ELAC SYSTEM-INTRODUCE ELAC SOFTWARE "L80" ALL	

M V T	REV	MOD	MP SB	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 00-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 TRANSCIEVER 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	.....	AIR CONDITIONING-PRESSURE CONTROL AND MONITORING-INTRODUCE PRESSURE CONTROLLER P/N 9022-15702-10 ALL	
.	035A	28164	.....	21-1116 04 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 00-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	MP	SB	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

01.10 FOREWORD

- GENERAL 1
- KIND OF OPERATIONS 1

01.20 GENERAL LIMITATIONS

- MINIMUM FLIGHT CREW 1
- CENTER OF GRAVITY LIMITS 1
- WEIGHT LIMITATIONS 1
- FLIGHT MANEUVERING LOAD ACCELERATION LIMITS 2
- ENVIRONMENTAL ENVELOPE 2
- AIRPORT OPERATIONS 3
- SPEED LIMITATIONS 4

01.21 AIR COND / PRESS / VENT

- CABIN PRESSURE 1
- RAM AIR INLET 1
- AIR CONDITIONING WITH LP GROUND UNIT 1
- AVIONICS VENTILATION 2

01.22 AUTO FLIGHT

- GENERAL 1
- AUTOMATIC APPROACH LANDING AND ROLL OUT 3

01.24 ELECTRICAL

01.27 FLIGHT CONTROL

01.28 FUEL

- GENERAL 1

01.29 HYDRAULIC

R 01.32 LANDING GEAR

- GENERAL 1

01.34 NAVIGATION

- INERTIAL REFERENCE SYSTEM 1
- ENHANCED GROUND PROXIMITY WARNING SYSTEM ◁* . . . 1

01.35 OXYGEN

- COCKPIT FIXED OXYGEN SYSTEM 1

01.49 APU

- GENERAL 1
- ENVELOPE 2

01.70 POWER PLANT

- THRUST SETTING/EGT LIMITS 1
- OIL 1
- RPM 2
- STARTER 2
- REVERSER THRUST 2
- REDUCED THRUST TAKEOFF 2

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

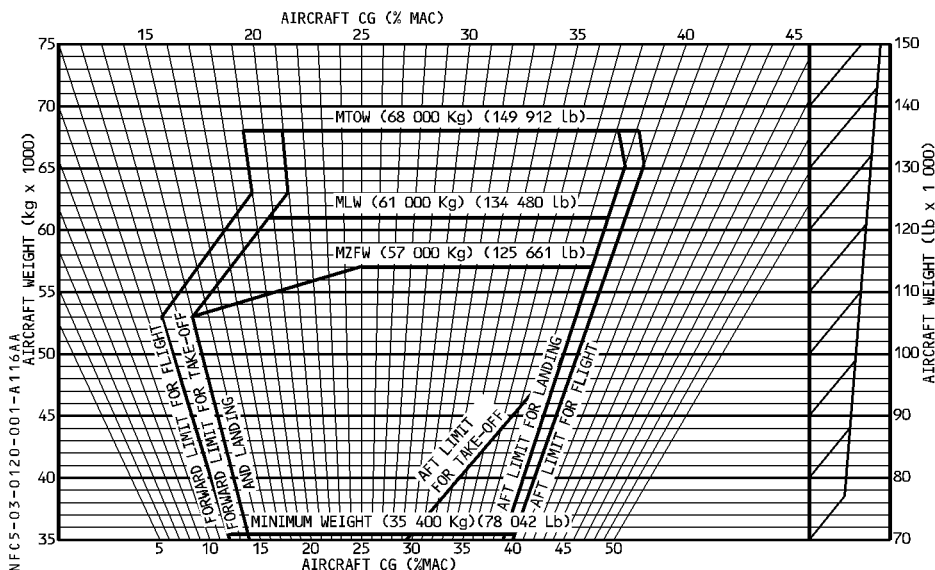
This airplane is certified in the public transport category (passengers and freight) for day and night operations, in the following conditions when the appropriate equipment and instruments required by the airworthiness and operating regulations are approved, installed and in an operable condition :

- 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

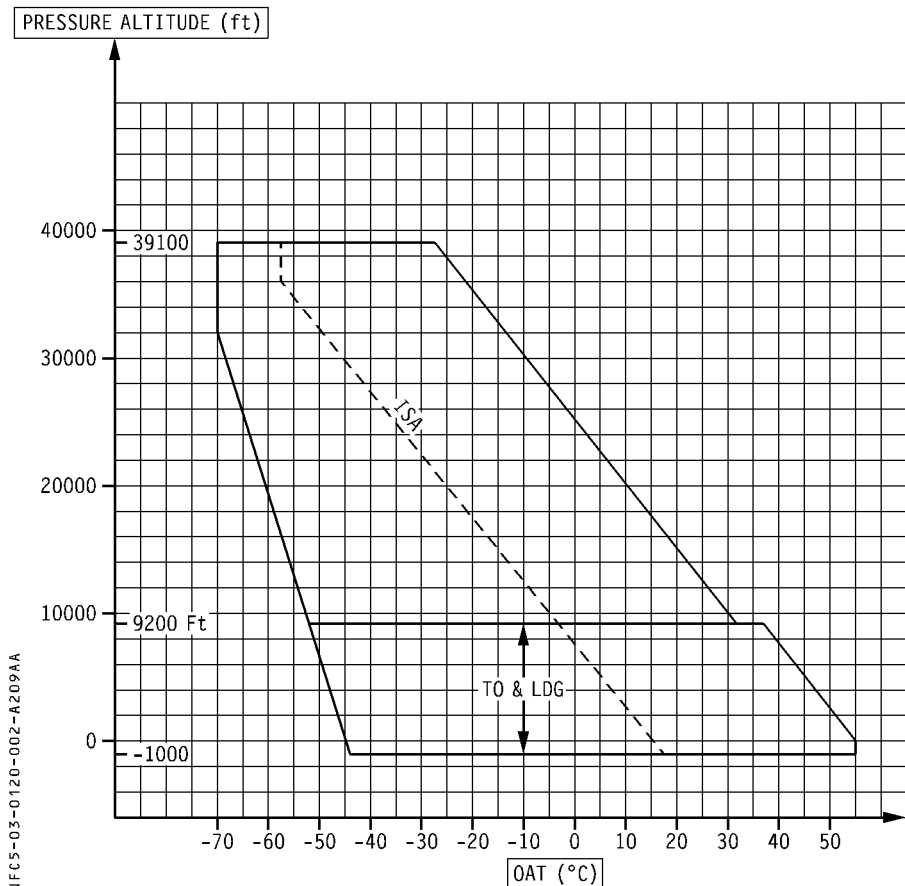
Maximum taxi weight	68 400 kg (150 794 lb)
Maximum takeoff weight (brake release)	68 000 kg (149 912 lb)
Maximum landing weight	61 000 kg (134 480 lb)
Maximum zero fuel weight	57 000 kg (125 661 lb)
Minimum weight	35 400 kg (78 042 lb)

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

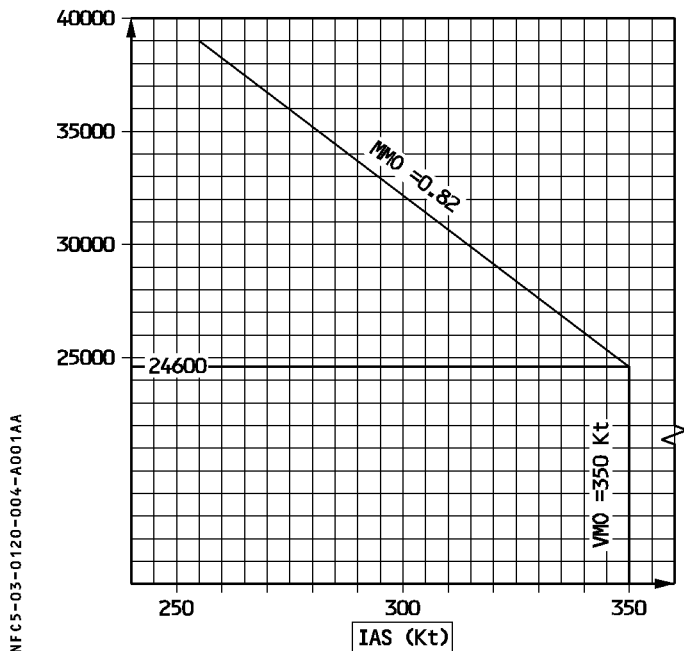
- Runway slope (mean) $\pm 2\%$
- Runway altitude 9200 feet
- Nominal runway width 45 meters
- Wind for takeoff and landing :
 - Maximum crosswind demonstrated for takeoff . . 29 knots gusting up to 38 knots*
 - Maximum crosswind demonstrated for landing . . 33 knots gusting up to 38 knots*
 - Maximum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

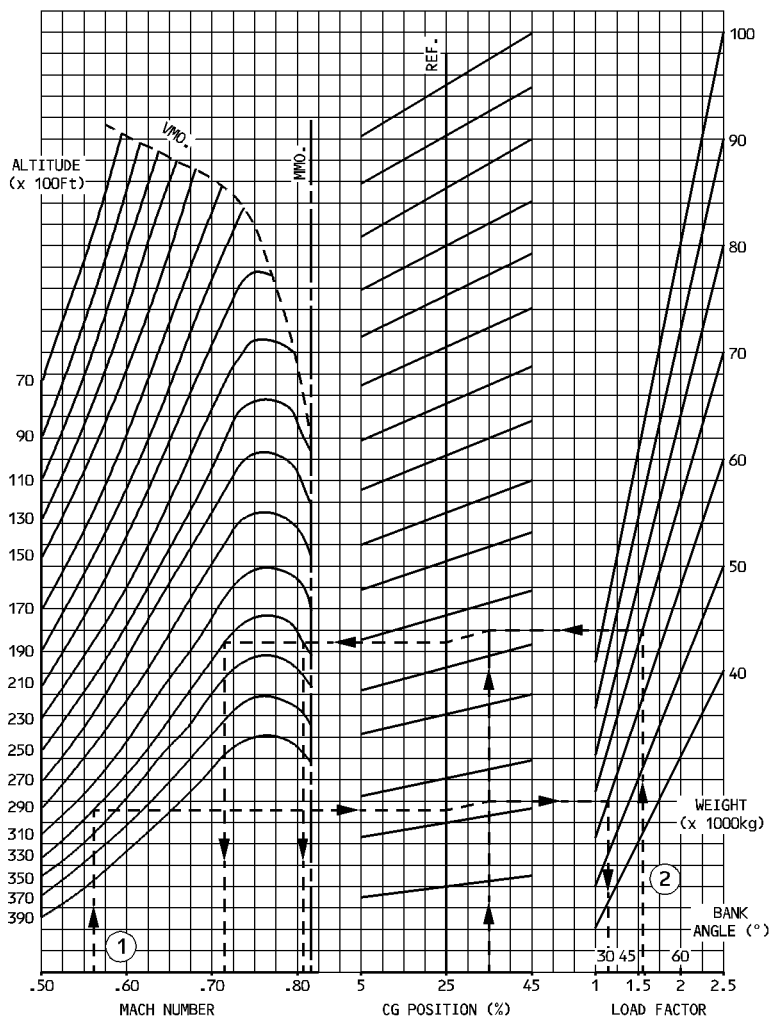
MAXIMUM OPERATING SPEED VMO/MMO

PRESSURE ALTITUDE (Ft)



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

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

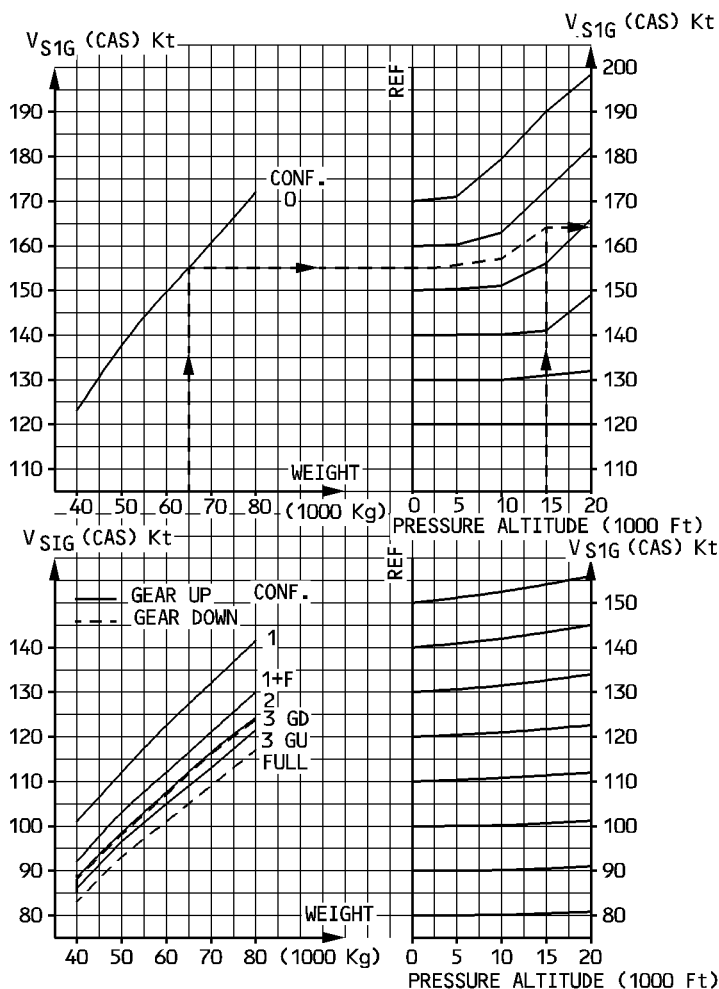
- Maximum speed 230 kt

COCKPIT WINDOW OPEN

- Maximum speed 200 kt

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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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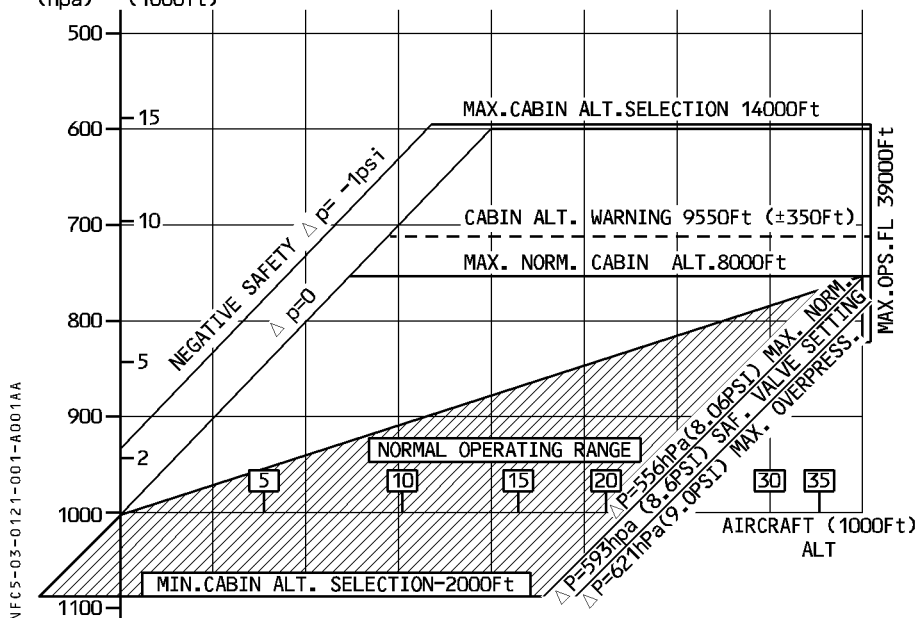
 CCM <i>Airlines</i> FLIGHT CREW OPERATING MANUAL	OPERATING LIMITATIONS		3.01.20	P 10
	GENERAL LIMITATIONS		SEQ 105	REV 25

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CABIN PRESSURE

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

CAB PRESS (Hpa)
CAB ALT (1000ft)



Note : Max Δp 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
R RNAV (including GPS) approach, but not for ILS, LOC, LOC-BC, LDA, SDF, or MLS final
R approach.
R For instrument approach procedures not coded in WGS 84 (or equivalent) coordinate
R system, the GPS must be deselected.
R FINAL APP mode guidance capability with GPS PRIMARY has been demonstrated down to
R MDH/DH (barometric) 250 feet.
R VOR, VOR/DME, NDB or NDB/DME approach procedures may be performed, in NAV, or
R 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
R the airborne radio equipment may be inoperative, or not installed, provided operational
R approval is obtained.
R – Without GPS PRIMARY :
R · The reference navaid and the corresponding airborne equipment is serviceable, tuned,
R and monitored during the approach, or
R · The radio navaid coverage supports the RNP value, specified for the approach
R 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
R supports the RNP value and HIGH accuracy is displayed on the MCDU with the specified
R 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
R 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 permitted 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 responsibility and in case of emergency autoland can be performed up to Max Takeoff Weight (MTOW).

R

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.

 CCM Airlines A319 A320 A321 FLIGHT CREW OPERATING MANUAL	OPERATING LIMITATIONS		3.01.24	P 1
	ELECTRICAL		SEQ 001	REV 24

ELECTRICAL

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

 A319 A320 A321 FLIGHT CREW OPERATING MANUAL	OPERATING LIMITATIONS		3.01.24	P 2
	ELECTRICAL		SEQ 001	REV 24

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FLIGHT CONTROL

Flaps and slats :

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

 CCM <i>Airlines</i> A319 A320 A321 FLIGHT CREW OPERATING MANUAL	OPERATING LIMITATIONS		3.01.27	P 2
	FLIGHT CONTROL		SEQ 001	REV 24

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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 $\pm$ 200

 A319 A320 A321 FLIGHT CREW OPERATING MANUAL	OPERATING LIMITATION		3.01.29	P 2
	HYDRAULIC		SEQ 001	REV 24

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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 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.
- 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 :
 - For operations to/from runways not incorporated in the EGPWS database.
 - 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

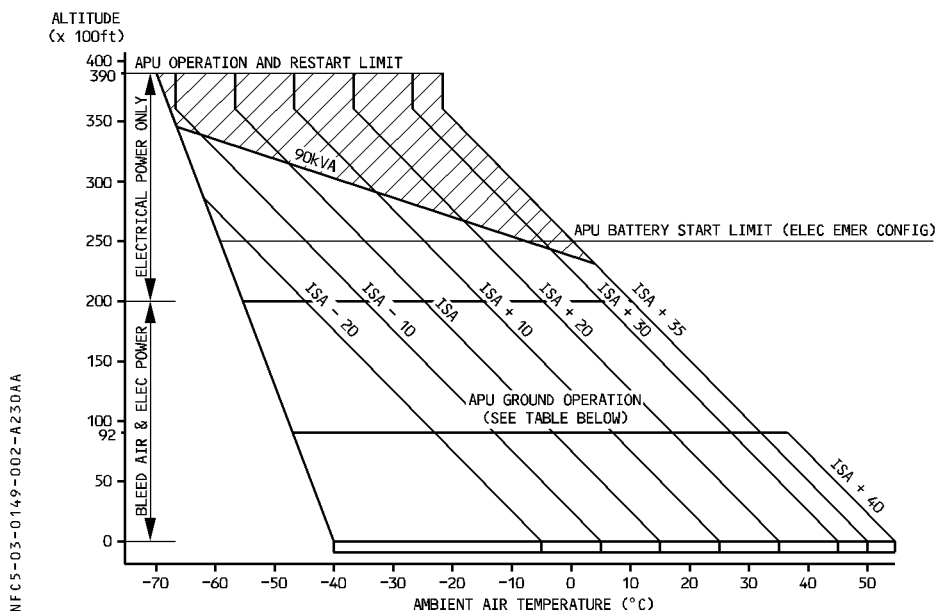
Maximum EGT for start :

- 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	100 % (90 KVA)	100 % (90 KVA)	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)

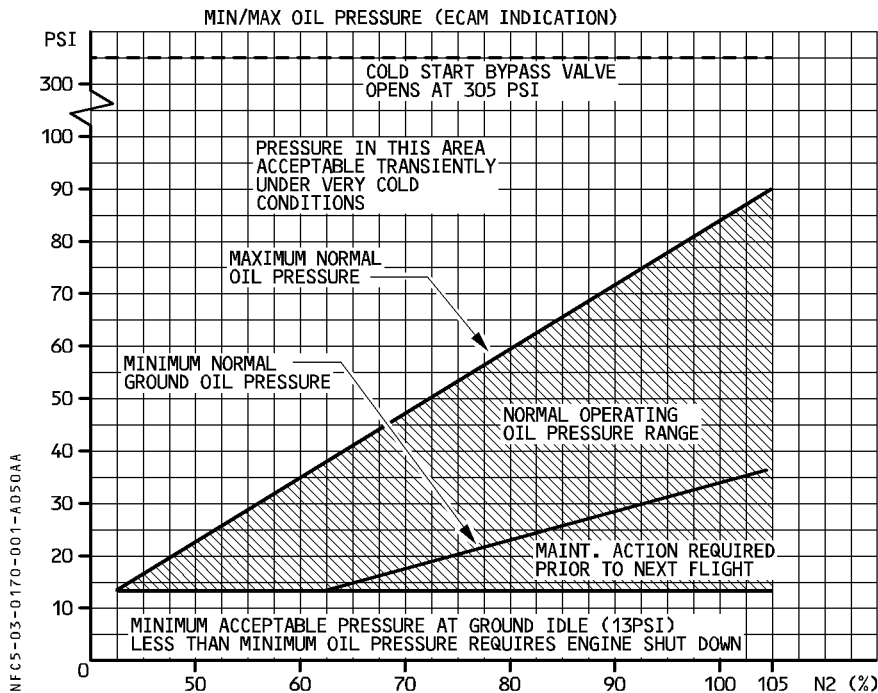
- Air bleed extraction for wing anti-icing is not permitted.

THRUST SETTING/EGT LIMITS

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

R

- Takeoff at reduced thrust is permissible, only if the airplane meets all applicable 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.

02.00 CONTENTS

02.01 INTRODUCTION

GENERAL	1
PRESENTATION	1

02.10 OPERATING TECHNIQUES

REJECTED TAKEOFF	1
ENG FAILURE AFTER V1 – CONTINUED TAKEOFF	4
IMMEDIATE VMC LDG FOLLOWING ENG FAILURE ON TAKEOFF	6
APPROACH WITH ONE ENGINE INOPERATIVE	6A
LANDING WITH SLATS OR FLAPS JAMMED	7

02.21 AIR/PRESS/VENT

AVNCS SYS FAULT	14
BLOWER FAULT	13
CABIN OVERPRESSURE	10
CRG HEAT FAULT (✖)	5
CRG ISOL VALVE (✖)	5
CRG VENT FAULT (✖)	5
DUCT OVHT	3
EXCESS CAB ALT	8
EXTRACT FAULT	13
GND COOL FAULT (✖)	14
HOT AIR FAULT	4
L + R CAB FAN FAULT	6
LAV + GALLEY FAN FAULT	6
LDG ELEV FAULT	11
LO DIFF PR	11
OUTFLOW VALVE NOT OPEN	11
PACK 1 + 2 FAULT	2
PACK 1(2) FAULT or OVHT or OFF	1
PACK 1(2) REGUL FAULT	2
SAFETY VALVE OPEN	12
SKIN VALVE FAULT	13
SYS 1(2) (1 + 2) FAULT	9
TOO HOT/COLD COCKPIT AND CABIN TEMPERATURE IN FLIGHT (✖)	7
TRIM AIR SYS FAULT	4
ZONE REGUL FAULT	6

02.22 AUTO FLT

A / THR OFF / AP OFF/A/THR LIMITED (<*)	6
FAC 1(2) FAULT	3
FAC 1 + 2 FAULT	4
FCU 1(2) (1 + 2) FAULT	5
LOW ENERGY WARNING (<*)	7
RUD TRIM 1(2) FAULT	2
RUD TRIM SYS	2
RUD TRV LIM 1(2)	2
RUD TRV LIM SYS	2
WINDSHEAR DET FAULT (<*)	7
YAW DAMPER 1(2)	1
YAW DAMPER SYS	1

02.23 COMMUNICATIONS

ACARS FAULT (<*)	1
CIDS 1 + 2 FAULT	1
HF EMITTING (<*)	1
VHF EMITTING	1

02.24 ELECTRICAL

AC BUS 1 FAULT	3
AC BUS 2 FAULT	5
AC ESS BUS FAULT	6
AC ESS BUS SHED	7
APU GEN FAULT	2
BAT 1(2) FAULT/OFF	2
BCL 1(2) FAULT	2
C / B TRIPPED	28
DC BAT BUS FAULT	24
DC BUS 1 + 2 FAULT	13
DC BUS 1 FAULT	8
DC BUS 2 FAULT	9
DC EMER CONFIG	25
DC ESS BUS FAULT	10
DC ESS BUS SHED	12
EMER CONFIG	15
ELEC EMER CONFIG – SYS REMAINING	20
EMER GEN 1 LINE OFF	27
ESS BUSES ON BAT	19
FLT ON BAT ONLY (◀*)	19
GEN 1(2) FAULT	1
GEN 1(2) OFF	1
GEN 1(2) or APU GEN OVER LOAD	24
IDG 1(2) OIL PR / OVHT	1
STAT INV FAULT	27
TR 1(2) or ESS TR FAULT	24

02.26 FIRE PROTECTION

APU FIRE	3
SMOKE/AVNCS SMOKE	4
ENG 1(2) FIRE (IN FLIGHT)	3
ENG 1(2) FIRE (ON GROUND)	2
ENG 1(2) / APU FIRE DET FAULT	1
ENG 1(2) / APU FIRE LOOP A(B) FAULT	1
FWD (AFT) BTL SQUIB FAULT (◀*)	11
FWD (AFT) CARGO SMOKE	11
FWD (AFT) CRG DET FAULT (◀*)	11
LAV + CRG DET FAULT	12
LAVATORY DET FAULT	12
LAVATORY SMOKE (◀*)	12
SMOKE/TOXIC FUMES REMOVAL	9

02.27 FLIGHT CONTROLS

ACTIVE CONTROL LAW	20
ADR DISAGREE	REFER TO 02.34
AIL SERVO FAULT	11
ALTN LAW	10
CONFIG L(R) SIDESTICK FAULT	9
CONFIG PITCH TRIM NOT IN T.O RANGE	9
CONFIG RUD TRIM NOT IN T.O RANGE $\triangleleft$	10
CONFIG SLATS (FLAPS) NOT IN T.O. CONFIG	4
CONFIG SPD BRK NOT RETRACTED	8
DIRECT LAW	9
ELAC 1(2) PITCH FAULT	7
ELAC FAULT	6
ELEV and STAB CONTROL AFTER FAILURE	21
ELEV SERVO FAULT	12
FCDC FAULT	11
FLAP ATTACH SENSOR	5
FLAPS/SLATS FAULT/LOCKED	3
FLAP/SLAT SYS 1(2) FAULT	5
FLAP/SLAT TIP BRK FAULT	5
FLAPS FAULT/LOCKED	1
GND SPLR FAULT	14
IR DISAGREE	REFER TO 02.34
L(R) AIL FAULT	11
L(R) ELEV FAULT	13
L(R) SIDESTICK FAULT	5
L + R ELEV FAULT	12
LAF ACCU FAULT (A320 with LAF only)	15
RUDDER JAM	19
SEC FAULT	8
SIDESTICK PRIORITY ($\triangleleft$)	16
SLATS and FLAPS FAULT in conf 0	4
SLATS FAULT/LOCKED	2
SPD BRK DISAGREE	14
SPD BRK FAULT	15
SPLR FAULT	13
STABILIZER JAM	17

02.28 FUEL

R	ACT PUMP LO PR (<*)	11
R	ACT XFR FAULT (<*)	11
	APU LP VALVE FAULT	6
	AUTO FEED FAULT (<*)	7
	CTR TK PUMP 1(2) LO PR (<*)	7
	CTR TK PUMPS LO PR (<*)	7
R	CTR TK PUMPS OFF (<*)	10
	ENG 1(2) LP VALVE OPEN	6
	FQI CH 1(2) FAULT	6
R	FUEL IMBALANCE	9
	FUEL LEAK	8
R	GRVTY FUEL FEEDING	10
	L(R) INNER (OUTER) TK HI TEMP	6
	L(R) INNER (OUTER) TK LO TEMP	5
	L(R) TK PUMP 1(2) LO PR	2
	L(R) TK PUMP 1 + 2 LO PR	1
	L(R) WING TK LO LVL	3
	L(R) XFR VALVE CLOSED or OPEN	4
	L + R WING TK LO LVL	3
	XFEED VALVE FAULT	5

02.29 HYDRAULIC

B ELEC PUMP LO PR or OVHT	16
B RSVR LO AIR PR / OVHT / LO LVL	1
B + Y SYS LO PR	12
G RSVR LO AIR PR / OVHT / LO LVL	2
G(Y) ENG PUMP LO PR	15
G + B SYS LO PR	6
G + Y SYS LO PR	9
PTU FAULT	16
RAT FAULT	16
Y RSVR LO AIR PR / OVHT / LO LVL	4
Y ELEC PUMP LO PR or OVHT	14

02.30 ICE AND RAIN PROTECTION

CAPT (F / O) (STBY) PROBES	4
CAPT (F / O) AOA or TAT	3
CAPT PITOT or L(R) STAT	2
DETECT FAULT	5
DOUBLE PROBE HEAT FAILURE	3
ENG 1(2) VALVE CLSD or OPEN	5
F / O PITOT or L(R) STAT	2
ICE DETECTED	5
L(R) WINDSHIELD (WINDOW)	1
L + R WINDSHIELD	1
SEVERE ICE DETECTED	5
STBY PITOT or L(R) STAT or AOA	3
WING A ICE L(R) HI PR	8
WING A ICE L(R) VALVE OPEN	6
WING A ICE OPEN ON GND	8
WING A ICE SYS FAULT	8

02.31 INDICATING/RECORDING

DFDR or FDIU FAULT	1
DISPLAY UNIT FAILURE	4
DMC FAULT	3
ECAM SINGLE DISPLAY	4
FWC 1(2) FAULT	3
FWC 1 + 2 FAULT	3
SDAC 1(2) FAULT	2
SDAC 1 + 2 FAULT	2

02.32 LANDING GEAR

BRAKES	A/SKID NWS FAULT	9
	ANTI SKID / NWS OFF	9
	AUTOBRK FAULT	10
	BSCU CH 1(2) FAULT	9
	CONFIG PARK BRAKE ON	9
	HOT	10
	LOSS OF BRAKING	11
L/G	BOGIE ALIGN FAULT (<*)	4
	DOORS NOT CLOSED	4
	GEAR NOT DOWN	5
	GEAR NOT DOWNLOCKED	2
	GEAR NOT UNLOCKED	1
	GEAR UPLOCK FAULT	4
	GRAVITY EXTENSION	3
	LDG WITH ABNORMAL L / G	6
	LGCIU FAULT	5
	SHOCK ABSORBER FAULT	1
	SYS DISAGREE	4
WHEEL	HYD SEL FAULT	11
	N.W. STEER FAULT	9
	TYRE LO PR (<*)	11

02.34 NAVIGATION

R
R

ADR CHECK PROC	19
ADR DISAGREE	18
ADR FAULT	2
ADR 1 + 2 + 3 FAULT	4
BARO REF DISCREPANCY (<*)	1
EGPWS ALERTS (<*)	15
FM/GPS POS DISAGREE (<*)	13
GPS 1(2) FAULT (<*)	13
GPWS ALERTS (<*)	15
GPWS FAULT (<*)	14
GPWS TERR DET FAULT (<*)	16
HDG / ATT / ALTI DISCREPANCY	1
ILS 1(2) FAULT	14
IR ALIGNMENT IN ATT MODE	10
IR DISAGREE	11
IR FAULT	7
OVER SPEED	1
PRED W/S DET FAULT (<*)	10
RA 1(2) FAULT	12
TCAS FAULT (<*)	12
TCAS WARNINGS (<*)	17
UNRELIABLE SPEED INDICATION	20

02.36 PNEUMATIC

<u>AIR</u>	– APU BLEED FAULT	5
	– APU BLEED LEAK	5
	– BLEED 1(2) OFF	1
	– DUAL BLEED FAULT	3
	– ENG 1(2) BLEED ABNORM PR	1
	– ENG 1(2) BLEED FAULT	2
	– ENG 1(2) BLEED LEAK	4
	– ENG 1(2) BLEED NOT CLSD	1
	– ENG 1(2) (1 + 2) BLEED LO TEMP	7
	– ENG HP VALVE FAULT	6
	– L(R) WING LEAK	4
	– L(R) WNG LEAK DET FAULT	6
	– XBLEED FAULT	5
<u>BLEED</u>	– MONITORING FAULT	6

02.49 APU

– APU AUTO (EMER) SHUT DOWN	1

02.52 DOORS

– DOORS NOT CLOSED	1

02.70 POWER PLANT

After ENG SHUT DOWN	13
BLEED STATUS FAULT	22
COMPRESSOR VANE	18
CTL VALVE FAULT	19
EIU FAULT	1
ENG DUAL FAILURE	20
ENG FAIL	11
ENG RELIGHT (in flight)	10
ENG STALL	5
ENG TAILPIPE FIRE	25
FADEC A(B) FAULT	23
FADEC ALTERNATOR	18
FADEC FAULT	23
FADEC HI TEMP	23
FLEX TEMP NOT SET	15
FUEL CTL FAULT	18
FUEL FILTER CLOG	1
FUEL RETURN VALVE	19
HIGH ENGINE VIBRATION	26
HP FUEL VALVE	6
IGN FAULT	15
LOW N1	8
N1 / N2 / EGT OVERLIMIT	3
N1 / N2 / EGT / FF DISCREPANCY	9
OIL FILTER CLOG	2
OIL HI TEMP	2
OIL LO PR	2
ONE TLA FAULT	15
OVSPD PROT FAULT	18
REV ISOL FAULT 	12
REV PRESSURIZED	1
REV SWITCH FAULT	1
REVERSE UNLOCKED	4
REVERSER FAULT	1
SENSOR / PROBES FAULT	19
START FAULT	7
START VALVE FAULT	6
THR LEVER DISAGREE	16
THR LEVER FAULT	17
THRUST LOCKED 	24
TYPE DISAGREE 	23
VIB SYS FAULT	2

R

02.80 MISCELLANEOUS

	BOMB ON BOARD	10
	COCKPIT WINDSHIELD/WINDOW CRACKED	14
	COCKPIT WINDSHIELD/WINDOW ARCING	14
	CREW INCAPACITATION	9
	DITCHING	2
	ECAM ADVISORY CONDITIONS	15
	EMER DESCENT	7
	FORCED LANDING	5
R	LDG CONF – APPR SPD – LDG DIST – CORRECTIONS FOR FAILURE	17
	ON GROUND EMER / EVACUATION	1
	OVERWEIGHT LANDING	8
R	UNRELIABLE SPEED INDICATION	REFER TO 02.34
	VOLCANIC ASH ENCOUNTER	13
R	WINDSHEAR	19
R	WINDSHEAR AHEAD	20

02.90 DETAILED CABIN/COCKPIT EVAC PROC

	GENERAL	1
	COCKPIT ASSIGNED AREAS FOR EVACUATION	2
	COMMUNICATIONS	3
	LAND EVACUATION	4
	EVACUATION ON WATER	5

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**

■ **F / O PROBES**

■ **STBY PROBES**

} a
}
} b
}
} c

procedure to be applied:
a or b or 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

■ **ON GROUND**

■ **IN FLIGHT**

} a
}
} b
}
} c

procedure to be applied
(a + b) or (a + 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 :

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 :

TITLE

Abnormal procedure displayed on ECAM

TITLE

Abnormal procedure not displayed on ECAM

TITLE

Emergency procedure displayed on ECAM

TITLE

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.
 - When performing an engine-out non precision approach, the use of autopilot is not 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 guaranteed. 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 * F/CTL B SYS LO PR	– 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 INOP SYS IF BLUE OVHT OUT : CAT 3 BLUE ELEC PUMP ON BLUE HYD CAT 2 ONLY SPLR 3 SLATS SLOW	– 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		– BRAKE RESPONSE MONITOR	
– REVERSE THRUST MAX AVAIL.		– 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			
<i>Set parking brake ON after aircraft stops.</i>			
– 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.**

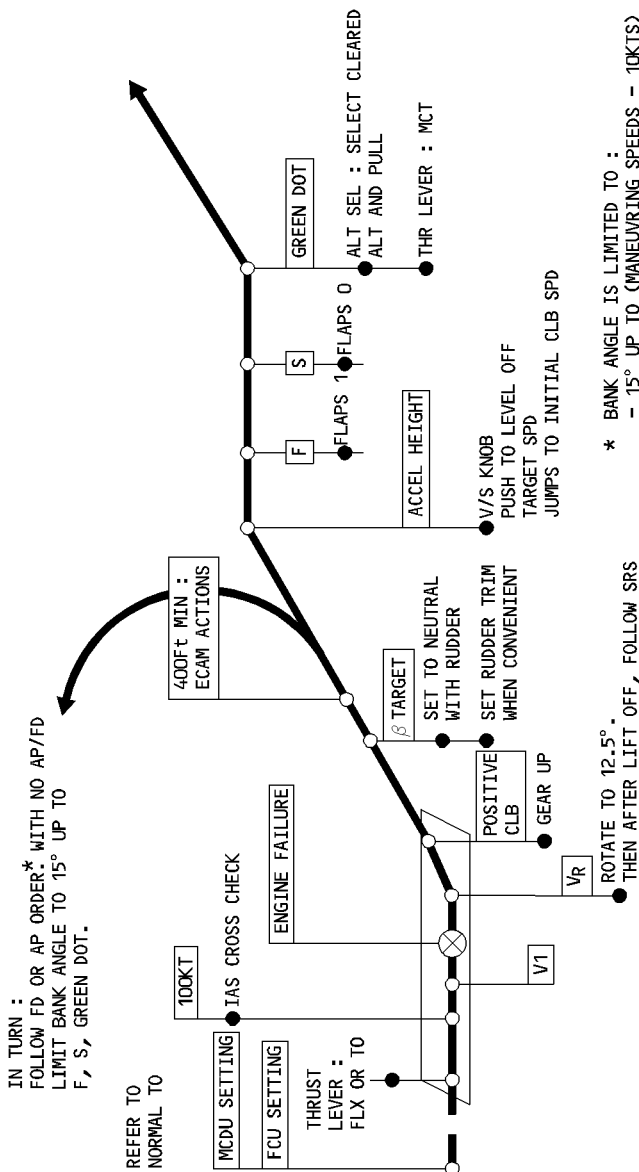
ENGINE FAILURE DURING INITIAL CLIMB-OUT

- 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)

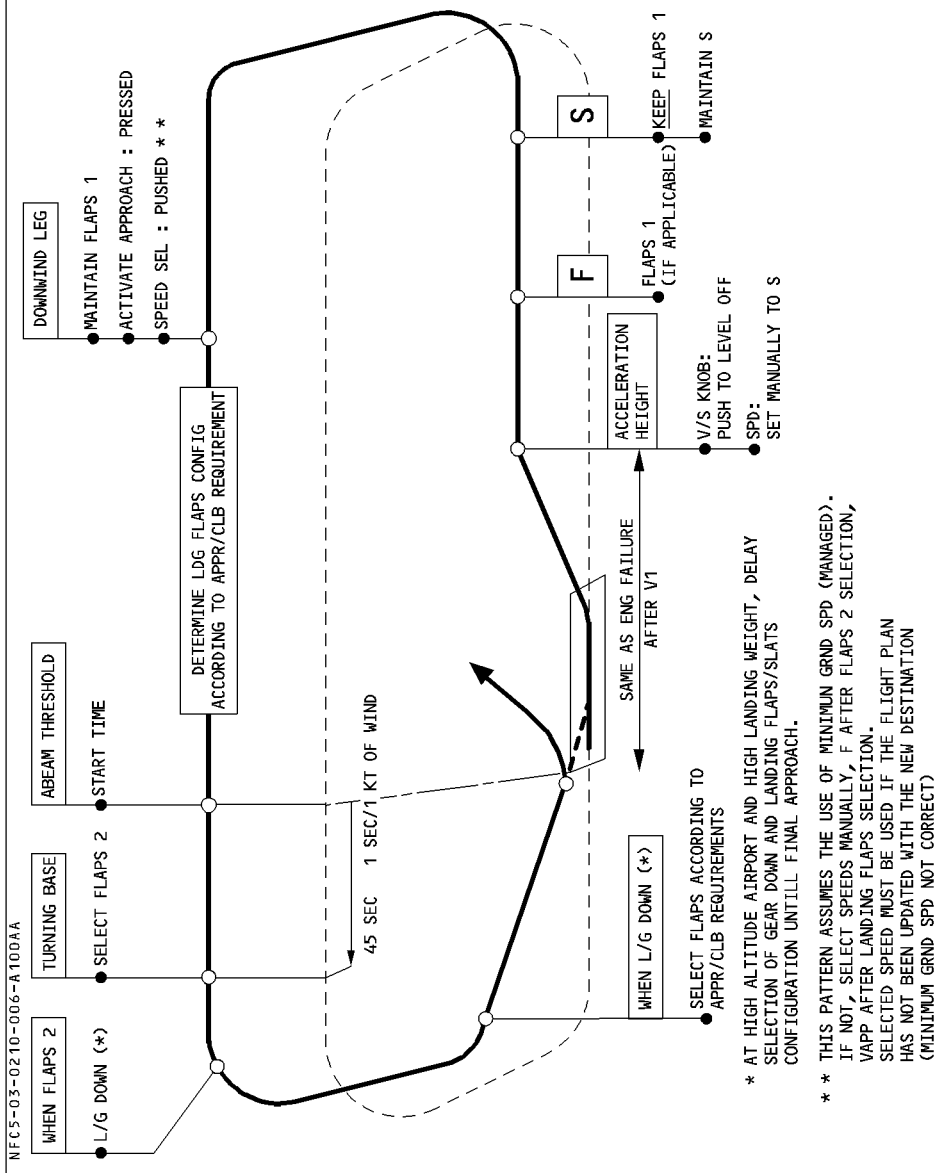
ENGINE OPERATION AT MAX T.O. THRUST IS LIMITED TO 10 MINUTES



* BANK ANGLE IS LIMITED TO :
- 15° UP TO (MANOEUVRING SPEEDS - 10KTS)
- THEN, LINEAR INCREASE TO 25°
UP TO (MANOEUVRING SPEEDS - 3KTS)
- 25° ABOVE (MANOEUVRING SPEEDS - 3KTS)

IMMEDIATE VMC LDG FOLLOWING ENG FAILURE ON TO

R



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

● FOR DIVERSION

- SELECT CLEAN CONFIGURATION
Recommended flaps retraction speed is between MAX SPEED – 10 knots and MAX SPEED.
- 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.*

*– In some cases, MAX SPEED – 10 knots may be a few knots higher
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.*

MAX SPEED

Flaps Slats	F = 0	0 < F ≤ 1	1 < F ≤ 2	2 < F ≤ 3	F > 3
S = 0	NO LIMITATION	215 knots	200 knots	185 knots	Not allowed (177 knots)
0 < S ≤ 1	230 knots				
1 < S ≤ 3	200 knots		200 knots	185 knots	177 knots
S > 3	177 knots		177 knots	177 knots	177 knots

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)

AIR PACK 1(2) FAULT

- PACK (affected)

.....

OFF

STATUS

|

INOP SYS

PACK 1(2)

AIR PACK 1(2) OFF

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.

STATUS

- **If system not recovered :**
CAB TEMP BY PACK ONLY

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

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).

INOP SYS

PACK 1 + 2

(if PACKS closed)

HOT AIR

R

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 :

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

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).
- 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

Extension of speedbrakes will significantly increase Vls.

In order to avoid autopilot disconnection and automatic retraction of speedbrakes due to possible activation of angle of attack protection, allow the speed to increase before 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.*

Notify the cabin crew when a safe flight level has been reached and oxygen 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 :**

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

– **MODE SEL** **MAN**

– **MAN V/S CTL** **AS RQRD**

· *It may take 10 seconds in manual mode before the crew notices a change of the outflow valve position. Use the cabin V/S indication to confirm the outflow valve 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 ΔP to 8.6 psi.*

STATUS

INOP SYS
CAB PR 1 + 2

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.

CABIN OVERPRESSURE

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

- PACK 1 or 2 OFF
- BLOWER + EXTRACT OVRD

Cabin air is extracted overboard

- ΔP FREQUENTLY MONITOR

● **If $\Delta P > 9$ PSI**

- PACK 1 + 2 OFF
- LAND ASAP

Before 10 minutes from landing :

- PACK 1 + 2 OFF
- BLOWER + EXTRACT AUTO

CAUTION

Check that ΔP 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
- It may take 10 seconds in manual mode before the crew notices a change of the outflow 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 selected with LDG ELEV selector. Refer to the LDG ELEV indication on the CRUISE page 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 .

It may take 10 seconds in manual mode before the crew notices a change of the 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.

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 outflow 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 ground only, if the reset is unsuccessful, the taxi and takeoff can be continued with 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.

CAT 3 SINGLE ONLY

STATUS

| INOP SYS
CAT 3 DUAL
RUD TRIM 1(2)

AUTO FLT RUD TRIM SYS

– FAC 1 + 2 OFF THEN ON

CAT 1 ONLY

STATUS

| 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.

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

Characteristics speeds displayed on the two PFDs are computed in the same FAC.

CAT 3 SINGLE ONLY

INOP SYS

**CAT 3 DUAL
FAC 1(2)**

R
R

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.

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**
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.

For voluntary disconnection, an amber A/THR OFF message is displayed on the right lower 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

I 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.

- 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.

2. If unsuccessful, deselect the identified failed VHF/HF transmission keys on the associated Audio Control Panel (ACP) to remove the caution. This ACP should only be used in 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 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\VHF1 C/B G09 on 49 VU, COM NAV\VHF2 C/B L04 on 121 VU, COM\VHF3 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.

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) 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

I

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

- 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

SPLR 3

ADR 3

RA 1

CAPT TAT

L WSHLD HEAT

L WNDW HEAT

CAT 3

L+R TK PUMP 1

CTR TK PUMP 1 <*

VENT BLOWER

GALLEY FAN

CRG VENT <*

GND COOL <*

N.W. STEER

MAIN GALLEY

B ELEC PUMP

BSCU CH 1

DMC 3

GPWS

LAV DET

PACK 1 REGUL

Other inoperative systems

Left cabin fan

Radar 1

Stby Pitot/AOA

Engine 1 ignition B

EVMU eng 1 and eng 2

Hydraulic quantity

indication

Printer

HF 1 <*

Zone controller prim channel

Partial galley

ACARS <*

Brake fans 5, 6, 7 and 8 <*

HUD <*

MCDU 3 <*

PVI <*

TCAS <*

***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

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

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

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
ILS 2
GPS 2
Y ELEC PUMP
SDAC 2
FWC 2
DMC 2
FDIU
R WSHLD HEAT

CTR TK PUMP 2 
LGCIU 2
RA 2
F/O PITOT
F/O AOA
F/O TAT
R WNDW HEAT
CAT 2
L+R TK PUMP 2

RUD TRV LIM 2
BSCU CH 2
REVERSER 2
VENT EXTRACT
GND COOL 
PACK 2 REGUL
MAIN GALLEY
YAW DAMPER 2
RUD TRIM 2

OTHER INOP SYS

Right cabin fan
Brake fans 1, 2, 3 and 4 
ADF 2 
DME 2
RADAR 2 

MCDU 2
ENG 2 ignition B
VOR 2
F/O PFD and ND

QAR
ATC 2
ECAM lower DU
HF 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

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)	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

ATC 1

CAPT AOA heat

DME 1

CVR

APU fuel pump

CAPT ND

ADF 1 

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.

R

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
CAPT STAT HEAT
STBY STAT HEAT
L. WSHLD HEAT
L. WNDW HEAT

CTR TK PUMP 1 
AVNCS VENT
GALLEY FAN
GND COOL 
REV 1

BSCU CH 1
LAV DET
PACK 1 REGUL

Other inoperative systems

Left cab fan
Zone controller primary channel
Sel cal
CFDIU

VHF 3 
RMP 3 
Hot air
Capt wiper

Eng 1 oil press and qty ind.
TPIS 
Brake temps ind.

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

ELAC 2 (a)

SEC 2 + 3

VHF 2

CTR TK PUMP 2 ◀

LGCIU 2

REV 2

CAB PR 2

CAT 3 DUAL

FAC 2

LTK PUMP 2

RTK PUMP 2

ENG 1 LOOP B

ENG 2 LOOP A

PACK 2 REGUL

FCDC 2

MAIN GALLEY

Y ELEC PUMP (if selected ON)

BSCU CH 2

F/O STAT

RWSLHD HEAT

RWNDW HEAT

AP 2

FCU 2

Other inoperative systems

SFCC 2

R cabin fan

F/O wiper

F/O rain rplnt

Eng 1 and 2 fire ext btl 2

Autobrake (due to loss of 2 SECs)

BMC 2

Bleed X feed auto control

RMP 2

FQI channel 2

zone controller sec

SDCU 2

Brake fan ◀

Eng 2 oil low press and qty ind

R loudspeaker

rudder trim ind

FMGC 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

- Affected systems
- * CAB PRESS

* HYD

* F/CTL



R

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
 SPLR 3
 VHF 1
 ACP 1+2
 WING A. ICE
 AP 1
 A/THR
 FCU 1

FAC 1
 L TK PUMP 1
 R TK PUMP 1
 REV 2
 ENG 2 START
 CAB PR 1

VENT EXTRACT
 B ELEC PUMP
 GPWS
 ENG 1 LOOP A
 ENG 2 LOOP B
 FCDC 1
 CAT 3

Other inoperative systems

BRK PRESS indicator
 Flight interphone
 EIU 2 (autothrust, eng start
 and reverser inop)
 Capt rain repellent
 Avionics air cond valve

Standby Horizon
 Standby compass light
 HP fuel shut-off valves
 SFCC 1
 RMP 1

Hyd fire valves Eng 1 and 2
 Ram air inlet
 ECAM control Panel
 Left loudspeaker
 DC SHED ESS BUS

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

X BLEED valve man ctl

SDCU 1

Crew oxygen valve

FMGC 1

BMC 1

FQ1 channel 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
ELAC 2 (a)
SEC 2 + 3
VHF 2
ACP 3
CAPT STAT heat
F/O STAT heat
STBY STAT heat
WSHLD HEAT
WNDW HEAT
AP 2
FCU 2
FCDC 2

CAT 3
FAC 2

ANTI SKID
N.W. STEER
LGCIU 2
REVERSER 1 + 2
CAB PRESS 2
AVNCS VENT
L + R CAB FAN
GALLEY FAN

GND COOL 
MAIN GALLEY
Y ELEC PUMP
BSCU CH 1
BSCU CH 2
APU FIRE DET
LAV DET
ENG 1 LOOP B
ENG 2 LOOP A
PACK 1 REGUL
PACK 2 REGUL
L TK PUMP 2
R TK PUMP 2
CTR TK PUMPS

R

Other inoperative systems

Selcal
Brake temp indication
Brake fans 
TPIS 
Capt and F/O wipers
Eng 1 and 2 oil pressure and
quantity indication
Autobrake
Stick and rudder pedals lock
(by AP)

VHF 3 
RMP 2
RMP 3 
CFDIU
Right loudspeakers
SFCC 2
CDLS 
APU ECB
Manual pressure control

FMGC 2
Rudder trim indication
BMC 2
FQI channel 2
Eng 1 and 2 fire ext btl 2
X Bleed auto control

APU fuel LP valve
SDCU 2

R

(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.

– 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. 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
REVERSER 1 + 2
ADR 2 + 3
IR 2 + 3
RA 1 + 2

SPLR 1 + 2 + 5
ELAC 2
SEC 2 + 3
A/CALL OUT
AP 1 + 2

A/THR
FUEL PUMPS
ANTI SKID
N.W. STEER

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
R

DC ESS BUS is supplied by the batteries. AC ESS BUS is also supplied by the batteries, via 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	Nº1 only (2)	Nº1 only (2)	Nº1 only (2)
	ADR	Nº1 only	Nº1 only	Nº1 only
	ADF 	Nº1 only	Inop	Inop
	VOR/MMR	Nº1 only	Nº1 only	Nº1 only (1)
	DME	Nº1 only	Inop	Inop
	VOR/DDRMI	Norm	Norm	Norm (1)
	ATC	Nº1 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

APU BAT START NOT AVAIL
ECB is no longer supplied

STATUS

INOP SYS

APU FIRE DET

See below

OTHER INOP SYS

APU ECB	Fwd (aft) cargo heat	APU fuel LP valve
Stick and rudder pedals lock (by AP)	controller <4>	Manual pressure control
Fwd (aft) cargo fire ext <4>	Fwd cargo isol valves <4>	

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

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

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

Note : *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.*

On the ground, do not re-engage any wing 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.

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

No crew action required in flight.

STATUS

INOP SYS
 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)

- **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)

■ 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).

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 $\triangleleft$.*.

• 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

● If no fuel vapor :

– CAB FANS OFF

To prevent smoke from entering the cockpit and cabin.

– PACK FLOW HI

To provide maximum airflow from the packs.

Do not shut down the air conditioning packs, and do not reduce ventilation in an attempt to smother the fire.

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)

● At FL100, or MEA :

- PACKS 1 + 2 OFF
- MODE SEL MAN
- MAN V/S CTL FULL UP
- RAM AIR ON

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

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).

2. If the slats are locked in clean configuration ($<18^\circ$), 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

APPR PROC

- FOR LDG USE FLAP 3
Do not select CONF FULL, so as not to degrade handling qualities.
- CTR TK PUMPS OFF
- GPWS LDG FLAP 3 ON
- APPR SPD See page 3
- 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)

INOP SYS

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

(a) If both slat channels fail.

FLAPS/SLATS FAULT/LOCKED

MAX SPEED

Flaps (1) Slats (1)	F = 0	0 < F ≤ 1	1 < F ≤ 2	2 < F ≤ 3	F > 3
S = 0	NO LIMITATION	215 kt	200 kt	185 kt	Not allowed (177 kt)
0 < S ≤ 1	230 kt				
1 < S ≤ 3	200 kt				
S > 3					177 kt

APPR SPD and LDG DIST

Flaps (1) Slats (1)	F = 0	0 < F < 1	1 ≤ F < 2	2 ≤ F < 3	F ≥ 3
S = 0	VREF + 60 (Appr) VREF + 50 (Touch Down) DIST × 1.7	VREF + 45 DIST × 1.6	VREF + 30 DIST × 1.4	VREF + 25 DIST × 1.35	(FLAPS > 3 not allowed) VREF + 25 DIST × 1.35
0 < S < 1					
1 ≤ S ≤ 3	VREF + 25 DIST × 1.35		VREF + 15 DIST × 1.2	VREF + 10 DIST × 1.15	VREF + 10 (2) DIST × 1.15
S > 3					VREF + 5 DIST × 1.1

(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

– 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.

(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

SLATS SLOW

STATUS
I

F/CTL FLAP SYS 1(2) FAULT

● If FLAP sys 1 fault

– GPWS FLAP MODE OFF

ENG 1(2) APPR IDLE ONLY
FLAPS SLOW

STATUS
I

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 It 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.

3. If the ELAC 1 computer is reset on ground, the pitch trim returns to the 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

Note : If the ELAC 1 computer is reset on ground, the pitch trim returns to the ground 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.

CAT 3 SINGLE ONLY

STATUS

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

SEC 1 + 2 or 2 + 3 X 1.1

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)

Note : In case of GPWS (EGPWS $\triangleleft$) alerts, since protections are lost respect stall warning when applying the GPWS (EGPWS $\triangleleft$) 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

Use small control inputs at high speed, since in direct law the controls are powerful. Use of 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 $\triangleleft$ *) alerts, since protections are lost, respect stall warnings when applying the GPWS (EGPWS $\triangleleft$ *) 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 $V_{\alpha \max}$).*
- *Bank and pitch limits are no longer displayed on the PFD.*
- *$V_{\alpha \text{ prot}}$, $V_{\alpha \max}$ are lost on the PFD.*
- *Vsw, displayed on the PFD, corresponds to the stall warning of the alternate and direct law.*

F/CTL INDICATIONS LOST

STATUS

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

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

INOP SYS
L (R) AIL

R
R

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

– LDG CONF 3 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.

– 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.

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

R
R

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

Note : When the ELAC 1 computer is reset on ground, the pitch trim returns to the 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

STABILIZER JAM

The ELACs may not detect a stabilizer jam when the pitch trim wheel is jammed.

The flight control normal law remains active in this case and there is no ECAM warning.

Apply the following procedure.

- AP OFF
- MAN PITCH TRIM CHECK

The pitch trim wheel may not be fully jammed, the force needed may be higher than 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).

APPR PROC

● IF MAN TRIM NOT AVAIL :

- FOR LDG USE FLAP 3
Do not select configuration full so as not to degrade the handling qualities.
- GPWS LDG FLAP 3 ON

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.*

ACTIVE CONTROL LAW

ACTIVE LAW ► SYS FAILED ▼	PITCH		ROLL	YAW
	LAW	PROTEC		
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
<u>NORM OPERATION</u>		ELAC2	ELAC2	ELAC2	
<u>SINGLE FAILURE</u>					
ELAC2	ELAC1	ELAC2	ELAC1	ELAC2	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	
<u>DOUBLE FAILURE</u>					
ELAC2 + ELAC1	ELAC1	SEC2	SEC2	SEC2	ELAC1
+ SEC2	ELAC1		ELAC1		ELAC1
+ SEC1	ELAC1		ELAC1		ELAC1
+ G	ELAC1		ELAC1		ELAC1
+ Y		SEC2	ELAC1		
+ B		SEC2	SEC2	SEC2	
ELAC1 + SEC2		ELAC2	ELAC2	ELAC2	
+ SEC1	SEC1	ELAC2	ELAC2	ELAC2	
+ G		SEC2	SEC2	SEC2	SEC1
+ Y		ELAC2	SEC2	ELAC2	
+ B			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
<u>TRIPLE FAILURE</u>					
<u>ELAC2</u>					
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	
<u>ELAC1</u>					
SEC2 + SEC1		ELAC2	ELAC2	ELAC2	
+ G	SEC1		SEC1		SEC1
+ Y	SEC1		SEC1		SEC1
+ B		ELAC2	ELAC2	ELAC2	
SEC1 + G		Damped	SEC2	SEC2	
+ Y			SEC2	Damped	
+ B		SEC2 ELAC2	ELAC2	ELAC2	
G + Y	SEC1		inop		SEC1
B + G	Damped		ELAC2	ELAC2	
B + Y		ELAC2	ELAC2	Damped	
<u>SEC2</u>					
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	
<u>SEC1</u>					
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

- 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)

● **When reaching FL 150 :**

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

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)

I

FUEL L (R) XFR VALVE OPEN

Crew awareness

STATUS

I 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

I 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

I 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

I 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

I

FUEL LEAK

A fuel leak may either be detected by :

- The sum of FOB and FUSED 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
- An excessive fuel flow (leak from engine), or
- 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
- 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

Do not open the FUEL X-FEED, even if requested by another ECAM procedure.
Do not apply the FUEL IMBALANCE procedure : Even with a fuel imbalance of one 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

● IF NO FUEL LEAK AND FOR AIRCRAFT HANDLING :

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

– GREEN ENG 1 PUMP
- OFF

OFF

■ RSVR LO AIR PR :

● IF PRESS FLUCTUATES :

- PTU

– GREEN ENG 1 PUMP
- OFF

OFF

G ENG 1 PUMP LO PR

G SYS LO PR

Affected systems

*WHEEL

*F/CTL



R

R

R

R

HYD G RSVR LO AIR PR/OVHT/LO LVL (CONT'D) STATUS

■ sys lost by RSVR LO AIR PR :

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 :

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

R

R

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

Y ENG 2 PUMP LO PR

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

Note : *Following a yellow hydraulic system failure, the parking brake may be inoperative due to a yellow 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

* WHEEL

* 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

– 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**

– 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**

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

APPR PROC DUAL HYD LO PR (line not
 displayed for a double LO LVL)

● **if sys lost by RSVR LO AIR PR :**

– related PUMP ON

– PTU (if no RSVR OVHT and no RSVR
 LO LVL) AUTO

● **if sys lost by RSVR OVHT :**

● **IF GREEN OVHT OUT :**

– GREEN ENG 1 PUMP ON

– PTU (if no Y RSVR OVHT and no
 RSVR LO LVL) AUTO

● **IF YELLOW OVHT OUT :**

– YELLOW ENG 2 PUMP ON

– PTU (if no G RSVR OVHT and no
 RSVR LO LVL) AUTO

● **IF HYD NOT RECOVERED (line not
 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

Note : *Following a yellow hydraulic system failure, the
parking brake may be inoperative due to yellow
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

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

CAT 3 SINGLE ONLY

INOP SYS

YELLOW HYD

SPLR 2 + 4

CAT 3 DUAL

ALTN BRK

REVERSER 2

Y ELEC PUMP

YAW DAMPER 2

R

R

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

INOP SYS
YELLOW HYD
SPLR 2 + 4
CAT 3 DUAL
ALTN BRK
REVERSER 2
PTU
Y ENG 2 PUMP
YAW DAMPER 2

Note : Following a yellow hydraulic system failure, the
parking brake may be inoperative due to a yellow
accumulator low pressure.

R
R
R

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.

Note : If the air conditioning packs are selected OFF and the warning is triggered on the ground when OAT is greater than 40°C or when the cockpit window/windshield is 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
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

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

I **INOP SYS**
ENG 1 (2) A. ICE

ANTI ICE ENG 1 (2) VALVE OPEN

THRUST LIM PENALTY

STATUS

THRUST LIM PENALTY

I

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

I **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

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

I

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 V_{α} prot since the margin versus stall may be reduced.

Note : If ice accretion, the approach speed must not be lower than :

– VLS + 5 knots in configuration full and the landing distance must be multiplied by 1.1.

– VLS + 10 knots in configuration 3 and the landing distance must be multiplied by 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

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.

– ECAM ENG FUEL F/CTL WHEEL (L/G pos ind) SYS PAGES 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

R
R

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
CAT 3 DUAL
FWC 1(2)

FWS FWC 1 + 2 FAULT

- MONITOR SYS
- MONITOR OVERHEAD PANEL

| NOT AVAIL
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 :**

This failure may be due to a DMC FAULT or a communication interruption between the DMC and DU.

- EIS DMC SWITCHING AS RQRD

● **If unsuccessful :**

- DU (affected) OFF THEN ON
Note : ND display may disappear, in case too many waypoints and associated information are displayed. Reduce the range, or deselect WPT or CSTR, and the display will automatically recover after about 30 seconds.

■ **INVERSION OF EWD AND SD :**

- 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

– L/G KEEP DOWN

INCREASED FUEL CONSUMP

INOP SYS

L/G RETRACT

Flight with landing gear extended has a significant effect on fuel consumption and climb gradient (see "SPECIAL OPERATIONS" - FLIGHT WITH GEAR DOWN).

Note : If WHEEL N.W. STEER FAULT is also displayed, then the nose wheels may be at maximum deflection. (turned 90 degrees from center). During landing, delay nose wheel touchdown for as long as possible.

■ Shock absorber extended on the ground :

Crew awareness.

L/G GEAR NOT UNLOCKED

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 UNLOCKED (CONT'D)

■ **L/G doors not closed :**

MAX SPEED 220/.54

– L/G RECYCLE

● **IF UNSUCCESSFUL :**

– L/G DOWN

MAX SPEED 280/.67

STATUS

MAX SPEED 280/.67

INCREASED FUEL CONSUMP

INOP SYS

L/G RETRACT

Note : – Flight with landing gear extended has a significant effect on fuel consumption and climb gradient (see “SPECIAL OPERATIONS” - FLIGHT WITH GEAR DOWN - FCOM 2.04.25). Multiply fuel consumption by approximately 2.8. Disregard FM fuel predictions.

– Other predictions should also be disregarded (altitude, speed and time), except time predictions at waypoints when in cruise.

– Do not use managed speed (except in approach) and CLB and DES autopilot 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

– L/G GRVTY EXTN

CAT 3 SINGLE ONLY

If gravity extension is unsuccessful, see “LDG WITH ABNORMAL L/G” procedure.

INOP SYS

CAT 3 DUAL

N.W. STEER

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.
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 climb gradient (see "SPECIAL OPERATIONS" - FLIGHT WITH GEAR DOWN). Multiply fuel 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
- GRVTY GEAR EXTN handcrank .. TURN BACK TO NORMAL
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
Manual braking will enable better pitch and roll control. Moreover, with at least one main landing gear in the abnormal position the autobrake cannot be activated (ground spoilers not armed).
- EMER EXIT LT ON
- CABIN REPORT OBTAIN
- **If one or both MAIN L/G abnormal**
 - A/SKID & N/S STRG OFF
With one main landing gear not extended, the reference speed used by the anti-skid to detect a wheel blockage is not correctly initialized. Consequently, the anti-skid must be switched off to prevent permanent brake release.
 - MAX BRAKE PR 1000PSI
Modulate the brake pressure to 1000 psi because the anti-skid is off.
 - GROUND SPOILERS DO NOT ARM
To keep as much roll authority as possible for maintaining the wings level. 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
Do not use reverse to prevent ground spoiler extension, and because the engine will 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
- 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.



NOSE L/G ABNORMAL



ONE MAIN L/G ABNORMAL



BOTH MAIN L/G ABNORMAL

REFERENCE AIRCRAFT ATTITUDE
AFTER IMPACT

R

NFCS-03-0232-008-A001AA

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.

2. As specified in the QRH 5.04, automatic rollout is 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

Failure of normal brake selector valve, or the steering selector valve, in the open position.

- *If the normal brake selector valve is failed open, full green hydraulic pressure is present at normal servovalves' entry.
Nosewheel steering remains available.*
- *On ground, do not tow the aircraft with the green hydraulic system pressurized :
Nosewheel steering remains pressurized, and so towing may either break the towbar shear pin, or the nose gear (if towbarless towing).*
- *Selecting A/SKID & N/W STRG OFF, or resetting the BSCU, will cause the nosewheel to 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
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 :

Flight control normal laws are lost. Pitch alternate law preserves the neutral static 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
In case of an 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.

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

Note : In case of an ADR 1 + 3 FAULT, the landing gear safety valve is closed. Landing gear extension must be performed by gravity.
(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

RUD WITH CARE ABV 160 KT

The rudder travel limit value is frozen at the value it had at the moment when the failure occurred. Therefore, rudder inputs must be limited at speeds above 160 knots, so as not to damage structure. At slats' extension, full rudder travel authority is recovered.

APPR PROC :

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 $\triangleleft$
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

IR MAY BE AVAIL IN ATT

Refer to the IR ALIGNMENT IN ATT MODE procedure.

CAT 3 SINGLE ONLY

INOP SYS

IR 1

CAT 3 DUAL

TCAS (*)

Note : () In case of an IR 1 fault, the TCAS may be inoperative (depending on the TCAS manufacturer).*

■ **IR 2 FAULT :**

- ATT HDG SWTG **F/O**

STATUS

IR MAY BE AVAIL IN ATT

Refer to the IR ALIGNMENT IN ATT MODE procedure.

CAT 3 SINGLE ONLY

INOP SYS

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

IR MAY BE AVAIL IN ATT

Refer to the IR ALIGNMENT IN ATT MODE procedure.

CAT 3 SINGLE ONLY

INOP SYS

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).

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.

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

Note : When the ELAC 1 computer is reset on ground, the pitch trim returns to the 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

R
R

NAV RA 1(2) FAULT

Crew awareness.

■ One RA FAULT :

CAT 2 ONLY

STATUS

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

ILS APPR mode cannot be engaged ; LOC mode is available via the FCU LOC pushbutton.

INOP SYS

RA 1 + 2

A/CALLOUT

AP 1 + 2 (when
landing gear is
down)

GPWS

R
R

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.

CAT 1 ONLY

STATUS

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.

– BOTH FDs OFF
Adjust the vertical speed, as required, to that indicated on the 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 V_{0max} and V_{max} .

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.

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° 10° 13°	CL
	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°	
	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 Descent profile : M 0.76 above FL 320 · 275 kt from FL 320 to FL 200 · 250 kt below FL 200	.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°	
	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) IN CONF 1 TO SELECT FLAPS 2 (equivalent to S speed) IN CONF 2 TO SELECT FLAPS 3 (equivalent to VLS + 10) IN CONF 3 TO SELECT FLAPS FULL (equivalent to VLS + 10) IN CONF FULL (equivalent to VLS + 10)	below 45 45 to 55 55 to 65 above 65	LEVEL OFF	5.5°	43 % 47 % 52 % 56 %
	below 45 45 to 55 55 to 65 above 65	LEVEL OFF	7.0°	44 % 49 % 53 % 58 %
	below 45 45 to 55 55 to 65 above 65	LEVEL OFF	8.0°	45 % 51 % 55 % 60 %
	below 45 45 to 55 55 to 65 above 65	LEVEL OFF	7.0°	51 % 56 % 61 % 65 %
	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 (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 performance.
 - X BLEED OPEN

STATUS

ONE PACK ONLY IF WAI ON

INOP SYS
 ENG 1(2) BLEED
 PACK 1(2)
 (if closed)

R

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

● IF A/C ICING SEVERE

- MIN SPD ALPHA PROT

INOP SYS
WING A.ICE
ENG 1(2) BLEED
PACK 1(2)

R

AIR X BLEED FAULT

- X BLEED MAN CTL
Select OPEN, when the APU BLEED pushbutton is ON, or for engine start, or when WING 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

I

AIR L (R) WNG LEAK DET FAULT

Crew awareness.

STATUS

I

INOP SYS
L(R) LEAK DET

BLEED MONITORING FAULT

Crew awareness.

STATUS

I

INOP SYS
BMC 1 + 2

AIR ENG 1(2) BLEED LO TEMP

In flight, 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 I

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 I

ENG 1(2) FUEL FILTER CLOG

Crew awareness.

Maintenance action is due.

ENG 1(2) REVERSER FAULT

Note : If this ECAM warning is triggered at engine shut down, it can be considered as 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.

STATUS

ENG 1(2) APPR IDLE ONLY

Minimum idle is lost.

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.

Maintenance action is due, except if the caution is temporarily displayed during cold engine start with engine oil temperature lower than 40°C.

R
R

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 :

ENG 1(2) AT IDLE

Displayed only if FADEC automatically sets the engine at idle (i.e. when 4 reverser doors not stowed or 1, 2 or 3 reverser doors not stowed with reverser pressurized).

- THR LEVER (affected engine) IDLE
- ENG MASTER (affected engine) OFF

■ In flight :

● If FADEC sets automatically the engine at idle :

ENG 1(2) AT IDLE

- THR LEVER (affected engine) IDLE

● IF BUFFET :

The warning alone without buffet or vibration may be a false warning.

MAX SPEED 240 KT

- ENG MASTER (affected engine) OFF

● If FADEC does not set automatically the engine at idle :

● IF BUFFET :

- THR LEVER (affected engine) IDLE

MAX SPEED 240 KT

- ENG MASTER (affected engine) OFF

● If reverser is actually deployed :

- RUD TRIM FULL R (L)

- CONTROL HDG WITH ROLL

Note : Do not follow beta and beta target, if displayed.

ENG 1(2)

SHUT DOWN

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

On the ground, consider application of "START VALVE MANUAL OPERATION" 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) :

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.

The following message will be displayed on the ECAM :

- 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 no start condition for appropriate maintenance action.

● On the ground (manual start) :

- MAN START (affected) OFF

- ENG MASTER (affected) OFF

- MODE SEL CRANK

- 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.

– 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) :

– MAN START (affected) OFF

– ENG MASTER (affected) OFF

– MODE SEL CRANK

– 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)

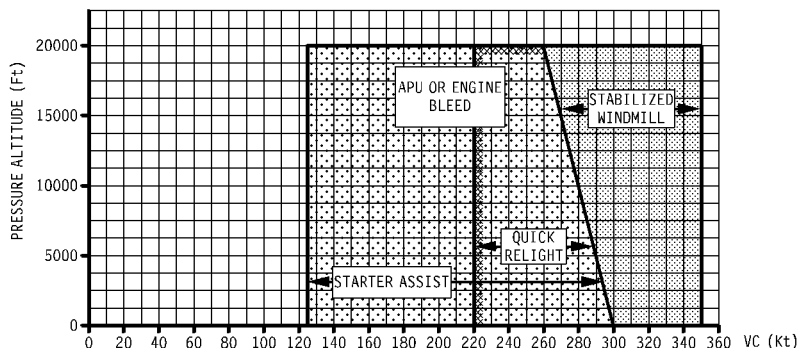
- MAX ALTITUDE** See below
- **ENG MASTER (affected)** OFF
 - **THR LEVER (affected)** Check IDLE
 - **MAN START pushbutton** OFF
- Auto start is recommended in flight. Be aware that, unlike the procedure for auto start on the ground, the crew must take appropriate action in case of abn start.*
- **ENG 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).*



NFC5-03-0270-010-A110AA

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.

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)

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 α_{Max}) 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 unsuccessful. If high vibration occurs and continues after engine shutdown, reduce airspeed and descent to a safe altitude.

Attempt to determine and use a practical 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.

– 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

■ 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.

■ 1, 2, or 3 doors not stowed (CFM) or reverse detected unlocked (IAE) :

● IF BUFFET :

– FOR LDG USE FLAP 3

– GPNS LDG FLAP 3 ON

APPR SPD : VREF + 10 kt

– LGD DISP PROC APPLY

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)

STATUS

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.

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 <4 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

For any case of thrust lever fault (TO, FLEX or between IDLE and MCT) the FADEC will command idle thrust for the approach when slats are extended (or when $MN < 0.47$ if associated EIU is failed). It is independant of the autothrust condition. Thrust of 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 % **I**

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. **I**

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 is – 4.5°. (For weights above 50 000 kg/110 000 lb add 1° for each 10 000 kg/22 000 lb.)

At 300 kt, the aircraft can fly up to about :

· 2 NM per 1000 ft at 50 000 kg/110 000 lb

· 2.2 NM per 1000 ft at 60 000 kg/132 000 lb

· 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.

APU start is unavailable for 45 seconds after the loss of both engine generators. This 45-second delay prevents any interference with emergency generator 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.*

R
R
R

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

I

ENG 1(2) HI GND IDLE

■ In flight

● If ENG ANTI ICE on

- ENG MODE SEL IGN

STATUS

I

ENG 1(2) HI GND IDLE

ENG 1(2) FADEC A(B) FAULT

Loss of one FADEC channel.

Crew awareness.

Note : Some cases of spurious FADEC fault have been experienced at engine start on ground.

The warning can be considered as spurious, if it disappears after application of the following procedure :

- Set the master lever to OFF, and wait until N2 speed goes below 5 %.
- Pull and reset the C/B's of the affected ECU electrical supply (A04 or A05 on 49 VU or R41 or Q40 on 120 VU).
- 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.

- 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 $\geq$ 6 units, N2 $\geq$ 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.

– ΔP CHECK ZERO

If ΔP is not at zero, select manual mode and V/S CTL-FULL UP in order to fully open the 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

– 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
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.
- BLEED (ENGs and APU) OFF
- DITCHING pushbutton ON
The outflow valve, emergency ram air inlet, avionics ventilation inlet and extract 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 :**
 - L/G lever DOWN
 - SLATS and FLAPS MAX AVAIL
- **If engines not running :**
 - FOR LDG USE FLAP 3
 - L/G GRVTY EXTN DOWN
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
- EVACUATION INITIATE

R

EMER DESCENT

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 ($\triangleleft$).*
- 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.

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

Automatic landing is certified up to MLW, but has been demonstrated in flight up to MTOW. In determining the best course of action, the flight crew may consider the option to perform 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 FCOM to find approach and landing configuration given as a function of the approach climb limiting weight.

Note : 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 (<41) 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 incapacitated 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.
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.

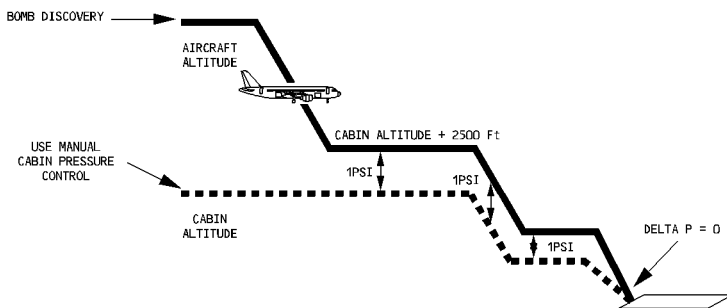
These conditions are achieved by using the manual pressure control.

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).



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) :**

- 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.

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.

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.

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.

– 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.

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

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 hand luggage (saturated with water or any other nonflammable liquid) up to the cabin ceiling, compressing as much as possible. Secure the LRBL stock in place using belt, 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.

If altitude permits, reduce thrust to idle. This maximizes engine surge margin and lowers 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.

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 =	FL	100	150	200	230
5 PSI	CABIN ALTITUDE	0	3000	6000	8000

● When starting the final descent

– **CAB PRESS MODE SEL AUTO**

COCKPIT WINDSHIELD/WINDOW ARCING

– **Affected WINDOW/WINDSHIELD 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 ΔP ≥ 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. <i>Note: If OIL TEMP rise follows thrust reduction, increasing thrust may reduce oil temperature.</i> 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. <u>Low Speed</u> - Increase engine speed to increase fuel flow and thereby cool IDG oil. 2. <u>High Speed</u> - 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. <i>Note: The advisory threshold may be decreased by a MCDU procedure at the level of vibration reached during the last flight.</i> <i>If this function has been activated, the N1 and N2 VIB indication will respectively pulse below 6 and 4.3.</i>

LDG CONF - APPR SPD - LDG DIST CORRECTIONS FOR FAILURES		FLAPS LEVER POSITION FOR LDG	APPR SPD : INCREMENT TO VREF (Δ 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 Slats $\geq$ 1	3	45	1.6 *
		3	25	1.35 *
	1 $\leq$ FLAPS < 2 : Slats < 1 Slats $\geq$ 1	3	30	1.4 *
		3	15	1.2 *
	2 $\leq$ FLAPS < 3 : Slats < 1 Slats $\geq$ 1	3	25	1.35 *
		3	10	1.15 *
	FLAPS = 3 : Slats < 1 1 $\leq$ Slats $\leq$ 3 Slats > 3	3	25	1.35 *
		3	10	1.15 *
		3	5	1.1 *
	FLAPS > 3 : Slats < 1 1 $\leq$ Slats $\leq$ 3 Slats > 3	NOT ALLOWED		
		FULL	10	1.15 *
		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 (Δ 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	3	10	1.2 *
	DUAL ADR FAULT			
	ADR 1 + 2 + 3 FAULT			
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

- Δ 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 Δ VREF ;
 - $VAPP = VREF + \Delta VREF + WIND CORRECTION$;
 - Determine the LDG DIST factor.
- For multiple failures :
 - Use the lowest LDG CONF ;
 - Use the highest Δ 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 $\geq$ 1)	LDG CONF 3	Δ VREF = 10 KT	LDG DIST $\times$ 1.15*
BRK ANTI SKID	NORM CONF	Δ VREF = 0	LDG DIST $\times$ 1.4
TOTAL	LDG CONF 3	Δ VREF = 10 KT	LDG DIST $\times$ 1.61
ALTN LAW	LDG CONF 3	Δ VREF = 10 KT	LDG DIST $\times$ 1.2*
FLAPS FAULT (F < 1, S $\geq$ 1)	LDG CONF 3	Δ VREF = 25 KT	LDG DIST $\times$ 1.35*
TOTAL	LDG CONF 3	Δ VREF = 25 KT	LDG DIST $\times$ 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 :

C A P T	– 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	– He proceeds to the cabin.
/	– He evacuates the aircraft through any suitable exit.
O	– 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.*

03.00	CONTENTS
03.01	GENERAL INFORMATION
03.02	FLIGHT PREPARATION
03.03	SAFETY EXTERIOR INSPECTION
03.04	PRELIMINARY COCKPIT PREPARATION
03.05	EXTERIOR INSPECTION
03.06	COCKPIT PREPARATION
03.07	BEFORE PUSHBACK OR START
03.08	ENGINE START
03.09	AFTER START
03.10	TAXI
03.11	BEFORE TAKEOFF
03.12	TAKEOFF
03.13	AFTER TAKEOFF
03.14	CLIMB
03.15	CRUISE
03.16	DESCENT PREPARATION
03.17	DESCENT
03.18	ILS APPROACH
03.19	NON PRECISION APPROACH
03.20	VISUAL APPROACH
03.21	PRECISION APPROACH
03.22	LANDING
03.23	GO AROUND
03.24	AFTER LANDING
03.25	PARKING
03.26	SECURING THE AIRCRAFT
R 03.90	STANDARD CALLS

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 :

Below 10 000 feet, any non-essential conversation within the cockpit and between the cabin and cockpit crews should be avoided. Adherence to this policy facilitates effective crew communication, as well as communication of emergency or safety-related 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 nav aids, 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 :
 - 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.

R

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 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 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).

■ If the aircraft has been electrically supplied during the last 6 hours :

— **BAT 1 and 2** **AUTO**

— **EXT PWR (when AVAIL light is on)** **ON**
AVAIL light goes out.

HYD

WARNING

R Do not pressurize hydraulic systems without clearance from ground crew.

APU FIRE

— **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 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 $24 \pm 6^{\circ} \text{C}$ ($75 \pm 11^{\circ} \text{F}$).

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**

Check that the oil quantity is at or above 9.5 qts + estimated consumption (maximum average estimated consumption ~ 0.5 qt/h).

R
R

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.

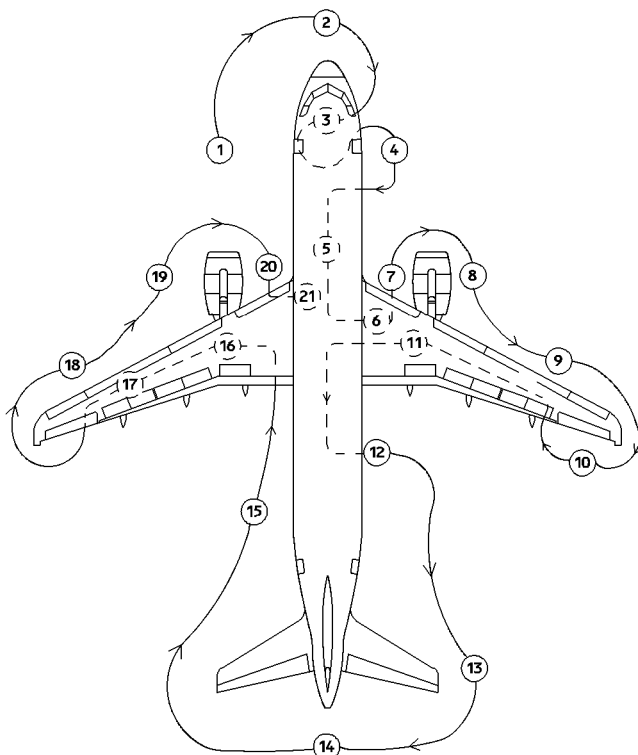
- Check structure for impact damage

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
- * — 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
- Inner tank magnetic fuel FLUSH
- Landing lights CONDITION
- Hydraulic reservoir pressurization door CLOSED
- RAT doors CLOSED

R

INTRODUCTION

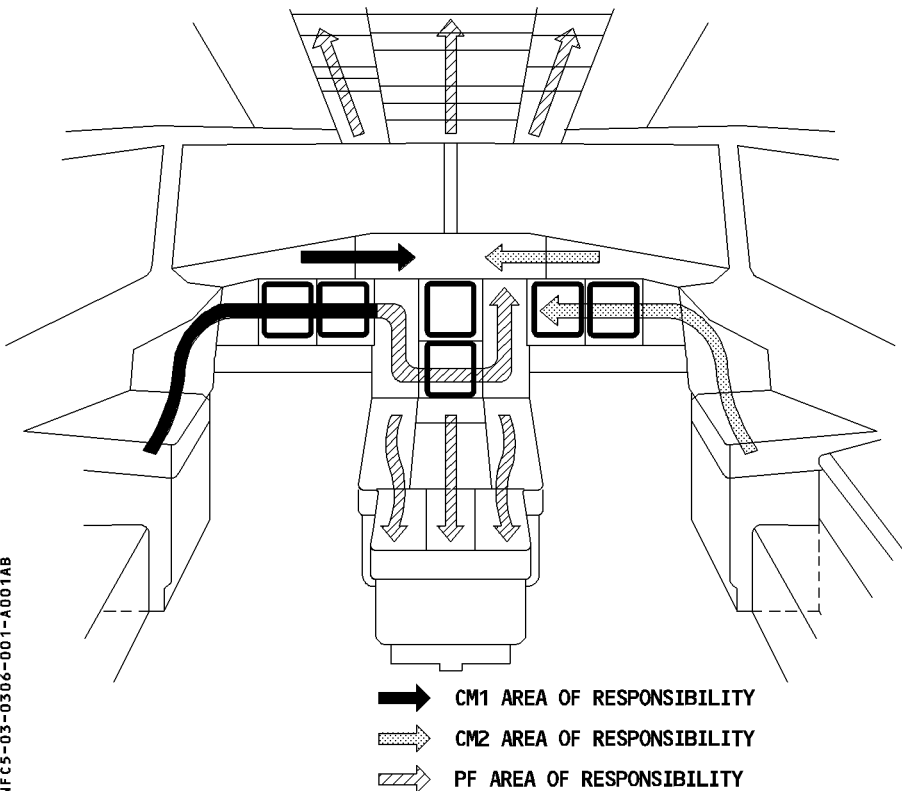
Items marked by (*) are the only steps to be completed during a transit stop.

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



NFCS-03-0306-001-A001AB

- * — **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 alignment is sufficient. ADIRS performance may be degraded, if complete 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.

R

R

- * — **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).
 - Vertical revision. Check or enter climb speed limit, constraints according to ATC 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 essential for position updating at takeoff and, consequently, for navigation accuracy.

R

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**

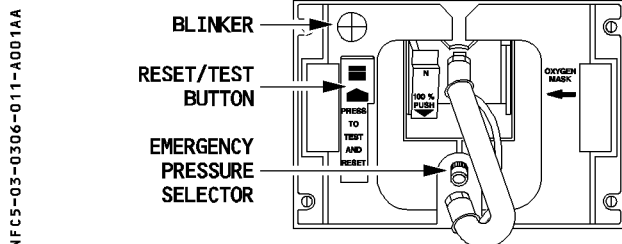
* — **SPD MACH window** **DASHED**

* — **HDG V/S-TRK FPA** **HDG V/S**

* — **ALT window** **INITIAL EXPECTED CLEARANCE ALT**

LATERAL CONSOLES

OXYGEN MASK TEST



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 * **CLOCK**

- Check time, adjust if necessary ; elapsed time at zero, chrono at zero.

NOSEWHEEL STEERING

- 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.
 - Check that fuel imbalance is within limits.

R

***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 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).
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, HARNESSSES, 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, maintenance action may be required before next flight.

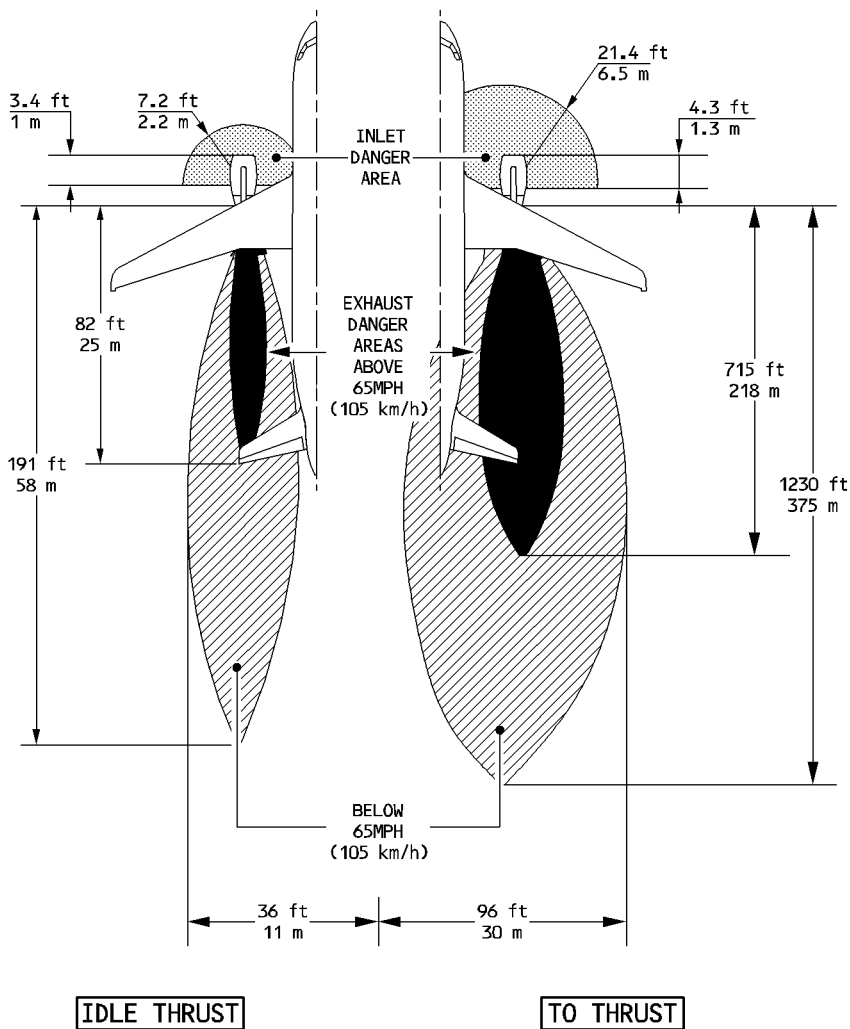
- **ENG MODE selector** **IGN/START**
The lower ECAM display shows the ENG page.
- **ANNOUNCE** **“STARTING ENGINE 2”**
Engine 2 is usually started first. It powers the yellow hydraulic system, which pressurizes the parking brake.
- **MASTER switch 2** **ON**
Do not turn the MASTER switch ON before all 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



NFC5-03-0308-003-A040AA

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 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, the engine should be accelerated to approximately 70 % N1 for 30 seconds before operating at higher thrust. (See also parking brake limitation 3.01.32). If airport surface conditions and congestion do not permit to accelerate the engine to 70 % N1, then power setting and dwell time should be as high as practical. This run up should also be performed just prior takeoff with particular attention to engine parameters to ensure 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**

If the aircraft has been parked in wet conditions for a long period, the efficiency of 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**

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 :

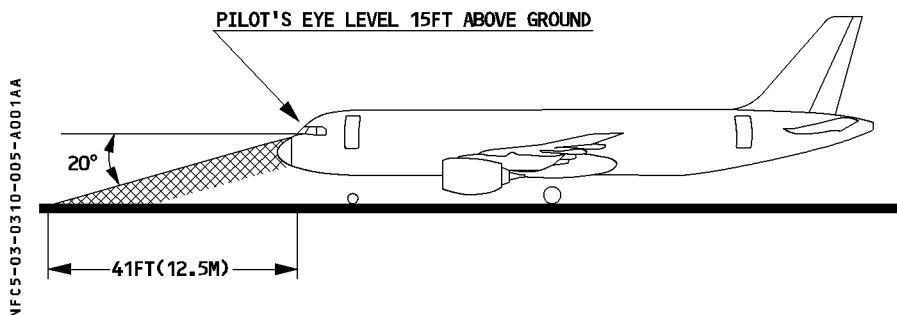
- **F-PLN (Runway)** **REVISE**
- **FLAPS LEVER** **AS APPROPRIATE**
Select takeoff position.
- **V1, VR, V2** **REINSERT**
- **FLX TO temperature** **REINSERT**

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.

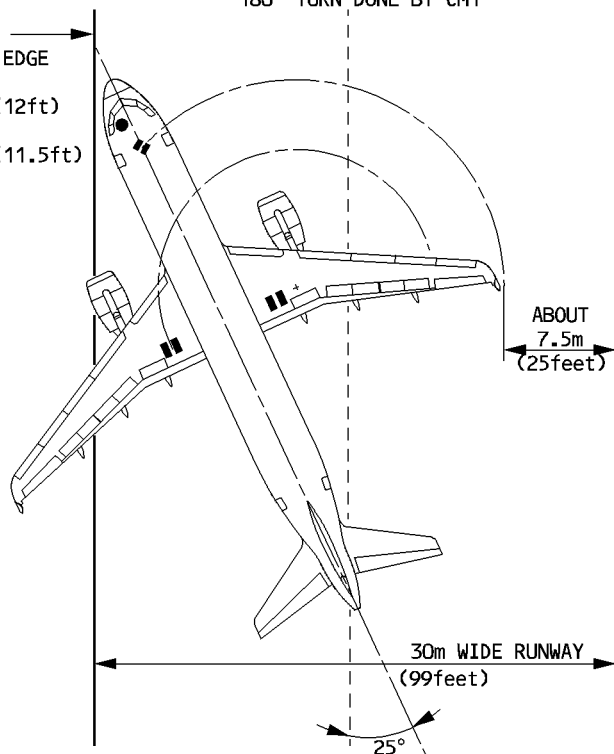
- When the CM1 is at about 2 meters before the runway edge, he turns the nosewheel full right and sets 40 % to 43 % N1 for CFM engines, or 1.05 EPR for IAE engines.

● FOR THE CM2

The procedure is symmetrical. (Taxi on the left-hand side of the runway).

CM1 ABOUT 2m
BEFORE THE RUNWAY EDGE
NOSEWHEEL
CLEARANCE : 3.6m (12ft)
MAIN GEAR
CLEARANCE : 3.5m (11.5ft)

180° TURN DONE BY CM1



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 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

Read the checklist below the line, when line up or takeoff clearance is received.

COMPLETE

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 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** »

- R
R
R
R

— **ROTATION** **PERFORM**

 - At VR, initiate the rotation to achieve a continuous rotation with a rate of about 3°/sec, towards a pitch attitude of 15° (12.5° if one engine is failed).
 - Minimize lateral inputs on ground and during the rotation, to avoid spoiler extension.
 - 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.

• **At F speed**

— ORDER "FLAPS 1"

— FLAPS 1 SELECT

— CONFIRM/ANNOUNCE "FLAPS 1"

Note : For takeoff in CONF 1 + F, "F" speed is not displayed.

• **At S speed**

— ORDER "FLAPS ZERO"

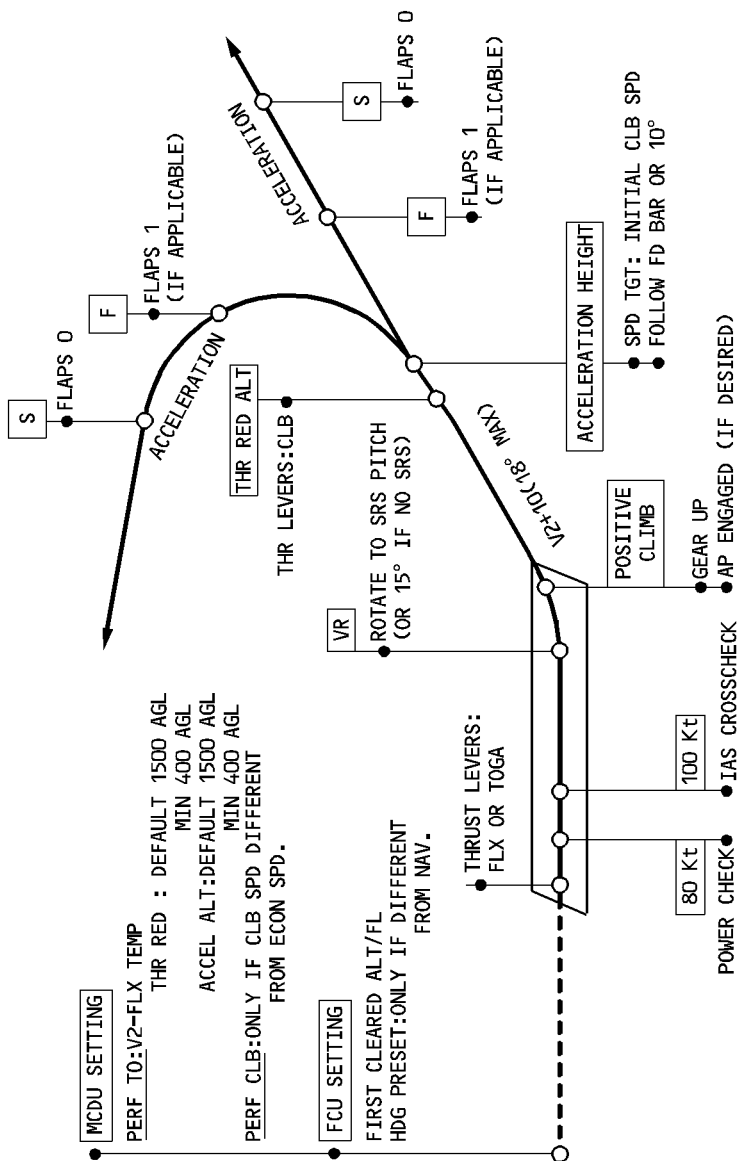
— FLAPS ZERO SELECT

— CONFIRM/ANNOUNCE "FLAPS ZERO"

Note : CRUISE page replaces ECAM ENG page.

— DERATED CLB OPS  REFER TO 3.04

NORMAL TAKEOFF PATTERN



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**

ENG ANTI ICE should be ON, when icing conditions are expected with a TAT at, or below, 10°C.

Note : 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).

R Check that the sum of the fuel on board and the fuel used is consistent with the fuel
R 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
the next flight. If the sum is unusually smaller than the fuel on board at departure, or
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.

● **If the oxygen mask has been used :**

— **OXYGEN MASK CHECK**

Check that the oxygen mask has been properly stowed, as indicated in the FCOM 1.35.20.

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R

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 (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 nav aids, 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 nav aids.

— **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).
- Go-around (Standard call/task sharing, Diversion decision).
- 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 modes and EXP mode (<4>).

— **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.

$$\text{FPA (}^\circ\text{)} = \Delta \text{ FL/DIST (NM)}$$

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 :**

— **TERR ON ND ON**

If use of radar is required, consider selecting the radar display on the PF side, and 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 :**

— **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 confirm APPROACH phase on the MCDU.
- R — **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

NAVIGATION ACCURACY	ND		AP/FD mode	TERR pushbutton
	PF	PNF		
GPS PRIMARY	ARC or ROSE NAV with navaid raw data		NAV	ON
NAV ACCUR HIGH				
NAV ACCUR LOW and NAV ACCURACY check ≤ 1 NM				
GPS PRIMARY LOST and NAV ACCUR LOW and NAV ACCURACY check > 1 NM	ROSE ILS	ARC or ROSE NAV or ROSE ILS with navaid raw data	HDG or TRK	OFF
GPS PRIMARY LOST and Aircraft flying within unreliable radio navaid area				

— **RADAR TILT** **ADJUST**

Increase tilt, as required (+ 3° to + 4°).

— **APPROACH CHECKLIST** **COMPLETE**

INTERMEDIATE/FINAL APPROACH (ILS approach entered in the F-PLN)

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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.

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 glide path,
- 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 policy/regulations, a go-around must be initiated.

- **APPR pushbutton on FCU PRESS**
 - Press the APPR pushbutton, only when ATC clears 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.
 - If residual pressure is indicated on the triple indicator, press the brake pedals several times to zero the residual alternate pressure. Select the AUTO BRK MED mode, if residual braking remains, in order to cancel residual pressure at touchdown.
 - Beware of possible braking asymmetry after touchdown, which can be controlled using pedals.
 - Do not switch off the A/SKID & NWS : The antiskid function limits the effect of the 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.

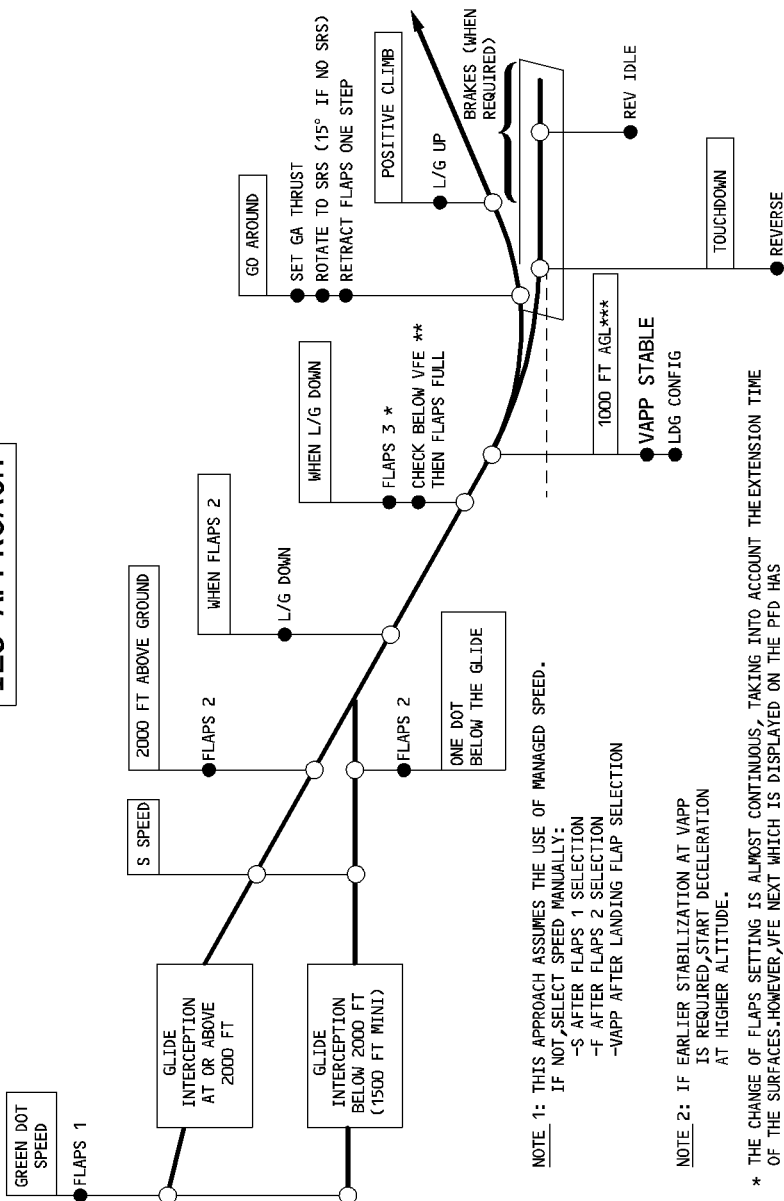
ILS APPROACH

SEQ 001

REV 36

ILS APPROACH

NFC5-03-0318-009-A001AA



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 INCL, 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 data 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 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 approach is intended.
- R In all cases, the recommended flying reference is FPV, which should be selected during 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 F-PLN).
 - R – The approach stored in the navigation database has been validated, and is approved by the operator,

R 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).

- R – 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.
- R – 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.
- R – Before starting the approach, two navigation systems must be operative : 2 FMGS and 2 sensors (2 GPS, 2 DME, 2 VOR as appropriate).
- R – 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.
- R – The final approach is laterally and vertically monitored, using the appropriate raw data (distance to the runway, altitude, FPV).

R Note : For additional information on recommended flight crew procedures, refer to the 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

NAVIGATION ACCURACY	Approach guidance	ND		AP/FD mode	TERR pushbutton
		PF	PNF		
GPS PRIMARY	Managed***	ARC or ROSE NAV * With navaid raw data		NAV-FPA or APP-NAV/ FINAL ***	ON
NAV ACCUR HIGH					
NAV ACCUR LOW and NAV ACCURACY check ≤ 1NM					
GPS PRIMARY LOST and NAV ACCUR LOW and NAV ACCURACY check > 1 NM	Selected	ROSE VOR **	ARC or ROSE NAV or ROSE VOR ** With navaid raw data	TRK-PFA	OFF
GPS PRIMARY LOST and aircraft flying within unreliable radio navaid area					

- (*) 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
R
R

Note : 1. During approach in overlay to a conventional radio navaid procedure, monitor raw data. If raw data indicates unsatisfactory managed guidance, revert to selected 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.
 - If residual pressure is indicated on the triple indicator, press the brake pedals several times to zero the residual alternate pressure. Select the AUTO BRK MED mode, if residual braking remains, in order to cancel residual pressure at touchdown.
 - Beware of possible braking asymmetry after touchdown, which can be controlled using pedals.
 - Do not switch off the A/SKID & NWS : The antiskid function limits the effect of the 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.
 - Check correct TO waypoint on the ND.

R

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. — 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.	• 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/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.

Note : 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**

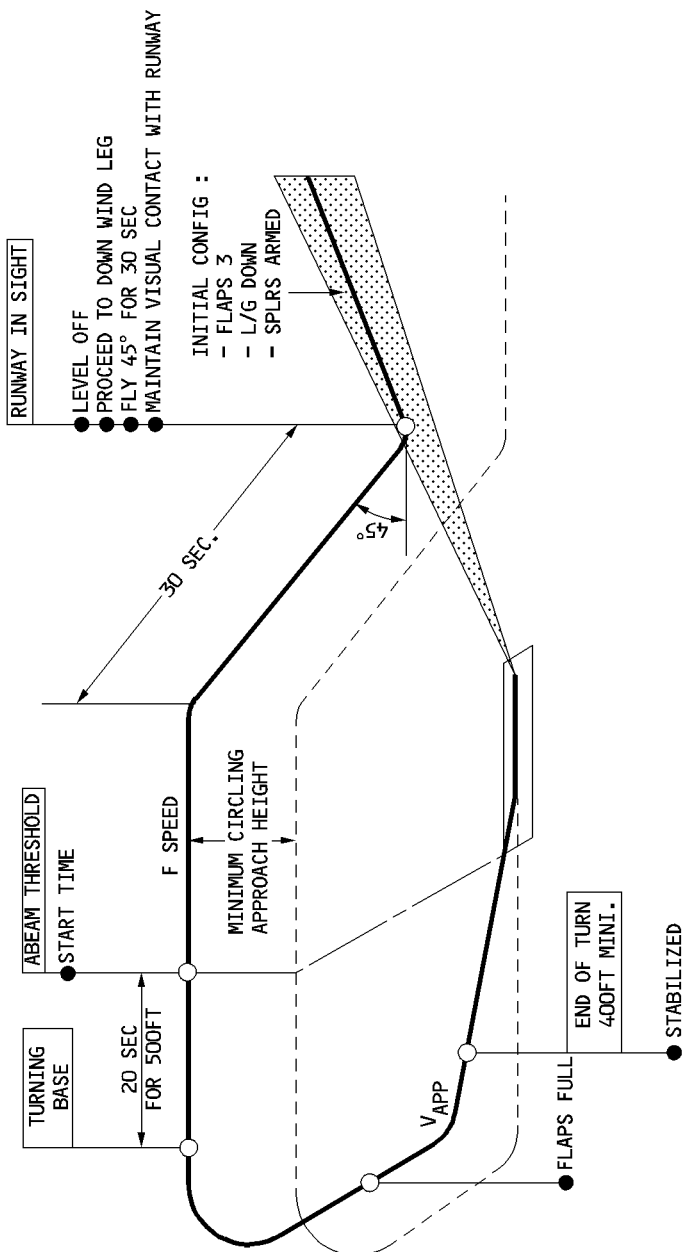
CAUTION

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 :

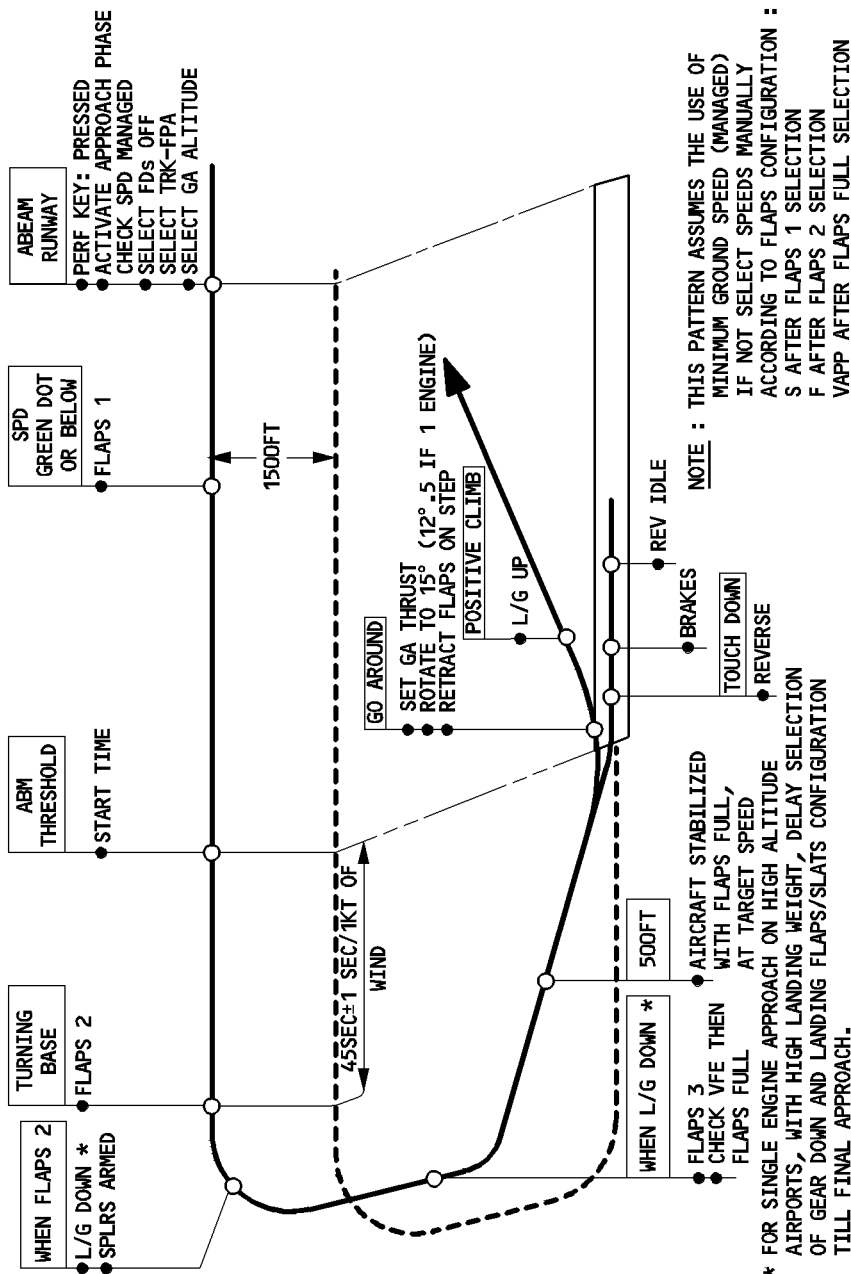
- **Manually ACTIVATE APPR phase.**
- **Select FDs to OFF. Select TRK-FPA to have FPV displayed.**
- **Check A/THR active.**

Extend the downwind leg to 45 seconds ($\pm$ 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)

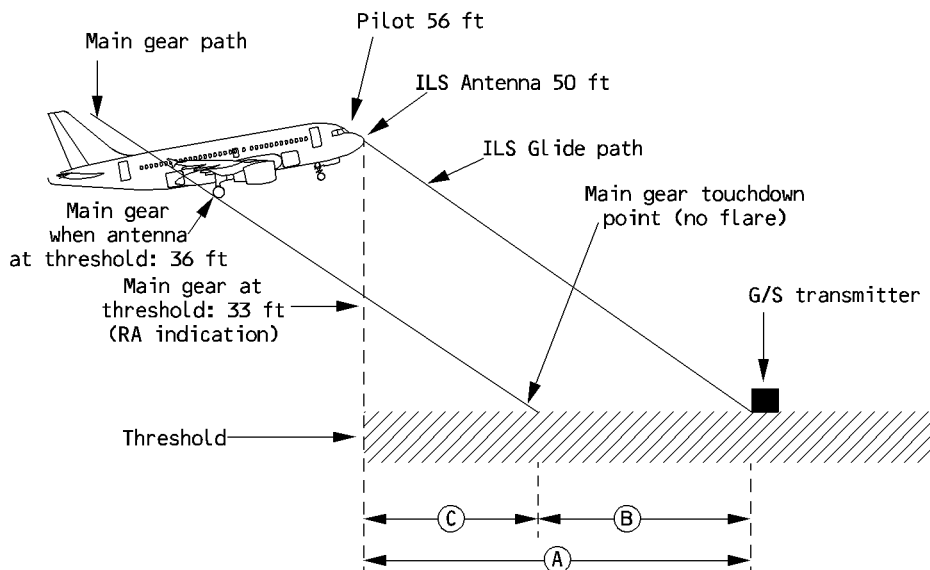


 A319 A320 A321 FLIGHT CREW OPERATING MANUAL	STANDARD OPERATING PROCEDURES		3.03.21	P 1
	PRECISION APPROACH		SEQ 001	REV 24

PRECISION APPROACH

R (Refer to FCOM 4.05.70).

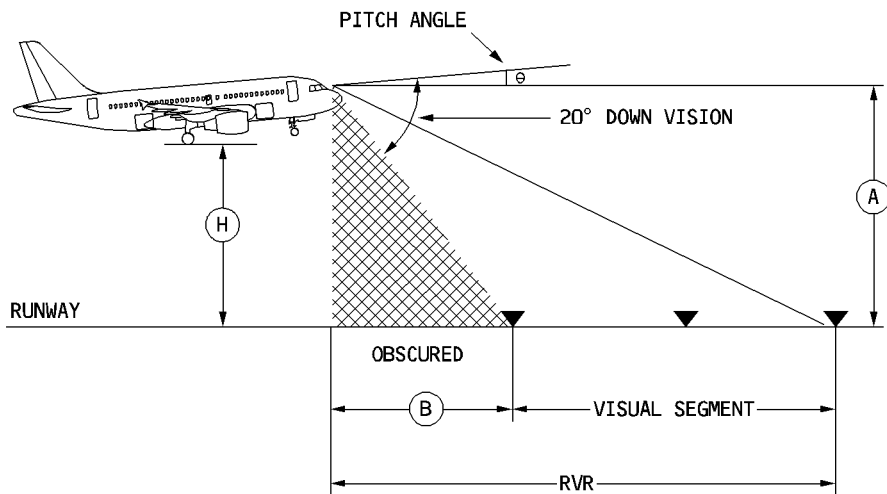
ILS FINAL APPROACH AND LANDING GEOMETRY



CONDITIONS :	PITCH ANGLE	GLIDE PATH (°)	(A)	(B)	TOUCHDOWN POINT (C)
- FLAPS FULL					
- ILS ANTENNA AT 50 ft AT THRESHOLD	4°8	2°5	349 m 1145 ft	114 m 375 ft	235 m 771 ft
- NO FLARE	5°3	3°	291 m 954 ft	100 m 329 ft	191 m 625 ft

NFC5-03-0322-001-A035AA

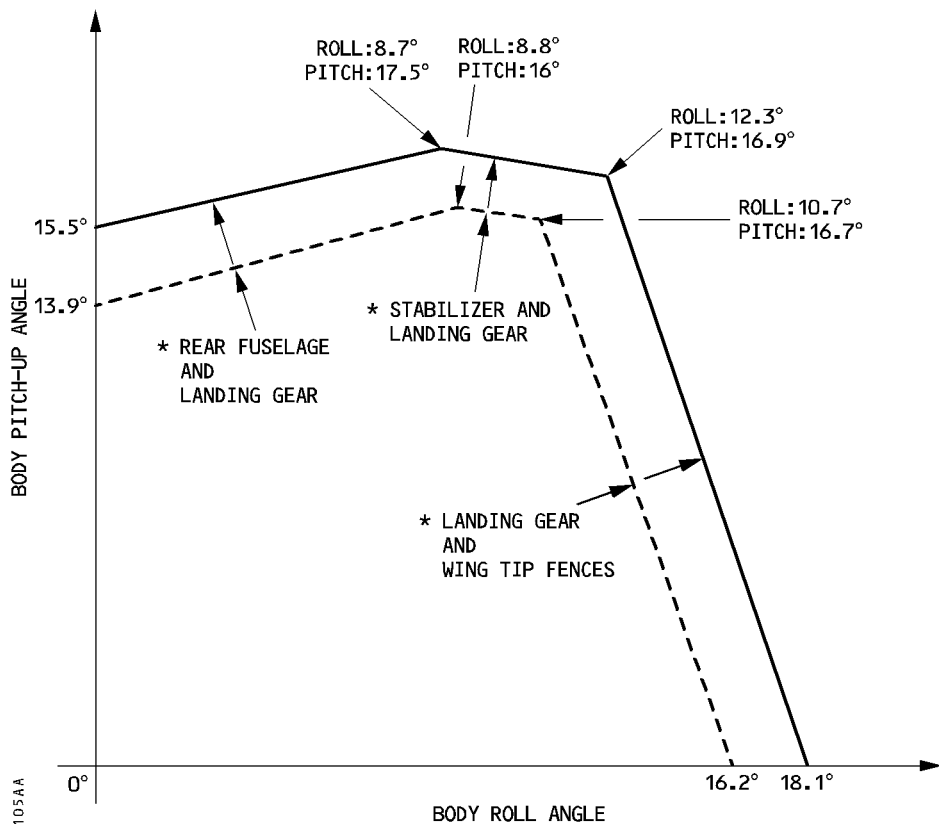
MINIMUM VISUAL GROUND SEGMENTS (Flare phase)



	CAT III		CAT II
(H)	15 ft ($\theta = 4.9^\circ$)	50 ft ($\theta = 5.3^\circ$)	100 ft ($\theta = 5.3^\circ$)
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)

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



* CONTACT POINTS OF THE AIRCRAFT ON GROUND

TOUCHDOWN ON ONE MAIN LANDING GEAR

— SHOCK ABSORBER NOT COMPRESSED

- - - SHOCK ABSORBER FULLY COMPRESSED

NFC5-03-0322-003-A105AA

LANDING

The cockpit cut-off angle is 20 degrees.

● **At about 20 feet :**

— **FLARE** **PERFORM**

— **ATTITUDE** **MONITOR**

The PNF should monitor the attitude, and call out :

— “PITCH, PITCH”, if the pitch angle reaches 10°.

— “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 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) :**

- **THRUST LEVERS** **CL**

● **At go-around acceleration altitude :**

— **Monitor target speed increases to green dot.**

● **If target speed does not increase to green dot :**

— **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.

- R

R
- BRAKE TEMPERATURE **CHECK**

 - Check brake temperature on the ECAM WHEEL page for discrepancies and high temperature.
 - If brake fans are installed (✎) :

Brake fans 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.

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

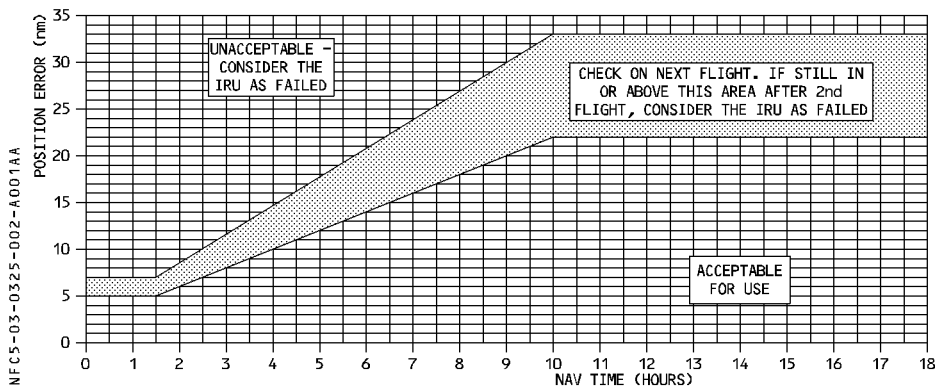
If JP4 fuel is used at ambient temperatures higher than 10°C, dry motor the engines for 2 minutes after engine shutdown. This dry motor period should start approximately 90 seconds after the master lever is selected off.

- 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.

Note : 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 acoustic 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 out) before switching off the batteries. Switching the batteries off before the APU flap is closed may cause smoke in the cabin during the next flight. If the batteries are off 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

04.10 OPERATING SPEEDS DEFINITION

- GENERAL 1
- CHARACTERISTIC SPEEDS 1
- PROTECTION SPEEDS 3
- LIMIT SPEEDS 3
- OTHER SPEEDS 4

04.21 AIR COND/PRESS/VENT

- AIR CONDITIONING 1

04.22 AUTO FLIGHT

- MCDU/FMGC RESET : REFER TO 4.06.20 1

04.23 COMMUNICATIONS

- VHF, HF UTILIZATION 1
- CAPT-ATT CALL 3
- CIDS RESET : REFER TO 3.04.24

04.24 ELECTRICAL

- TRIPPED C/B RESET 1
- COMPUTER RESET 1

R 04.27 FLIGHT CONTROLS (FLYING TECHNIQUES)

- GENERAL 1
- NORMAL OPERATIONS 1
- ABNORMAL OPERATIONS 4
- THE PROTECTION SYSTEMS 8
- R** – AIRCRAFT TRIMMING 12
- ELAC/SEC RESET : REFER TO 3.04.24

04.28 FUEL SYSTEM

- FQI IN DEGRADED MODE 1

04.30 ICE AND RAIN PROTECTION

- ICING CONDITIONS 1
- OPERATIONS IN ICING CONDITIONS 1
- RAIN REPELLENT 1
- GROUND OPERATIONS IN HEAVY RAIN 2

04.31 ELECTRONIC INSTRUMENT SYSTEM

- USE OF FLIGHT PATH VECTOR. 1
- FWC RESET : REFER TO 3.04.24

04.32 LANDING GEAR

- BSCU RESET 1
- BRAKING IN ALTERNATE MODE 1
- BRAKE TEMPERATURE LIMITATIONS REQUIRING
MAINTENANCE ACTIONS 2
- OPERATION WITH NOSEWHEEL STEERING OFFSET 3
- TIRE PRESSURE  4

R

R

04.34 NAVIGATION

- PROCEDURES FOR TUNING STANDBY NAVIGATION RADIOS 1
- AUTOMATIC IDENTIFICATION OF ADF/VOR/ILS 2
- WEATHER RADAR 3
- FLT INSTRUMENT TOLERANCES 6
- ADIRS ALIGNMENT 7
- TCAS  11
- APPROACH ON PAPI 16
- QNH USE FOR TO / APPR / LDG ON QFE / QNH
PIN PROGRAMED A/C 16
- QFE USE FOR TO / APPR / LDG ON A / C WITH
QNH ONLY PIN PROGRAMMING 17
- HEAD UP DISPLAY  18
- PARAVISUAL INDICATOR  18
- ENHANCED GROUND PROXIMITY WARNING SYSTEM  21

04.46 INFORMATION SYSTEM ()

- ATSU INITIALIZATION 1

04.70 POWER PLANT

- THRUST CONTROL 1
- MANUAL ENG START 3
- ENG START WITH EXT PNEUMATIC POWER 6
- CROSSBLEED ENG START 7
- START VALVE MANUAL OPERATION 8

04.80 MISCELLANEOUS

- PUSHBACK WITH POWER PUSH UNIT
BY THE MAIN LANDING GEAR 1

04.90 ONE ENGINE TAXI

- GENERAL 1
- DEPARTURE 1
- ARRIVAL 2

04.91 ADVERSE WEATHER

– SEVERE TURBULENCE	1
– OPERATIONS IN WINDSHEAR OR DOWNBURST CONDITIONS .	3
– COLD WEATHER	5
– OPERATIONS IN VOLCANIC ASH	11

R 04.92 LESS PAPER IN THE COCKPIT

– INTRODUCTION	1
– GENERAL	1
– LPC TAKEOFF MODULE	2
– LPC FCOM MODULE	4
– LPC MEL MODULE	4
– LPC W&B MODULE	4

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 :

$$V2 = 1.2 \times 0.94 VS1g = 1.13 VS1g$$

$$VREF = 1.3 \times 0.94 VS1g = 1.23 VS1g$$

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 $2 \times \text{weight (tonnes)} + 85$
 Above 20000 feet add 1 knot per 1000 feet

PROTECTION SPEEDS

V_{α} PROT, V_{α} 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).

- V_{α} 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.
- V_{α} MAX : Maximum angle of attack speed.
Corresponds to the maximum angle of attack that may be reached in pitch normal law
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 $1.23 \times VS$ 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 : $VAPP = VLS + \text{wind correction}$.
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 :
 $VAPP TARGET = GS_{mini} + \text{actual headwind (measured by ADIRS)}$
 $GS_{mini} = VAPP - \text{TOWER WIND (headwind component along runway axis calculated by FMGC from tower wind entered on MCDU)}$.

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.

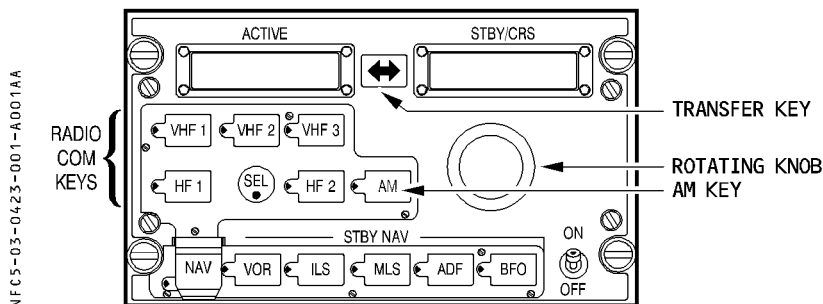
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VHF, HF UTILIZATION

- R** Note : 1. Reception of some frequencies could be noisy, on one or more VHF. 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.

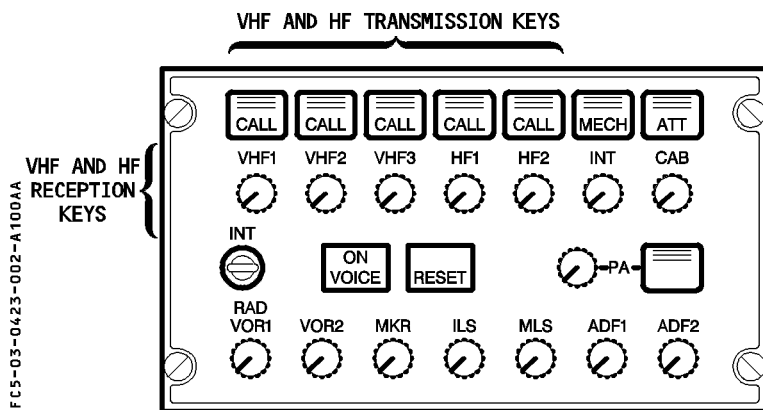
- **SEL It** **CHECK OFF**
If SEL light is on, select the appropriate radio systems dedicated to the on side RMP.

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**

Note : 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, supersede 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 T7 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 T(2) FAULT	FAC 1(2)	Refer FCOM 3.02.22 if applicable.
	WINDSHEAR DET FAULT or REAC W/S DET FAULT (<A>)	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 UNSECCESFUL : – 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.

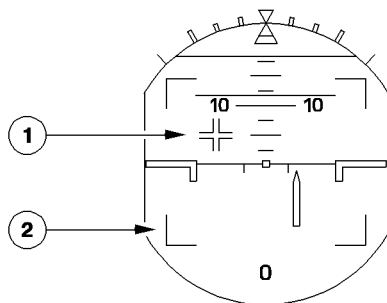
At ground speeds above 70 knots, the authority in pitch is reduced from 30° up to 20° up. In this ground mode, movements of the control surfaces in pitch and roll correspond directly to the stick inputs.

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.

NFC5-03-0427-002-A001AA



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 during takeoff roll.

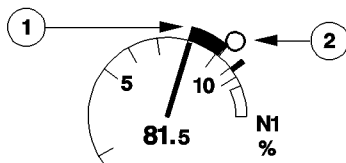
Small limit marks (2) indicate the limits of stick travel ($\pm 16^\circ$ in pitch, $\pm 20^\circ$ in roll).

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

NFC5-03-0427-002-B001AA



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 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.

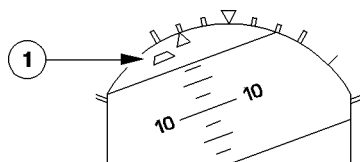
Even during an approach in considerable turbulence, the control system resists the
disturbances quite well without pilot inputs. In fact, the pilot should try to limit his control
inputs to those necessary to correct the flight path trajectory and leave the task of
countering air disturbances to the 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



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.

NFC5-03-0427-004-A001A

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, while maintaining the thrust at idle. In case of a strong bounce, initiate a go-around, initially maintaining the pitch attitude. Retract the flaps one step, and then the landing gear, once the aircraft is properly established on the go-around segment. In all cases, do not attempt 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 retracts 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.

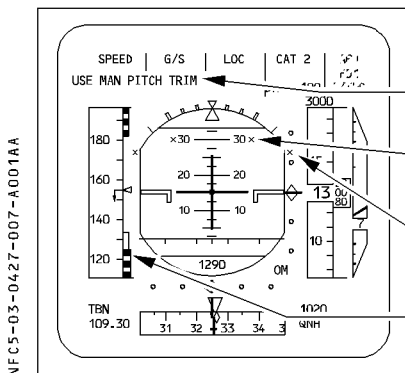
- Out of stall, when no threat of ground contact :

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.



DISPLAYED, WHEN IN PITCH DIRECT (AMBER)

REPLACED BY "MAN PITCH TRIM ONLY" (RED), WHEN IN PITCH BACKUP

AMBER INDICATION THAT PITCH ATTITUDE PROTECTION IS NO LONGER AVAILABLE (ALTERNATE OR DIRECT LAW).

AMBER INDICATION THAT BANK ANGLE PROTECTION IS NO LONGER AVAILABLE (ALTERNATE OR DIRECT LAW).

V STALL WARNING

At low speed the change in the speed scale is very noticeable. VLS remains, but V_{α} PROT and V_{α} 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, α_{floor} 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 α_{max} , THE PILOT CAN MAKE GENTLE TURNS, IF NECESSARY.

As the aircraft enters protection at the amber and black strip. (α_{prot}), 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 α_{prot} except for brief periods when maximum maneuvering is required. If the pilot enters α_{prot} 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 α_{floor} 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 α_{prot} if the stick is released with the angle of attack still greater than the value set for α_{prot} . Thus to exit α_{prot} properly, the pilot should reduce angle attack to a value less than the value set for α_{prot} .

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.

α_{floor} will usually be triggered just after α_{prot} 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, α_{prot} should be exited by easing forward on the sidestick, as described above, and the α_{floor} 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 α_{prot} at a high level, where it protects the aircraft from the buffet boundary. The PFD shows that α_{prot} 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 α_{prot} . (This value of alpha is not however the same as the value used at low speed : alpha for α_{prot} 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 α_{prot} . If the pilot has flown into α_{prot} , he should leave it as soon as other considerations allow by easing forward on the stick to reduce alpha below the value of α_{prot} 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 $\pm 1.5^\circ$, 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 : $\pm$ 110 kg (240 lb).

center tank affected : $\pm$ 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**

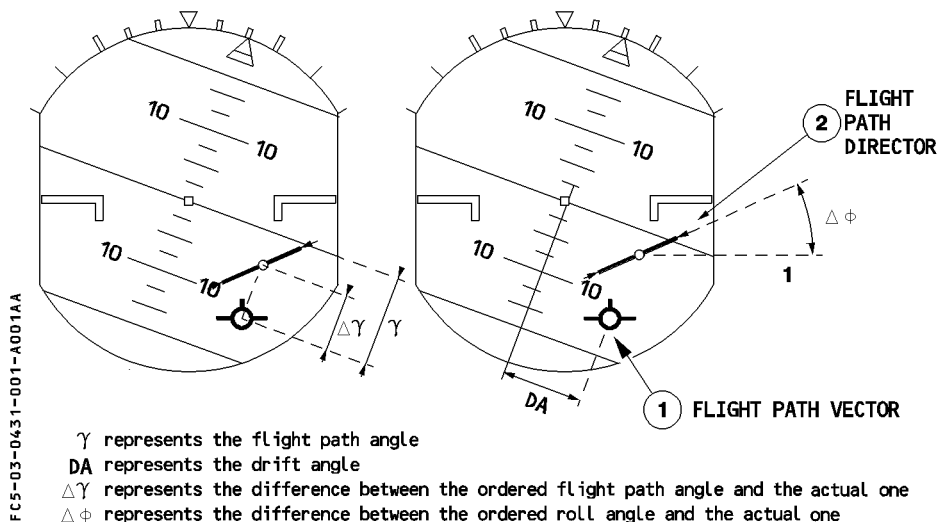
This adds air from the air conditioning system to ventilation air. If bleed air is not available, the arrangement can function for a limited time, as follows :

- 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



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.

Note : Checking the normal braking after a BSCU reset in flight is not necessary (and not possible), since the BSCU would detect any loss of normal braking at touchdown, and the ECAM would inform the crew of the switch to alternate 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 system itself. The latter case is identifiable due to flight crews' repetitive reports of permanent aircraft veering tendency. Such reports enable maintenance to determine when 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 $\leq 0.5^\circ$	$0.5^\circ < \text{Offset} \leq 1.5^\circ$	Offset $> 1.5^\circ$
Rudder trim to taxi straight	Trim $\leq 2.5^\circ$	$2.5^\circ < \text{Trim} \leq 7.5^\circ$	Trim $> 7.5^\circ$
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 ($\pm 0.5^\circ$ NWS offset, corresponding to the $\pm 2.5^\circ$ rudder trim necessary to taxi straight) remains valid. Operating the aircraft outside the maintenance tolerance is possible by using the applicable procedure. However, in such cases, the flight crew must accurately and systematically make logbook entries (indicating the rudder trim input value to taxi straight) to ensure that maintenance can take corrective action within the applicable timeframe.

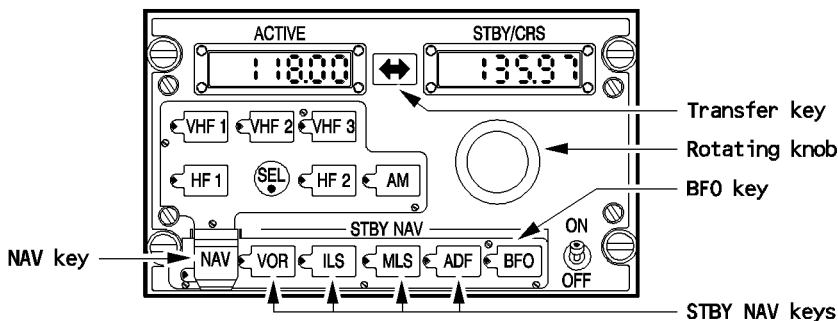
When using rudder trim to taxi straight for NWS offset identification, takeoff must only be performed after a rudder trim reset.

PROCEDURES FOR TUNING STANDBY NAVIGATION RADIOS

CAUTION

Pilots should use these procedures only when both FMGCs or both MCDUs are inoperative. When at least one FMGC is operative, the use of NAV key on RMP while the LOC update is active, may freeze the FM position during approach and must be 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 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 to AUTO). The sensitivity of the receiver may vary from one type of radar system to another.

R
R

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

Before selecting WX, WX/T or MAP mode on the control unit, make certain that :

- No one is within a distance less than 5 meters from the antenna in movement, within an arc of plus or minus 135° on either side of the aircraft centerline.
- The aircraft is not directed towards any large metallic obstacle, such as a hangar, which is within 5 meters in an arc of plus or minus 90° on either side of the aircraft 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 :

$$\Delta h \text{ (feet)} \sim d(\text{NM}) \times \text{Tilt (degrees)} \times 100.$$

Example :

Cell at 40 NM disappearing at less than 3 degrees downtilt

$$\Delta h \sim 40 \times 3 \times 100 = 12\,000 \text{ feet.}$$

- 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 possibility of encountering turbulence stronger than expected.
- R 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

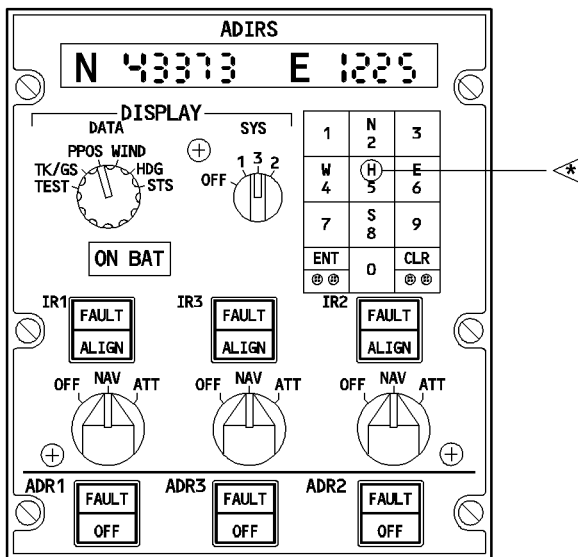
Maximum differences between Speed/Mach indications :

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	
GND CHECK	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



ALIGNMENT (on the ground)

When an IR is off, the flight crew must align it before it can enter the navigation mode and supply data to various aircraft systems. The aircraft must be stationary during alignment. Any aircraft motion while in ALIGN mode will restart the alignment. Also avoid alignment during engine start or while engines are running. This will prevent the alignment from 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 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.

- **All 3 mode selectors OFF for more than 10 seconds.**
- **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 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.

For transit flights, or for any flight with GPS, the best PPOS to be used when performing an alignment are, by priority :

1. The airport coordinates stored in the FMS database.
2. The gate coordinates.
3. The airport coordinates shown on the Jeppesen chart.

For aircraft without GPS, and when flying long segments without radio updates, the best PPOS to be used when performing an alignment are, by priority :

1. The gate coordinates.
2. The airport coordinates stored in the FMS database.
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. <u>Note</u> : 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).

– **Avoidance 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

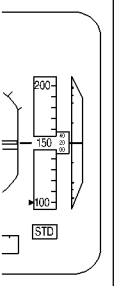
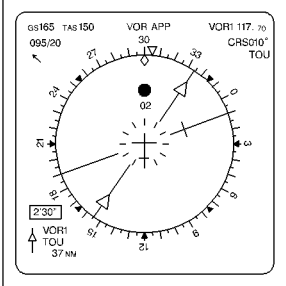
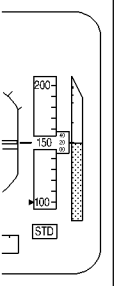
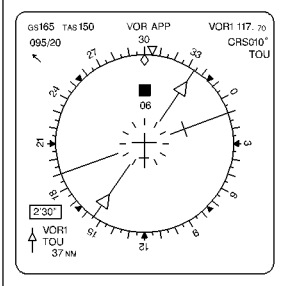
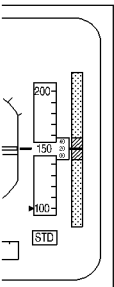
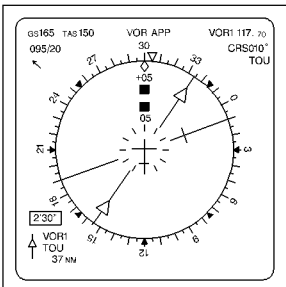
● **Avoidance generalities :**

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.

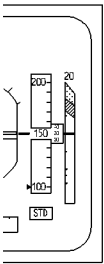
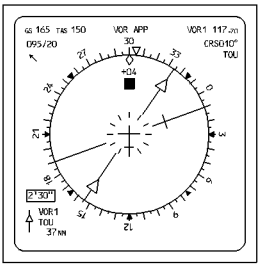
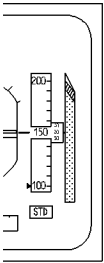
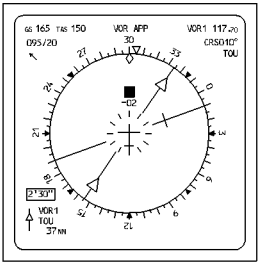
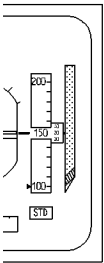
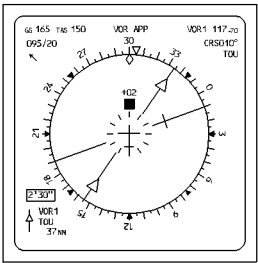
Pilots should comply with the vertical speed limitations prescribed in the Airman's Information Manual during the last 2000 feet of a climb or descent. In particular, pilots should limit vertical speeds to 1500 feet/min during the last 2000 feet of a climb or descent, especially when they are aware of 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...)

SCENARIO	AURAL WARNING and TYPICAL DISPLAY		CREW RESPONSE
	PFD	ND	
TRAFFIC ADVISORY - one intruder is ahead at 12:00 o'clock beyond 6 NM, 200 ft below your altitude		"TRAFFIC, TRAFFIC" 	- 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
RESOLUTION ADVISORY (PREVENTIVE) - One intruder is ahead at 12:00 o'clock, 600 ft below your altitude		"MONITOR VERTICAL SPEED" 	- Do not descend
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		MAINTAIN VERTICAL SPEED MAINTAIN 	- Remain in level flight - Do not climb or descend

V/S scale color legend:  : green  : red

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:

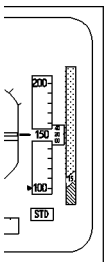
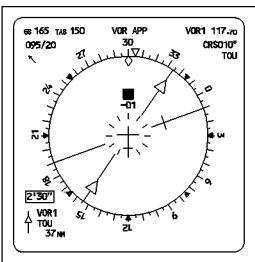
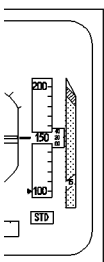
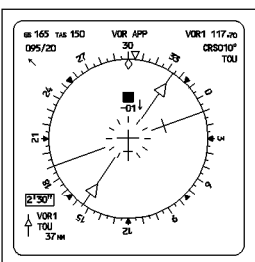
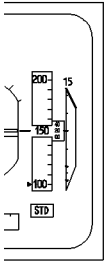
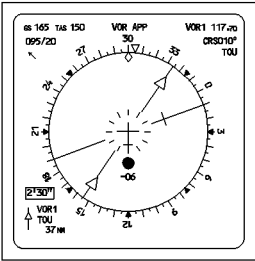


: green



: red

NFC5-03-0434-014-A105AA

SCENARIO	AURAL WARNING and TYPICAL DISPLAY		CREW RESPONSE
	PFD	ND	
RESOLUTION ADVISORY (ADDITIONAL CORRECTIVE) - The intruder ahead has stopped its climb - It is now 100 ft below your altitude			- 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			- 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			- Return promptly to the previous ATC clearance.

V/S scale color legend:



: green



: 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 than 45 feet.

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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LEFT INTENTIONALLY BLANK

 A319 A320 A321 FLIGHT CREW OPERATING MANUAL	SUPPLEMENTARY TECHNIQUES		3.04.34	P 20
	NAVIGATION		SEQ 001	REV 28

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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
- 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
- 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 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 :**
 - **Start Engine 2 first.**
- Note : As necessary, Engine 1 can also be started by using the external pneumatic power. If Engine 1 is started first, check the brake accu pressure prior to 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.
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.

 CCM <i>Airlines</i> A319 A320 A321 FLIGHT CREW OPERATING MANUAL	SUPPLEMENTARY TECHNIQUES		3.04.70	P 9
	POWER PLANT		SEQ 001	REV 30

LEFT INTENTIONALLY BLANK

 A319 A320 A321 FLIGHT CREW OPERATING MANUAL	SUPPLEMENTARY TECHNIQUES		3.04.70	P 10
	POWER PLANT		SEQ 001	REV 30

LEFT INTENTIONALLY BLANK

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, HARNESSSES, 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 is unavoidable, aim to keep the speed in the region of the target speed given in this section, so as to provide the best protection against the effect of gust on the structural limits, whilst 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

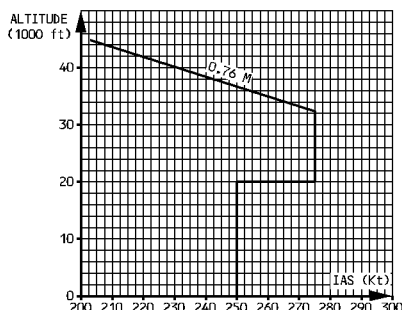
Before entering an area of known turbulence, the flight crew and the cabin crew must secure all loose equipment and turn on the "SEAT BELTS" and "NO SMOKING" signs.

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 attempts to obtain, in stabilized conditions, the speed for turbulence penetration given in the graph below.
- R Only change thrust in case of an extreme variation in airspeed, and do not chase your Mach or airspeed.
- R A transient increase is preferable to a loss of speed, that decreases buffet margins and is difficult to recover.



NFC5-03-0491-001-A110AA

THRUST SETTING FOR RECOMMENDED SPEED

FL	SPD	GROSS WEIGHT (1000 kg)							
	or	40	44	48	52	56	60	64	68
	Mach	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
R

- Check that no external air is supplied to the aircraft, via the low or high pressure 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
R

The aircraft may be de-iced or anti-iced with its engines and APU stopped, or with the APU 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
- OUTFLOW VALVE CHECK OPEN
On the ECAM PRESS page, confirm that the outflow valve indication reaches the open 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 :

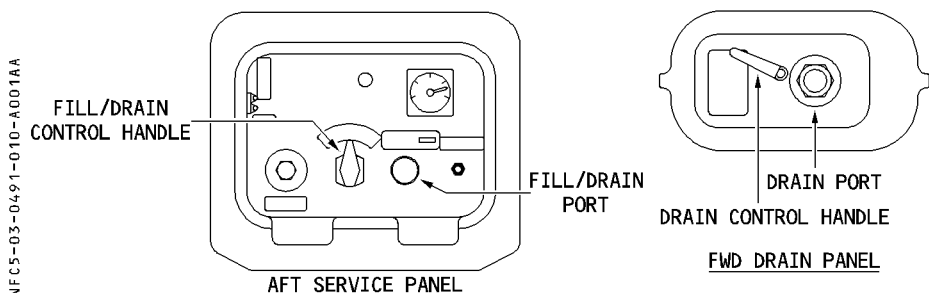
R

Configuration			Exposure time	Water tank drain
Air Conditioning	Cabin temperature	Outside Air Temperature		
ON	Above 10° C (50° F)	Between 0° C and – 15° C (32° and 5° F)	None	Not required
		Below – 15° C (5° F)	1 h 15 min	
OFF		Between 0° C and – 7° C (32° and 19.4° F)	1 h 30 min	Required
		Between – 7° C and – 15° C (19.4° and 5° F)	0 h 30 min	
		Below – 15° C (5° F)	Any	

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).

R **Securing the aircraft**

R If the aircraft is to be parked at an airport contaminated with volcanic ash, install engine inlet covers and other protective covers and plugs.

R In addition,

R ● **After switching off all bleeds and before switching off AC power :**

R — **DITCHING pushbutton ON**

R This closes the outflow valve, pack valves and avionic ventilation inlet and extract valves.

R ● **After switching off the batteries :**

R — **DITCHING pushbutton OFF**

R **FLIGHT OPERATIONS**

R Avoid flight into areas of known volcanic activity.

R 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).

R 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:

- R · smoke or dust in the cockpit,
- R · acrid odor similar to that of electrical smoke,
- R · at night, the appearance of St. Elmo's fire and static discharges around the windshield,
- R · bright white or orange glow appearing in the engine inlets,
- R · sharp, distinct beams from the landing lights,
- R · multiple engine malfunctions, such as rising EGT, decreasing power, stall, or flame out.

R ● **If the aircraft enters a volcanic ash cloud :**

R — **ESCAPE MANEUVER (terrain permitting) INITIATE**

R Because the lateral dimensions of ash cloud are not known, the pilot should if possible turn 180°.

R — **ATC NOTIFY**

R — **A/THR OFF**

R This will prevent thrust variations.

R — **THRUST (terrain permitting) DECREASE**

R 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

- Whenever operating in areas affected by volcanic activity, flight crews should be aware of volcanic reporting procedures and be familiar with the use of the ICAO Special Air Report of Volcanic Activity (Model VAR).
- If the aircraft encounters a volcanic ash cloud, the flight crew should report the location, altitude, and direction of drift for the ash cloud to ATC, flight conditions and crew duties 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**

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.

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 :
- Computation by using the PC to verify that the entered data is correct.
 - 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

05.05 OPERATING DATA

- CONVERSIONS IAS. MACH - TAS. MACH - SAT. TAT 1
- INTERNATIONAL STANDARD ATMOSPHERE 2
- CONVERSIONS QNH - QFE - PRESSURE ALTITUDE 3
- CONVERSIONS QFE - hPa - in.Hg - ft 4
- WIND COMPONENTS (FOR TAKEOFF AND LANDING) 5
- ALTITUDE TEMPERATURE CORRECTION 6

05.06 THRUST RATINGS

05.10 CLIMB

- GENERAL 1
- CLIMB 250KT/300KT/M.78 2

05.15 CRUISE

- GENERAL 1
- OPTIMUM MACH NUMBER 1
- OPTIMUM AND MAXIMUM ALTITUDES 5
- WIND ALTITUDE TRADE FOR CONSTANT SPECIFIC RANGE 7
- OPTIMUM ALTITUDE ON SHORT STAGE 8
- CRUISE AT M.78 9
- CRUISE AT LONG RANGE 13

05.20 IN CRUISE QUICK CHECK

- GENERAL 1
- CORRECTION FOR DEVIATION FROM REFERENCE WEIGHT 1
- EXAMPLE 2
- IN CRUISE QUICK CHECK M.78 3
- IN CRUISE QUICK CHECK LONG RANGE 8

05.25 HOLDING

- GENERAL 1
- CLEAN CONFIGURATION – GREEN DOT SPEED 2
- CLEAN CONFIGURATION – 210 KT 3
- CONFIGURATION 1 – S SPEED 4
- CONFIGURATION 1 – 170 KT 5

05.30 DESCENT

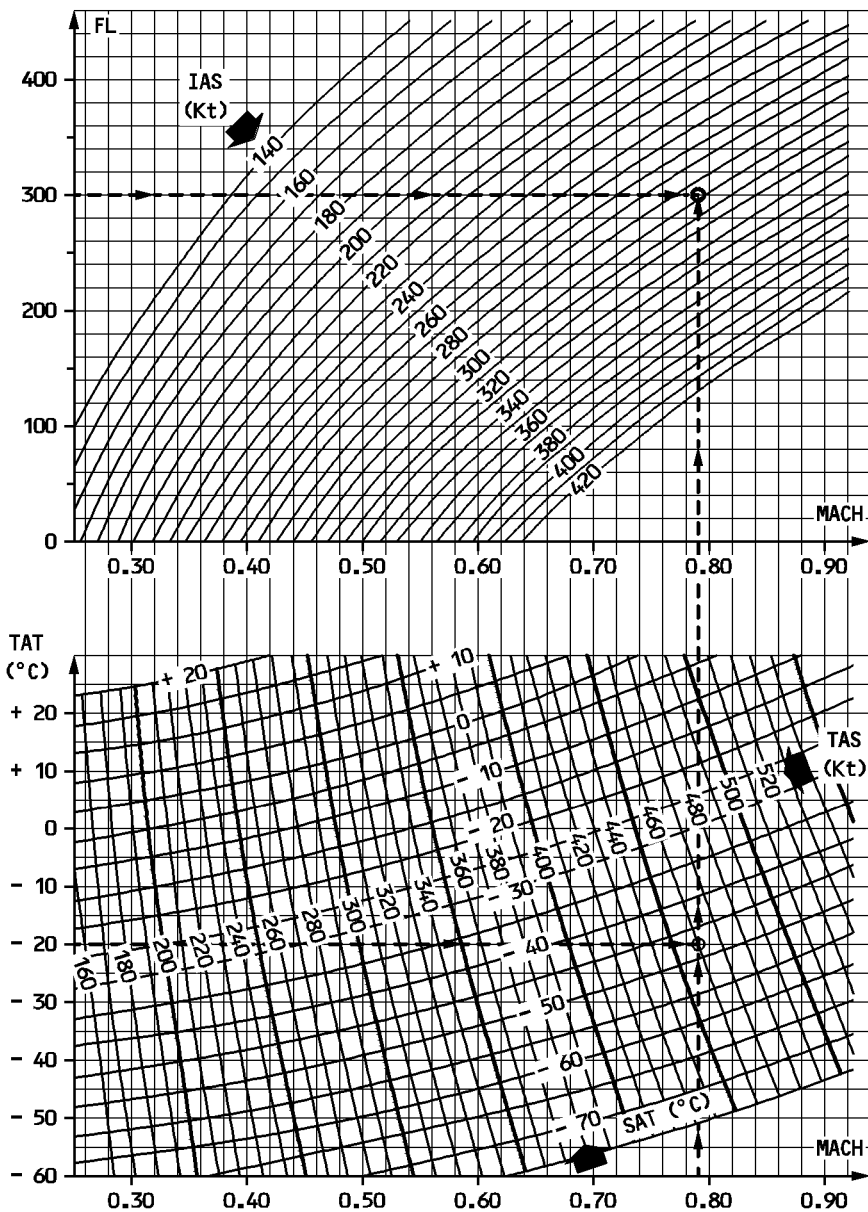
- GENERAL 1
- DESCENT M.78/300KT/250KT 2
- EMERGENCY DESCENT MMO/VMO 3

05.35 GO AROUND

05.40 ALTERNATE

05.50 GROUND DISTANCE/AIR DISTANCE CONVERSION

CONVERSIONS – IAS . MACH – TAS . MACH – SAT . TAT



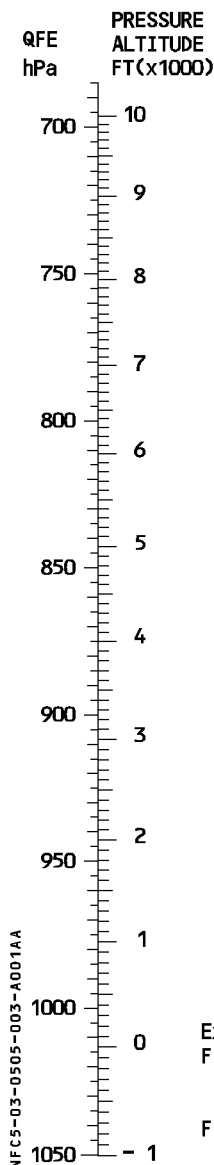
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INTERNATIONAL STANDARD ATMOSPHERE (ISA)

R

ALTITUDE (Feet)	TEMP. (°C)	PRESSURE			PRESSURE RATIO $\delta = P / P_o$	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

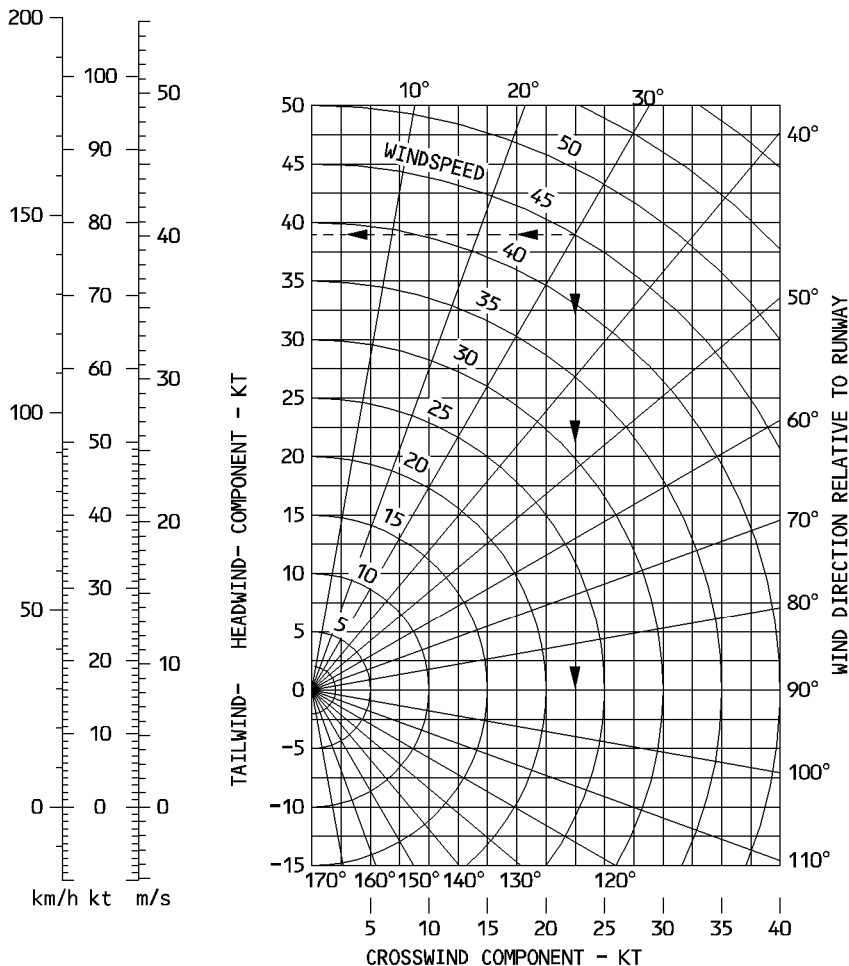
CONVERSIONS QFE hPa – in. Hg – ft

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)

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

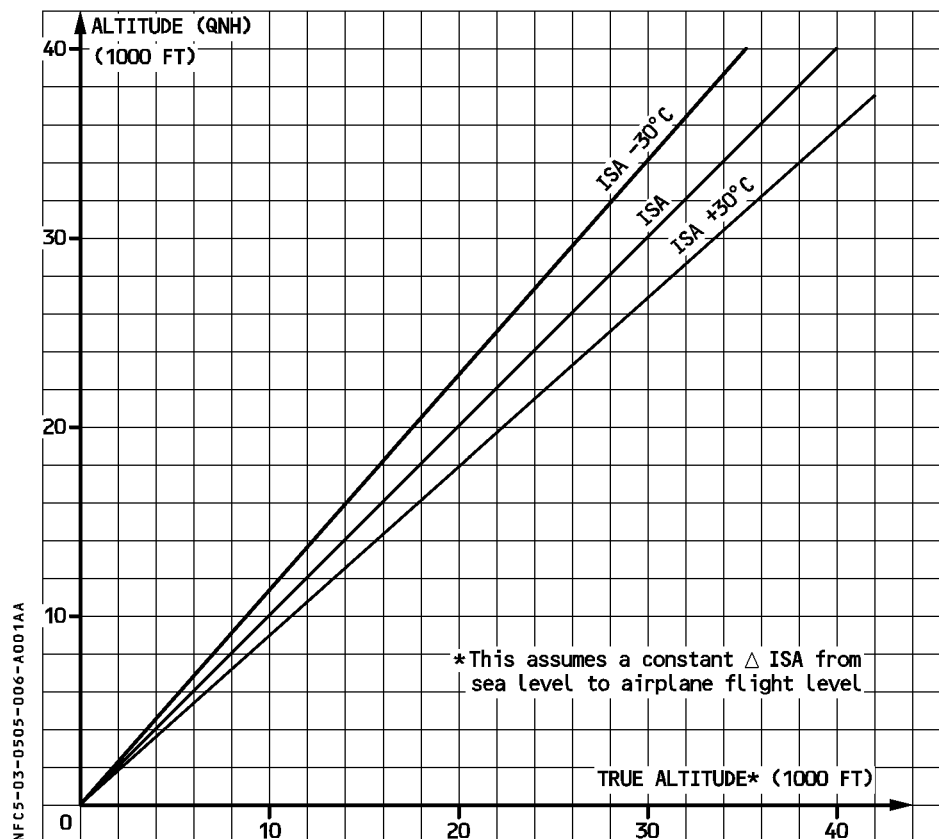
GIVEN	FIND
WIND DIRECTION RELATIVE TO RUNWAY HEADING=30 DEG WIND SPEED=45 KT	CROSS WIND COMPONENT=22.5 KT HEAD WIND COMPONENT=39.0 KT



NFC5-03-0505-005-A001AA

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
Δ ISA	- 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 Δ ISA 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.

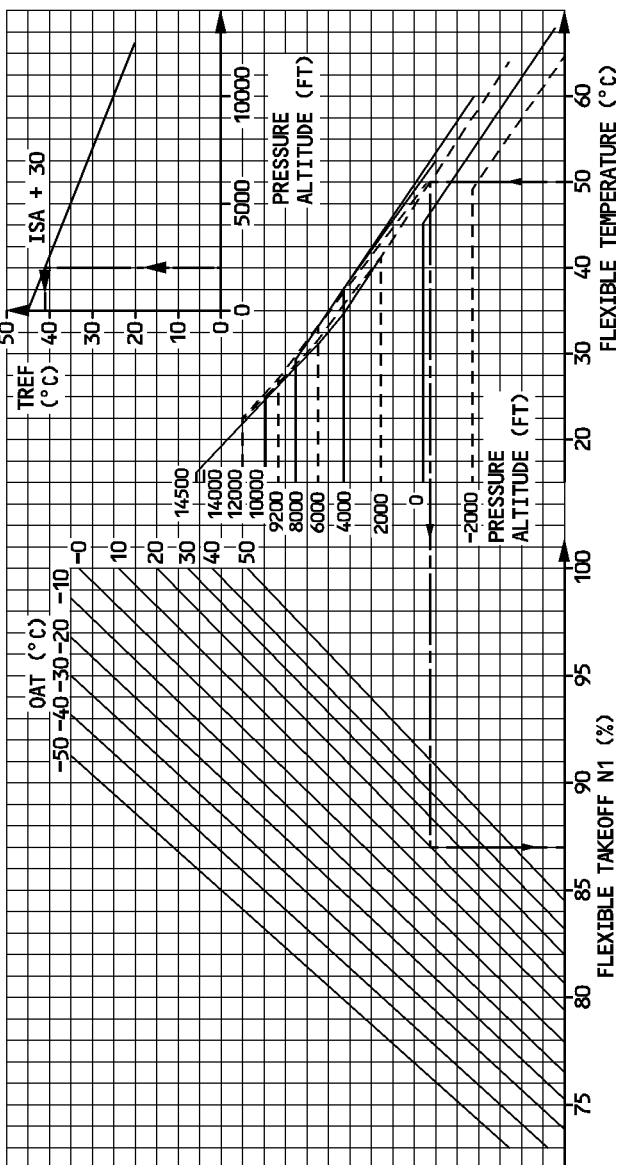
It is not displayed to the pilot, and the N1 limit which is displayed in cruise is the maximum climb N1.

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

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 → N1 FLEX = 87%
OAT: 20°C



CFM56-5B6	N1 CORRECTIONS FOR AIR BLEED	
	FLEX TAKEOFF N1	AIR CONDITIONING ON
		ENGINE ANTI ICE ON
	MACH = .000	ENGINE AND WING ANTI ICE ON
		- .7
		0
		0

TAKEOFF

CFM56-5B6		N1 CORRECTIONS FOR AIR BLEED					OAT < ISA + 30		OAT ≥ ISA + 30						
TAKE OFF		AIR CONDITIONING ON					-7		-7						
N1		ENGINE ANTI ICE ON					0.0		-1.4						
NO AIR BLEED		ENGINE ANTI ICE AND WING ANTI ICE ON					0.0		-2.1						
MACH=.000															
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	OAT < ISA + 30									
50.0	88.7	89.4	90.0	90.6	91.1						OAT ≥ ISA + 30				
54.0	88.2	88.8	89.5												

LEFT INTENTIONALLY BLANK

GO AROUND
R

CFM56-5B6		N1 CORRECTIONS FOR AIR BLEED					OAT < ISA + 30		OAT ≥ ISA + 30	
GO AROUND							.6		.6	
N1		AIR CONDITIONING OFF					.6		.6	
AIR CONDITIONING ON		ENGINE ANTI ICE ON					0.0		-1.3	
MACH=.225		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 OFF						.6		.6
AIR CONDITIONING ON MACH=.225		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			N1 CORRECTIONS FOR AIR BLEED					OAT > ISA + 10		OAT > ISA + 10	
MAXIMUM CONTINUOUS N1 AIR CONDITIONING ON* IAS=230 KT			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)	
	WEIGHT AT BRAKE RELEASE (1000KG)							
FL	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)	
	WEIGHT AT BRAKE RELEASE (1000KG)							
FL	64	66	68	70	72	74	76	
390	26 1835 172 394							
370	22 1650 141 384	23 1740 150 385	25 1840 160 387	27 1952 172 389	29 2081 186 391			
350	20 1531 123 376	21 1606 129 377	22 1686 137 378	23 1773 145 379	24 1867 153 381	26 1970 163 383	27 2086 175 385	
330	18 1435 109 368	19 1502 115 369	20 1571 120 370	20 1645 127 371	22 1724 133 372	23 1808 141 373	24 1899 149 375	
310	16 1346 97 360	17 1406 102 360	18 1469 107 361	19 1534 112 362	19 1604 117 363	20 1677 123 364	21 1755 130 365	
290	15 1254 86 350	15 1308 90 350	16 1365 94 351	17 1424 98 352	17 1487 103 352	18 1552 108 353	19 1620 113 354	
270	13 1143 73 336	14 1192 76 337	14 1242 80 337	15 1295 83 338	15 1349 87 339	16 1406 91 339	17 1465 95 340	
250	12 1044 62 323	12 1088 65 324	13 1133 68 324	13 1180 71 325	14 1228 74 326	14 1278 77 326	15 1330 80 327	
240	11 998 58 317	11 1039 60 317	12 1082 63 318	12 1126 65 318	13 1171 68 319	13 1219 71 320	14 1268 74 320	
220	10 910 49 304	10 948 51 305	10 986 53 305	11 1025 56 306	11 1066 58 306	12 1108 60 307	12 1152 63 308	
200	9 828 42 292	9 862 44 292	9 896 45 293	10 932 47 293	10 968 49 294	10 1006 51 294	11 1045 53 295	
180	8 751 35 279	8 781 37 279	8 812 38 279	9 844 40 280	9 877 42 281	9 911 43 281	10 946 45 282	
160	7 678 30 265	7 705 31 266	7 733 32 266	8 762 34 267	8 791 35 267	8 821 36 268	8 852 38 269	
140	6 609 25 251	6 633 26 252	6 658 27 252	7 683 28 253	7 709 29 253	7 736 30 254	7 764 32 255	
120	5 542 21 236	5 563 21 236	6 586 22 237	6 608 23 238	6 631 24 238	6 655 25 239	7 680 26 240	
100	4 434 14 209	4 451 15 209	4 469 16 210	5 487 16 211	5 505 17 211	5 525 17 212	5 544 18 213	
50	3 282 8 171	3 293 8 171	3 305 8 172	3 316 8 173	3 328 9 174	3 340 9 174	3 352 9 176	
15	2 177 3 121	2 184 4 122	2 191 4 122	2 198 4 123	2 205 4 124	2 212 4 125	2 219 4 126	
LOW AIR CONDITIONING ΔFUEL = - 0.5 %		HIGH AIR CONDITIONING ΔFUEL = + 0.5 %		ENGINE ANTI ICE ON ΔFUEL = + 2 %		TOTAL ANTI ICE ON 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)	
	WEIGHT AT BRAKE RELEASE (1000KG)							
FL	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)
WEIGHT AT BRAKE RELEASE (1000KG)

FL	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
 $\Delta \text{FUEL} = - 0.5 \%$
 $\Delta \text{FUEL} = + 0.5 \%$
 $\Delta \text{FUEL} = + 2 \%$
 $\Delta \text{FUEL} = + 5 \%$

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)
WEIGHT AT BRAKE RELEASE (1000KG)

FL	50	52	54	56	58	60	62
390	20 1405 131 401	21 1484 140 402	22 1570 149 403	24 1662 159 404	25 1764 170 406	27 1879 184 408	
370	18 1313 115 394	19 1384 122 395	20 1457 129 396	21 1535 137 396	22 1617 145 397	23 1705 154 398	25 1800 163 400
350	16 1237 103 387	17 1302 109 388	18 1368 115 389	19 1438 121 389	20 1512 128 390	21 1589 135 391	22 1670 143 392
330	15 1167 93 380	15 1227 98 381	16 1288 103 381	17 1352 109 382	18 1419 114 383	19 1489 120 383	20 1562 127 384
310	13 1098 83 372	14 1153 88 372	15 1209 92 373	16 1268 97 374	16 1329 102 374	17 1393 107 375	18 1459 113 375
290	12 1023 74 361	13 1073 78 362	13 1125 81 363	14 1179 85 363	15 1235 90 364	15 1293 94 364	16 1352 99 365
270	11 933 63 348	11 978 66 348	12 1024 69 349	12 1073 72 349	13 1122 76 350	14 1174 80 350	14 1226 83 351
250	10 851 54 335	10 892 56 335	11 934 59 336	11 977 62 336	12 1022 65 336	12 1068 68 337	13 1115 71 337
240	9 813 50 328	9 852 52 329	10 892 54 329	10 933 57 329	11 975 60 330	11 1018 62 330	12 1063 65 331
220	8 741 42 315	8 776 44 316	9 812 46 316	9 849 49 317	10 887 51 317	10 926 53 317	10 966 55 317
200	7 673 36 302	7 705 38 303	8 737 39 303	8 770 41 303	9 805 43 304	9 840 45 304	9 875 47 304
180	6 609 30 289	7 638 32 289	7 667 33 290	7 697 35 290	8 727 36 290	8 759 38 291	8 791 40 291
160	6 549 25 275	6 574 27 275	6 600 28 276	6 627 29 276	7 654 30 276	7 682 32 277	7 711 33 277
140	5 491 21 260	5 514 22 261	5 537 23 261	6 561 24 261	6 585 25 262	6 610 26 262	6 636 28 262
120	4 436 17 245	4 456 18 245	5 476 19 245	5 498 20 246	5 519 21 246	5 542 22 246	6 564 23 247
100	3 346 12 216	3 362 13 217	4 379 13 217	4 396 14 218	4 413 14 218	4 431 15 218	4 449 16 219
50	2 225 6 178	2 235 7 178	2 245 7 179	2 256 7 179	3 267 8 180	3 279 8 180	3 291 8 181
15	1 139 3 127	1 146 3 128	1 152 3 128	2 159 3 128	2 166 3 129	2 173 4 129	2 180 4 130

LOW AIR CONDITIONING
HIGH AIR CONDITIONING
ENGINE ANTI ICE ON
TOTAL ANTI ICE ON
 $\Delta \text{FUEL} = - 0.5 \%$
 $\Delta \text{FUEL} = + 0.5 \%$
 $\Delta \text{FUEL} = + 2 \%$
 $\Delta \text{FUEL} = + 5 \%$

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)
WEIGHT AT BRAKE RELEASE (1000KG)

FL	64	66	68	70	72	74	76
390							
370	26 1904 174 401	28 2019 187 403	30 2149 201 405				
350	23 1756 151 393	24 1848 160 394	26 1948 169 395	27 2057 180 397	29 2179 193 399	31 2316 207 401	33 2476 225 403
330	21 1638 133 385	22 1719 141 386	23 1804 148 387	24 1895 156 388	26 1994 166 389	27 2101 176 391	29 2219 187 393
310	19 1528 118 376	20 1600 124 377	21 1676 131 378	22 1756 137 379	23 1841 145 380	24 1933 152 381	25 2030 161 382
290	17 1415 103 365	18 1479 108 366	19 1547 114 367	19 1618 119 368	20 1693 125 369	21 1772 131 370	22 1856 138 371
270	15 1281 87 351	16 1338 91 352	16 1397 95 352	17 1459 100 353	18 1523 104 354	19 1591 109 355	19 1662 115 356
250	13 1163 74 338	14 1214 77 338	14 1266 81 339	15 1320 84 339	16 1377 88 340	16 1436 92 341	17 1498 96 341
240	12 1109 68 331	13 1157 71 331	13 1206 74 332	14 1257 77 333	15 1310 81 333	15 1365 84 334	16 1423 88 335
220	11 1007 58 318	11 1050 60 318	12 1094 63 319	12 1139 66 319	13 1186 68 320	13 1235 71 321	14 1286 74 321
200	10 912 49 305	10 950 51 305	10 990 53 306	11 1030 55 306	11 1072 58 307	12 1116 60 307	12 1161 63 308
180	8 824 41 291	9 858 43 291	9 893 45 292	10 929 47 292	10 967 49 293	10 1005 50 294	11 1046 53 294
160	7 741 35 277	8 771 36 278	8 803 37 278	8 835 39 279	9 868 41 279	9 903 42 280	9 938 44 281
140	7 663 29 263	7 690 30 263	7 718 31 264	7 747 32 264	8 776 34 265	8 807 35 265	8 838 37 266
120	6 588 24 247	6 612 25 247	6 637 26 248	6 662 27 249	7 689 28 249	7 716 29 250	7 744 30 251
100	4 468 16 219	5 487 17 220	5 507 18 220	5 527 18 221	5 548 19 222	5 570 20 223	6 592 21 224
50	3 303 9 181	3 315 9 182	3 328 9 182	3 341 10 183	3 354 10 184	3 368 10 186	3 382 11 187
15	2 188 4 130	2 195 4 131	2 203 4 132	2 211 4 133	2 219 5 134	2 228 5 135	2 236 5 137

LOW AIR CONDITIONING
 $\Delta \text{FUEL} = - 0.5 \%$
HIGH AIR CONDITIONING
 $\Delta \text{FUEL} = + 0.5 \%$
ENGINE ANTI ICE ON
 $\Delta \text{FUEL} = + 2 \%$
TOTAL ANTI ICE ON
 $\Delta \text{FUEL} = + 5 \%$

R

CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST			ISA +20		FROM BRAKE RELEASE		
NORMAL AIR CONDITIONING			CG=33.0%		TIME (MIN)	FUEL (KG)	
ANTI-ICING OFF					DISTANCE (NM)	TAS (KT)	
	WEIGHT AT BRAKE RELEASE (1000KG)						
FL	50	52	54	56	58	60	62
390	23 1550 156 409	24 1644 166 410	26 1746 178 411	28 1860 192 413			
370	20 1440 135 401	21 1521 144 402	23 1606 152 403	24 1697 162 404	26 1794 172 405	27 1899 184 406	29 2016 197 408
350	18 1352 121 394	19 1425 128 395	21 1502 135 396	22 1583 143 397	23 1668 151 398	24 1758 161 399	26 1855 170 400
330	17 1272 109 387	18 1339 115 388	19 1409 121 388	20 1482 128 389	21 1559 135 390	22 1640 142 391	23 1725 150 392
310	15 1192 97 379	16 1253 102 379	17 1317 108 380	18 1384 113 380	19 1454 119 381	20 1526 126 382	21 1603 133 383
290	14 1104 85 368	15 1160 89 368	15 1218 94 369	16 1279 99 369	17 1341 104 370	18 1406 109 371	19 1475 115 371
270	12 1000 72 353	13 1050 75 354	13 1101 79 354	14 1155 83 355	15 1210 87 355	15 1267 91 356	16 1326 96 356
250	11 909 61 339	11 953 64 340	12 999 67 340	12 1046 70 341	13 1095 74 341	14 1146 77 342	14 1198 81 342
240	10 866 56 333	11 908 59 333	11 952 62 334	12 996 65 334	12 1043 68 334	13 1090 71 335	13 1139 74 335
220	9 786 47 319	9 824 50 320	10 863 52 320	10 903 55 320	11 944 57 321	11 987 60 321	12 1030 63 322
200	8 712 40 306	8 745 42 306	9 780 44 306	9 816 46 307	9 853 48 307	10 890 50 307	10 929 53 308
180	7 641 34 292	7 672 35 292	8 703 37 292	8 735 39 293	8 768 40 293	9 801 42 293	9 836 44 293
160	6 576 28 277	6 603 29 277	7 631 31 278	7 659 32 278	7 688 34 278	8 718 35 279	8 749 37 279
140	5 514 23 262	6 538 24 262	6 562 26 263	6 588 27 263	6 614 28 263	7 641 29 264	7 668 30 264
120	5 454 19 246	5 476 20 246	5 497 21 246	5 520 22 247	6 543 23 247	6 567 24 247	6 591 25 248
100	4 360 13 216	4 377 14 216	4 394 14 217	4 412 15 217	4 430 16 218	4 449 16 218	5 468 17 218
50	2 233 7 176	2 243 7 176	3 255 7 177	3 266 8 177	3 278 8 178	3 290 8 178	3 302 9 178
15	1 144 3 123	2 150 3 123	2 157 3 124	2 164 3 124	2 172 4 124	2 179 4 125	2 187 4 125
LOW AIR CONDITIONING ΔFUEL = - 0.5 %		HIGH AIR CONDITIONING ΔFUEL = + 0.5 %		ENGINE ANTI ICE ON ΔFUEL = + 2 %		TOTAL ANTI ICE ON ΔFUEL = + 5 %	

R

CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST			ISA +20		FROM BRAKE RELEASE			
NORMAL AIR CONDITIONING			CG=33.0%		TIME (MIN)		FUEL (KG)	
ANTI-ICING OFF					DISTANCE (NM)		TAS (KT)	
	WEIGHT AT BRAKE RELEASE (1000KG)							
FL	64	66	68	70	72	74	76	
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 ΔFUEL = - 0.5 %		HIGH AIR CONDITIONING ΔFUEL = + 0.5 %		ENGINE ANTI ICE ON ΔFUEL = + 2 %		TOTAL ANTI ICE ON 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)							
		FLIGHT LEVEL					
WEIGHT/WIND		290	310	330	350	370	390
1000kg (kt)							
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		

R

COST INDEX = 10 kg/min								COST INDEX = 20 kg/min							
		FLIGHT LEVEL								FLIGHT LEVEL					
WEIGHT/WIND		290	310	330	350	370	390	WEIGHT/WIND		290	310	330	350	370	390
1000kg (kt)								1000kg (kt)							
50	100.	.616	.643	.674	.699	.735	.765	50	100.	.643	.675	.704	.746	.773	.783
	50.	.630	.659	.688	.721	.753	.775		50.	.660	.693	.733	.770	.782	.786
	0.	.646	.678	.706	.748	.773	.783		0.	.689	.716	.766	.781	.785	.788
	-50.	.672	.699	.746	.775	.782	.786		-50.	.721	.761	.781	.785	.788	.791
	-100.	.710	.749	.778	.783	.786	.789		-100.	.771	.786	.788	.790	.792	.794
55	100.	.641	.672	.695	.732	.763	.778	55	100.	.671	.699	.738	.768	.782	.785
	50.	.657	.686	.716	.749	.773	.782		50.	.689	.721	.761	.779	.785	.786
	0.	.676	.703	.743	.771	.783	.785		0.	.706	.760	.778	.784	.787	.789
	-50.	.697	.739	.771	.782	.786	.787		-50.	.756	.779	.784	.787	.790	.792
	-100.	.740	.777	.782	.786	.788	.790		-100.	.780	.786	.788	.791	.794	.794
60	100.	.669	.690	.725	.759	.777	.781	60	100.	.693	.728	.759	.779	.785	.785
	50.	.682	.710	.743	.769	.781	.783		50.	.710	.752	.775	.784	.786	.785
	0.	.699	.735	.764	.781	.785	.785		0.	.749	.775	.783	.786	.788	.787
	-50.	.729	.764	.780	.785	.787	.786		-50.	.777	.783	.786	.789	.791	.790
	-100.	.771	.782	.785	.788	.789	.789		-100.	.784	.787	.790	.792	.794	.793
65	100.	.685	.717	.752	.774	.780		65	100.	.718	.750	.773	.783	.785	
	50.	.703	.735	.764	.779	.783			50.	.740	.769	.782	.785	.785	
	0.	.726	.757	.777	.784	.785			0.	.768	.781	.785	.787	.787	
	-50.	.756	.776	.784	.786	.786			-50.	.781	.785	.788	.790	.790	
	-100.	.779	.784	.787	.789	.789			-100.	.786	.789	.791	.793	.793	
70	100.	.708	.744	.769	.779			70	100.	.739	.766	.780	.784		
	50.	.726	.757	.775	.782				50.	.761	.780	.785	.785		
	0.	.749	.772	.783	.785				0.	.777	.784	.786	.787		
	-50.	.771	.782	.786	.786				-50.	.784	.787	.789	.789		
	-100.	.783	.786	.788	.789				-100.	.787	.790	.792	.793		
75	100.	.734	.763	.777	.780			75	100.	.759	.776	.783	.783		
	50.	.750	.772	.781	.782				50.	.775	.784	.785	.784		
	0.	.767	.780	.784	.784				0.	.783	.786	.786	.785		
	-50.	.781	.785	.786	.784				-50.	.785	.788	.789	.788		
	-100.	.785	.788	.788	.787				-100.	.789	.791	.792	.790		

R

COST INDEX = 40 kg/min								COST INDEX = 60 kg/min							
		FLIGHT LEVEL								FLIGHT LEVEL					
WEIGHT/WIND		290	310	330	350	370	390	WEIGHT/WIND		290	310	330	350	370	390
1000kg	(kt)							1000kg	(kt)						
50	100.	.709	.754	.779	.785	.788	.791	50	100.	.785	.788	.790	.793	.794	.796
	50.	.740	.772	.785	.788	.791	.794		50.	.790	.792	.794	.795	.796	.798
	0.	.780	.787	.789	.792	.794	.795		0.	.794	.795	.797	.799	.799	.800
	-50.	.790	.792	.794	.795	.796	.798		-50.	.797	.799	.800	.800	.800	.800
	-100.	.795	.796	.798	.799	.799	.800		-100.	.800	.800	.800	.800	.800	.800
55	100.	.734	.778	.783	.787	.789	.791	55	100.	.785	.788	.791	.793	.795	.796
	50.	.764	.782	.786	.789	.792	.794		50.	.790	.792	.794	.795	.797	.798
	0.	.783	.787	.790	.793	.795	.795		0.	.793	.795	.797	.797	.799	.800
	-50.	.790	.792	.794	.795	.797	.798		-50.	.797	.799	.800	.800	.800	.800
	-100.	.795	.796	.798	.798	.799	.800		-100.	.800	.800	.800	.800	.800	.800
60	100.	.765	.781	.785	.788	.790	.789	60	100.	.786	.788	.791	.794	.795	.794
	50.	.779	.784	.788	.790	.792	.792		50.	.790	.792	.794	.796	.797	.796
	0.	.785	.788	.791	.794	.795	.794		0.	.793	.795	.796	.798	.799	.798
	-50.	.790	.792	.794	.796	.797	.796		-50.	.797	.799	.799	.800	.800	.798
	-100.	.795	.796	.797	.798	.799	.798		-100.	.800	.800	.800	.800	.800	.798
65	100.	.776	.783	.787	.789	.789		65	100.	.786	.789	.792	.794	.794	
	50.	.783	.786	.789	.791	.791			50.	.790	.792	.794	.796	.795	
	0.	.786	.789	.792	.794	.793			0.	.793	.795	.796	.798	.797	
	-50.	.790	.793	.795	.796	.796			-50.	.797	.798	.798	.800	.800	
	-100.	.795	.796	.797	.798	.798			-100.	.800	.800	.800	.800	.800	
70	100.	.781	.785	.788	.788			70	100.	.787	.790	.793	.793		
	50.	.784	.788	.790	.790				50.	.790	.793	.795	.795		
	0.	.787	.790	.792	.793				0.	.793	.795	.797	.797		
	-50.	.791	.793	.795	.795				-50.	.796	.797	.799	.799		
	-100.	.794	.796	.797	.798				-100.	.800	.800	.800	.800		
75	100.	.784	.787	.787	.786			75	100.	.789	.791	.792	.790		
	50.	.786	.789	.790	.788				50.	.791	.794	.794	.790		
	0.	.789	.791	.792	.790				0.	.794	.796	.796	.790		
	-50.	.792	.794	.795	.790				-50.	.796	.798	.798	.790		
	-100.	.795	.796	.797	.790				-100.	.799	.800	.800	.790		

R

COST INDEX = 80 kg/min								COST INDEX = 100 kg/min							
		FLIGHT LEVEL								FLIGHT LEVEL					
WEIGHT/WIND		290	310	330	350	370	390	WEIGHT/WIND		290	310	330	350	370	390
1000kg (kt)								1000kg (kt)							
50	100.	.793	.795	.797	.798	.799	.800	50	100.	.797	.800	.800	.800	.800	.800
	50.	.796	.798	.800	.800	.800	.800		50.	.800	.800	.800	.800	.800	.800
	0.	.799	.800	.800	.800	.800	.800		0.	.800	.800	.800	.800	.800	.800
	-50.	.800	.800	.800	.800	.800	.800		-50.	.800	.800	.800	.800	.800	.800
	-100.	.800	.800	.800	.800	.800	.800		-100.	.800	.800	.800	.800	.800	.800
55	100.	.793	.795	.796	.797	.799	.799	55	100.	.797	.800	.800	.800	.800	.800
	50.	.796	.798	.799	.799	.800	.800		50.	.800	.800	.800	.800	.800	.800
	0.	.799	.800	.800	.800	.800	.800		0.	.800	.800	.800	.800	.800	.800
	-50.	.800	.800	.800	.800	.800	.800		-50.	.800	.800	.800	.800	.800	.800
	-100.	.800	.800	.800	.800	.800	.800		-100.	.800	.800	.800	.800	.800	.800
60	100.	.793	.794	.796	.797	.799	.798	60	100.	.797	.799	.799	.800	.800	.798
	50.	.796	.797	.798	.799	.800	.798		50.	.800	.800	.800	.800	.800	.798
	0.	.799	.800	.800	.800	.800	.798		0.	.800	.800	.800	.800	.800	.798
	-50.	.800	.800	.800	.800	.800	.798		-50.	.800	.800	.800	.800	.800	.798
	-100.	.800	.800	.800	.800	.800	.798		-100.	.800	.800	.800	.800	.800	.798
65	100.	.792	.794	.796	.797	.797		65	100.	.797	.798	.799	.800	.800	
	50.	.795	.796	.798	.799	.799			50.	.800	.800	.800	.800	.800	
	0.	.799	.799	.800	.800	.800			0.	.800	.800	.800	.800	.800	
	-50.	.800	.800	.800	.800	.800			-50.	.800	.800	.800	.800	.800	
	-100.	.800	.800	.800	.800	.800			-100.	.800	.800	.800	.800	.800	
70	100.	.793	.794	.796	.796			70	100.	.796	.797	.799	.799		
	50.	.795	.796	.798	.798				50.	.799	.799	.800	.800		
	0.	.798	.798	.800	.800				0.	.800	.800	.800	.800		
	-50.	.800	.800	.800	.800				-50.	.800	.800	.800	.800		
	-100.	.800	.800	.800	.800				-100.	.800	.800	.800	.800		
75	100.	.793	.795	.796	.790			75	100.	.796	.798	.798	.790		
	50.	.795	.797	.797	.790				50.	.797	.799	.800	.790		
	0.	.797	.799	.799	.790				0.	.800	.800	.800	.790		
	-50.	.799	.800	.800	.790				-50.	.800	.800	.800	.790		
	-100.	.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.

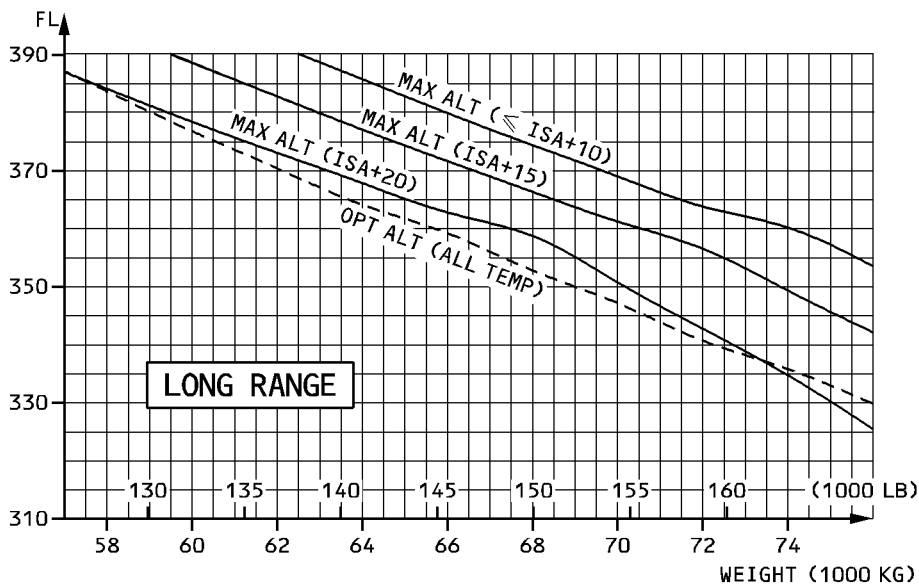
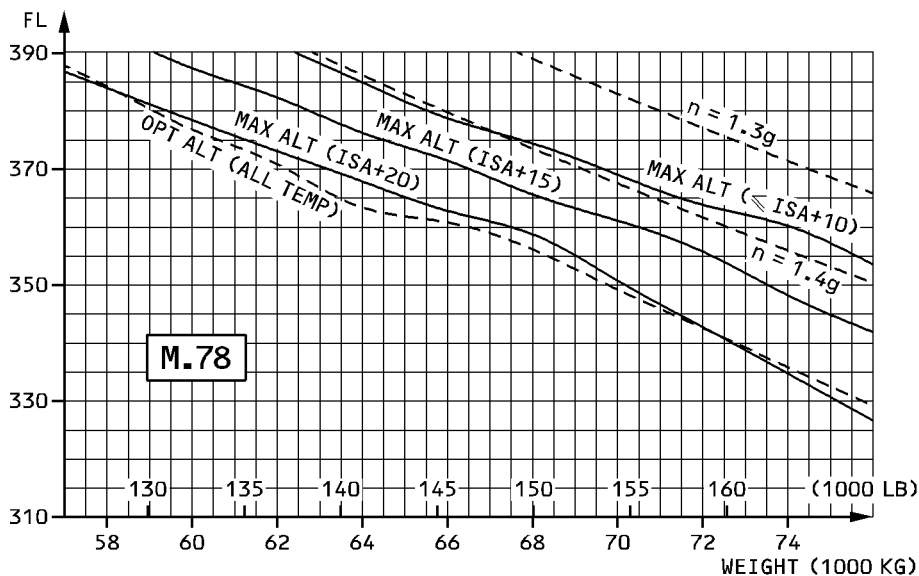
R OPTIMUM WEIGHT FOR 4000 FEET STEP CLIMB
R

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

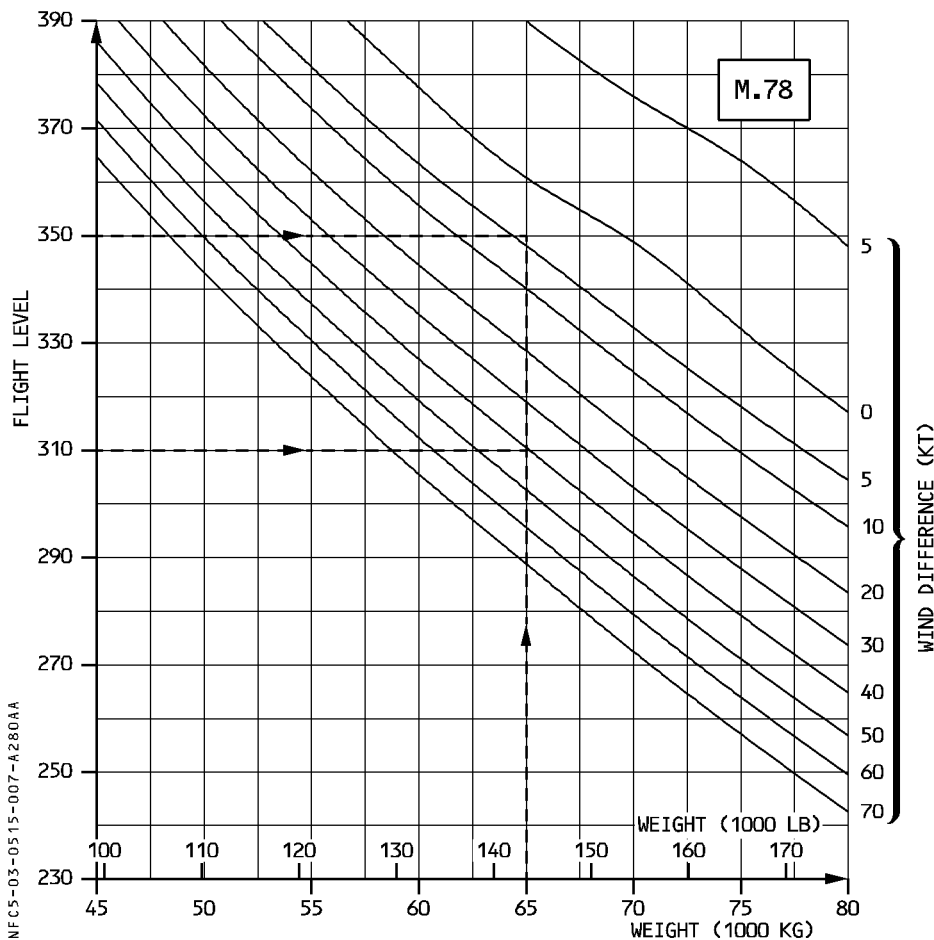
CORRECTIONS	ENGINE ANTI ICE	TOTAL ANTI ICE
ISA	Max Alt. : – 200 ft Opt Alt. : – 300 ft	Max Alt. : – 400 ft Opt Alt. : – 300 ft
ISA + 10	Max Alt. : – 1200 ft Opt Alt. : – 200 ft	Max Alt. : – 2300 ft Opt Alt. : – 300 ft
ISA + 15	Max Alt. : – 1400 ft Opt Alt. : – 400 ft	Max. Alt. : – 3200 ft Opt Alt. : – 1600 ft
ISA + 20	Max Alt. : – 3000 ft Opt Alt. : – 3000 ft	Max Alt. : – 5500 ft Opt Alt. : – 5000 ft

R



NFC5-03-0515-006-A280AA

WIND ALTITUDE TRADE FOR CONSTANT SPECIFIC RANGE



GIVEN : Weight : 65000 kg (143 300 lb)

Wind at FL350 : 10 kt head

FIND : Minimum wind difference to descend to FL310 : $(40 - 4) = 36$ kt

RESULTS : Descent to FL310 may be considered provided the tail wind at this altitude is more than $(36 - 10) = 26$ kt.

OPTIMUM ALTITUDE ON SHORT STAGE

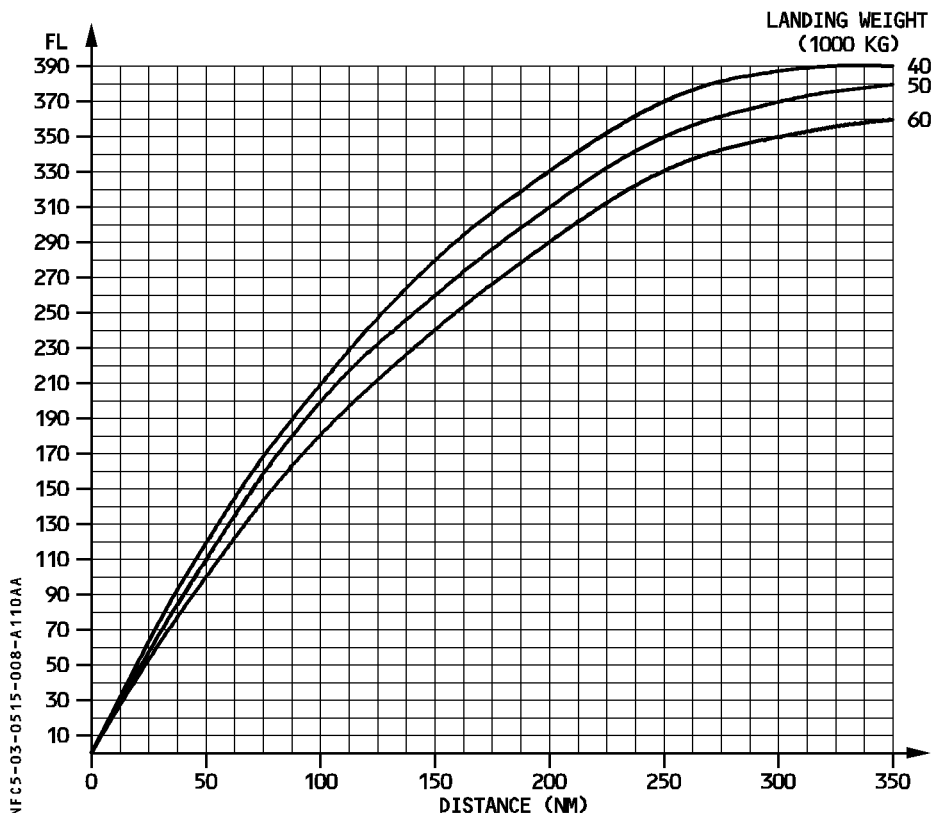
According to the air distance (from brake release point to landing), the cruise flight level is limited by the distance required to perform climb and descent. The graph determines the optimum altitude.

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

ΔFUEL = -0.6 %

ENGINE ANTI ICE ON

ΔFUEL = +2.5 %

TOTAL ANTI ICE ON

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 1339 302 176.1 472	81.9 .780 1242 289 188.3 468	81.8 .780 1155 277 200.8 464	81.8 .780 1079 264 213.1 460	82.4 .780 1018 252 224.8 458	83.5 .780 975 241 234.8 458	
52	82.3 .780 1348 302 174.9 472	82.1 .780 1252 289 186.7 468	82.0 .780 1167 277 198.7 464	82.1 .780 1092 264 210.5 460	82.7 .780 1034 252 221.2 458	84.0 .780 997 241 229.6 458	
54	82.5 .780 1358 302 173.7 472	82.3 .780 1263 289 185.1 468	82.3 .780 1180 277 196.4 464	82.4 .780 1108 264 207.6 460	83.2 .780 1053 252 217.3 458	84.5 .780 1022 241 223.9 458	
56	82.6 .780 1368 302 172.4 472	82.5 .780 1275 289 183.4 468	82.6 .780 1194 277 194.2 464	82.8 .780 1124 264 204.5 460	83.6 .780 1074 252 213.1 458	85.1 .780 1051 241 217.6 458	
58	82.8 .780 1378 302 171.1 472	82.7 .780 1288 289 181.5 468	82.8 .780 1208 277 192.0 464	83.1 .780 1141 264 201.4 460	84.1 .780 1097 252 208.6 458	85.7 .780 1085 241 210.8 458	
60	83.0 .780 1390 302 169.7 472	83.0 .780 1302 289 179.6 468	83.1 .780 1224 277 189.4 464	83.5 .780 1160 264 198.1 460	84.6 .780 1123 252 203.8 458	86.4 .780 1120 241 204.2 458	
62	83.1 .780 1402 302 168.2 472	83.2 .780 1315 289 177.8 468	83.4 .780 1241 277 186.9 464	84.0 .780 1182 264 194.5 460	85.1 .780 1152 252 198.6 458	87.1 .780 1158 241 197.6 458	
64	83.4 .780 1416 302 166.6 472	83.5 .780 1330 289 175.8 468	83.8 .780 1258 277 184.3 464	84.4 .780 1206 264 190.7 460	85.6 .780 1186 252 192.8 458	87.8 .780 1196 241 191.3 458	
66	83.6 .780 1430 302 164.9 472	83.7 .780 1346 289 173.7 468	84.1 .780 1278 277 181.5 464	84.8 .780 1231 264 186.7 460	86.2 .780 1222 252 187.3 458		
68	83.8 .780 1443 302 163.4 472	84.0 .780 1363 289 171.5 468	84.6 .780 1299 277 178.4 464	85.3 .780 1260 264 182.5 460	86.8 .780 1258 252 181.8 458		
70	84.0 .780 1458 302 161.7 472	84.3 .780 1381 289 169.3 468	85.0 .780 1323 277 175.2 464	85.8 .780 1294 264 177.7 460	87.5 .780 1297 252 176.4 458		
72	84.3 .780 1474 302 159.9 472	84.7 .780 1400 289 167.0 468	85.4 .780 1349 277 171.9 464	86.3 .780 1329 264 173.0 460	88.2 .780 1336 252 171.3 458		
74	84.5 .780 1491 302 158.1 472	85.0 .780 1422 289 164.5 468	85.8 .780 1376 277 168.5 464	86.9 .780 1365 264 168.4 460			
76	84.8 .780 1509 302 156.3 472	85.4 .780 1445 289 161.9 468	86.2 .780 1408 277 164.6 464	87.5 .780 1403 264 163.8 460			
LOW AIR CONDITIONING ΔFUEL = -0.6 %			ENGINE ANTI ICE ON ΔFUEL = +2.5 %			TOTAL ANTI ICE ON 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
1357 302
175.6 476

82.8 .780
1258 289
187.8 473

82.7 .780
1170 277
200.3 469

82.8 .780
1093 264
212.5 465

83.3 .780
1031 252
224.3 463

84.5 .780
988 241
234.2 463

52

83.2 .780
1366 302
174.4 476

83.0 .780
1269 289
186.2 473

82.9 .780
1182 277
198.2 469

83.0 .780
1107 264
210.0 465

83.7 .780
1048 252
220.7 463

85.0 .780
1010 241
229.0 463

54

83.3 .780
1376 302
173.2 476

83.2 .780
1280 289
184.6 473

83.2 .780
1196 277
195.9 469

83.4 .780
1122 264
207.0 465

84.1 .780
1067 252
216.8 463

85.5 .780
1036 241
223.3 463

56

83.5 .780
1386 302
171.9 476

83.4 .780
1292 289
182.9 473

83.5 .780
1210 277
193.7 469

83.7 .780
1139 264
204.0 465

84.6 .780
1088 252
212.6 463

86.0 .780
1066 241
217.0 463

58

83.6 .780
1396 302
170.6 476

83.6 .780
1305 289
181.0 473

83.7 .780
1224 277
191.5 469

84.1 .780
1157 264
200.9 465

85.0 .780
1112 252
208.1 463

86.6 .780
1100 241
210.2 463

60

83.8 .780
1408 302
169.2 476

83.9 .780
1319 289
179.1 473

84.0 .780
1240 277
188.9 469

84.5 .780
1176 264
197.6 465

85.5 .780
1138 252
203.3 463

87.3 .780
1136 241
203.6 463

62

84.0 .780
1421 302
167.7 476

84.1 .780
1333 289
177.3 473

84.3 .780
1257 277
186.4 469

84.9 .780
1198 264
194.0 465

86.0 .780
1168 252
198.0 463

64

84.2 .780
1434 302
166.1 476

84.3 .780
1348 289
175.3 473

84.7 .780
1275 277
183.8 469

85.3 .780
1222 264
190.2 465

86.6 .780
1203 252
192.3 463

66

84.5 .780
1448 302
164.5 476

84.6 .780
1364 289
173.2 473

85.1 .780
1295 277
181.0 469

85.8 .780
1248 264
186.2 465

87.2 .780
1238 252
186.8 463

68

84.7 .780
1462 302
162.9 476

84.9 .780
1381 289
171.0 473

85.5 .780
1317 277
178.0 469

86.2 .780
1277 264
181.9 465

87.8 .780
1276 252
181.3 463

70

84.9 .780
1477 302
161.3 476

85.2 .780
1399 289
168.8 473

85.9 .780
1341 277
174.7 469

86.7 .780
1312 264
177.2 465

72

85.2 .780
1494 302
159.5 476

85.6 .780
1419 289
166.5 473

86.3 .780
1367 277
171.4 469

87.3 .780
1347 264
172.5 465

74

85.4 .780
1511 302
157.7 476

85.9 .780
1441 289
164.0 473

86.7 .780
1395 277
168.0 469

87.8 .780
1384 264
167.9 465

76

85.7 .780
1529 302
155.8 476

86.3 .780
1464 289
161.4 473

87.1 .780
1428 277
164.1 469

LOW AIR CONDITIONING
ΔFUEL = -0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
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 ΔFUEL = -0.6 %					ENGINE ANTI ICE ON ΔFUEL = +2.5 %			TOTAL ANTI ICE ON ΔFUEL = +4.5 %				

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)	FL100	FL150	FL200	FL230	FL250	FL270
50	58.2 .439 1108 243 126.5 280	63.8 .515 1144 260 141.0 323	67.4 .559 1087 256 158.0 344	70.6 .609 1091 263 169.4 370	72.2 .634 1072 263 178.1 382	73.5 .654 1042 261 187.3 390
52	60.7 .473 1216 261 124.0 302	64.6 .522 1177 263 139.1 327	68.8 .577 1140 264 155.4 354	71.6 .622 1129 269 167.2 377	73.0 .643 1101 267 175.7 387	74.4 .663 1073 265 184.5 396
54	62.7 .498 1305 276 121.8 318	65.5 .532 1214 268 137.2 333	69.9 .590 1183 271 153.3 363	72.4 .631 1161 273 165.1 383	73.8 .651 1130 271 173.5 392	75.2 .671 1101 268 182.1 401
56	63.6 .507 1346 281 120.3 324	66.5 .541 1252 273 135.3 339	70.7 .600 1216 275 151.5 368	73.2 .640 1191 277 163.0 388	74.6 .660 1162 275 171.1 398	75.7 .676 1123 270 179.7 403
58	64.4 .515 1381 285 119.0 329	67.4 .549 1288 277 133.5 344	71.9 .617 1265 283 149.8 379	74.0 .647 1219 280 161.1 393	75.3 .668 1189 278 168.9 402	76.1 .677 1140 271 177.3 404
60	65.1 .522 1416 289 117.7 333	68.2 .556 1321 281 131.9 348	72.7 .626 1299 288 148.0 385	74.7 .655 1250 284 159.1 398	76.0 .674 1216 281 166.9 406	76.4 .677 1155 271 175.1 404
62	65.9 .529 1450 293 116.4 338	69.0 .565 1357 285 130.3 354	73.4 .634 1331 292 146.4 390	75.4 .663 1281 288 157.1 403	76.4 .677 1236 282 164.9 408	77.0 .683 1183 273 172.3 408
64	66.6 .535 1482 297 115.2 341	69.8 .575 1398 291 128.8 360	74.1 .642 1362 295 144.7 394	76.0 .669 1308 291 155.4 406	76.8 .678 1253 283 162.9 408	77.7 .691 1217 277 169.5 413
66	67.2 .540 1511 299 114.0 345	70.7 .585 1440 296 127.4 367	74.8 .648 1390 299 143.2 398	76.7 .676 1336 294 153.6 410	77.1 .679 1269 283 160.9 409	78.4 .700 1253 280 166.7 418
68	67.8 .545 1541 302 112.9 348	71.5 .595 1480 301 126.0 373	75.4 .654 1418 301 141.7 402	77.0 .678 1355 295 151.9 412	77.6 .684 1298 285 158.6 412	79.1 .709 1290 284 164.0 423
70	68.4 .549 1568 305 111.8 351	72.4 .606 1522 307 124.8 380	76.0 .661 1450 305 140.1 406	77.4 .680 1373 295 150.2 412	78.2 .691 1332 289 156.2 416	79.8 .718 1329 288 161.3 429
72	68.9 .553 1595 307 110.7 353	73.3 .619 1567 313 123.6 387	76.6 .667 1477 308 138.7 410	77.7 .680 1388 295 148.6 413	78.9 .699 1368 292 153.8 421	80.5 .726 1365 292 158.8 433
74	69.5 .557 1622 309 109.7 356	74.0 .627 1605 318 122.4 393	77.1 .673 1506 310 137.3 413	78.1 .684 1416 297 146.6 415	79.5 .708 1407 296 151.5 426	81.0 .733 1399 295 156.3 438
76	70.1 .564 1659 313 108.6 360	74.6 .634 1637 321 121.3 397	77.7 .678 1533 313 135.9 417	78.7 .691 1451 301 144.5 419	80.2 .717 1446 300 149.2 432	81.5 .740 1435 298 153.9 442

LOW AIR CONDITIONING
 $\Delta \text{FUEL} = -0.6 \%$
ENGINE ANTI ICE ON
 $\Delta \text{FUEL} = +2.5 \%$
TOTAL ANTI ICE ON
 $\Delta \text{FUEL} = +4.5 \%$

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 1012 258 196.8 398	75.3 .676 960 248 206.8 397	76.6 .698 946 245 214.6 406	78.2 .726 941 245 222.4 419	79.6 .752 939 242 229.7 431	81.6 .778 946 240 236.0 446
52	75.3 .676 1031 259 194.0 400	76.0 .684 989 251 202.9 401	77.5 .710 983 250 210.2 413	78.9 .736 976 248 217.5 424	80.4 .764 977 247 224.2 438	82.3 .782 975 242 230.0 449
54	75.7 .676 1047 259 191.3 400	76.8 .693 1023 255 198.9 407	78.5 .723 1021 254 205.9 420	79.6 .748 1013 252 212.7 431	81.1 .775 1015 251 218.9 444	82.8 .785 1006 243 223.8 450
56	76.2 .680 1068 260 188.3 402	77.6 .703 1058 258 195.0 413	79.1 .731 1054 258 201.7 425	80.2 .757 1047 256 208.2 436	81.8 .781 1048 253 213.8 448	83.4 .785 1035 243 217.4 450
58	76.9 .689 1103 264 184.8 408	78.5 .715 1096 263 191.3 419	79.8 .741 1089 261 197.7 431	81.0 .769 1088 260 203.6 443	82.4 .784 1076 254 208.8 449	84.0 .786 1071 243 210.5 451
60	77.7 .698 1137 268 181.5 413	79.3 .725 1133 267 187.8 426	80.4 .750 1125 265 193.8 436	81.6 .778 1126 264 199.2 449	82.9 .786 1108 255 203.5 451	84.7 .786 1106 243 203.8 451
62	78.4 .707 1174 272 178.3 419	79.9 .734 1168 270 184.3 430	81.0 .759 1161 268 190.0 441	82.2 .782 1156 265 195.0 451	83.4 .786 1137 255 198.2 451	85.4 .786 1144 243 197.1 451
64	79.2 .719 1214 276 175.2 425	80.5 .742 1204 274 180.9 436	81.6 .770 1203 273 186.1 448	82.7 .784 1184 266 190.8 452	84.0 .786 1172 255 192.4 451	86.1 .785 1180 243 190.9 450
66	80.0 .727 1249 280 172.2 430	81.0 .750 1240 277 177.6 440	82.3 .779 1241 276 182.5 453	83.2 .786 1215 267 186.5 453	84.6 .786 1207 255 186.9 451	
68	80.5 .734 1284 283 169.3 435	81.6 .759 1277 281 174.4 445	82.8 .782 1271 277 178.9 455	83.7 .786 1245 267 182.0 453	85.2 .787 1245 255 181.3 451	
70	81.0 .742 1319 286 166.5 439	82.2 .770 1319 285 171.2 452	83.3 .784 1300 278 175.4 456	84.2 .786 1278 267 177.3 453	85.9 .787 1286 255 175.7 452	
72	81.5 .750 1355 289 163.7 444	82.8 .778 1358 288 168.0 456	83.7 .785 1330 279 171.8 457	84.7 .786 1312 267 172.7 453	86.3 .781 1304 253 171.9 448	
74	82.0 .756 1390 292 161.0 448	83.3 .782 1389 290 165.1 459	84.2 .787 1362 280 168.1 458	85.3 .787 1350 267 167.9 453		
76	82.6 .766 1433 296 158.3 454	83.8 .784 1419 291 162.1 460	84.6 .786 1391 279 164.3 457	85.9 .787 1389 267 163.3 454		
LOW AIR CONDITIONING ΔFUEL = -0.6 %				ENGINE ANTI ICE ON ΔFUEL = +2.5 %		TOTAL ANTI ICE ON ΔFUEL = +4.5 %

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)	FL100	FL150	FL200	FL230	FL250	FL270
50	59.4 .439 1136 243 125.7 286	65.7 .524 1193 264 140.2 335	69.1 .563 1117 258 157.8 353	71.7 .601 1097 260 169.6 372	73.5 .629 1085 261 178.3 387	75.0 .650 1058 259 187.3 396
52	62.4 .480 1265 265 123.2 312	66.6 .532 1227 268 138.4 340	70.1 .575 1158 263 155.6 360	73.0 .618 1144 267 167.4 383	74.3 .639 1116 265 175.8 392	75.9 .661 1092 264 184.5 403
54	64.7 .508 1364 281 121.0 330	67.4 .539 1258 272 136.7 344	71.2 .588 1200 270 153.4 368	73.8 .628 1177 272 165.2 389	75.2 .647 1146 269 173.5 398	76.7 .668 1120 267 182.0 407
56	65.5 .515 1398 285 119.8 335	68.1 .544 1286 275 135.1 347	72.0 .597 1233 274 151.6 374	74.6 .637 1209 276 163.0 394	76.1 .658 1182 274 171.0 404	77.3 .673 1143 269 179.5 410
58	66.2 .521 1429 289 118.6 339	68.8 .550 1315 277 133.5 351	73.1 .611 1279 281 149.8 383	75.4 .644 1238 279 161.1 399	76.8 .666 1212 277 168.8 409	77.6 .675 1161 270 177.1 411
60	66.8 .526 1457 292 117.4 342	69.5 .554 1341 280 131.9 354	74.0 .623 1317 286 148.1 390	76.2 .652 1270 283 159.0 404	77.5 .672 1239 280 166.7 413	78.0 .676 1178 270 174.8 412
62	67.3 .531 1483 294 116.3 345	70.3 .563 1379 285 130.4 360	74.7 .630 1348 290 146.4 395	76.9 .661 1303 287 157.0 409	78.0 .675 1260 281 164.6 415	78.6 .681 1207 272 172.0 415
64	67.9 .535 1509 296 115.2 348	71.1 .573 1420 290 128.9 366	75.4 .638 1380 293 144.7 399	77.5 .667 1331 290 155.2 413	78.3 .676 1277 282 162.6 415	79.3 .690 1243 276 169.1 420
66	68.5 .539 1536 299 114.1 350	72.0 .583 1462 295 127.4 373	76.2 .645 1412 297 143.1 404	78.2 .673 1360 293 153.4 417	78.7 .677 1296 282 160.6 416	80.0 .697 1278 279 166.3 425
68	69.0 .543 1564 301 112.9 353	72.8 .593 1502 300 126.0 378	76.8 .651 1441 300 141.6 408	78.6 .676 1380 294 151.6 419	79.2 .682 1325 285 158.2 419	80.7 .706 1316 283 163.5 430
70	69.6 .548 1592 304 111.8 356	73.5 .600 1535 304 124.8 383	77.5 .659 1477 304 139.9 413	78.9 .677 1398 294 149.9 419	79.9 .690 1361 288 155.7 424	81.4 .716 1356 287 160.9 436
72	70.2 .552 1620 306 110.7 359	74.6 .614 1587 311 123.6 392	78.1 .665 1505 307 138.4 417	79.2 .678 1415 294 148.2 420	80.5 .697 1397 291 153.3 428	82.1 .724 1394 291 158.3 441
74	70.8 .556 1647 308 109.7 361	75.3 .624 1627 316 122.3 398	78.6 .671 1534 309 137.0 420	79.7 .682 1444 296 146.2 422	81.1 .705 1434 295 151.0 433	82.7 .731 1431 294 155.8 446
76	71.4 .563 1685 312 108.6 366	75.9 .630 1660 319 121.2 402	79.2 .676 1561 312 135.6 423	80.3 .689 1480 300 144.1 427	81.8 .714 1474 299 148.8 439	83.2 .738 1468 297 153.3 450

LOW AIR CONDITIONING
ΔFUEL = -0.6 %

ENGINE ANTI ICE ON
ΔFUEL = +2.5 %

TOTAL ANTI ICE ON
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 ΔFUEL = -0.6 %					ENGINE ANTI ICE ON ΔFUEL = +2.5 %					TOTAL ANTI ICE ON ΔFUEL = +4.5 %	

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 1150 243 125.3 288	66.6 .527 1212 266 140.0 339	69.7 .561 1125 257 157.9 355	72.3 .599 1104 259 169.7 375	74.2 .628 1092 260 178.3 390	75.7 .649 1067 259 187.3 400
52	63.7 .489 1306 271 122.8 321	67.3 .533 1240 269 138.4 343	70.8 .574 1166 263 155.6 363	73.6 .616 1151 266 167.4 385	75.0 .637 1124 265 175.8 395	76.7 .660 1102 263 184.4 406
54	65.6 .511 1386 283 120.9 335	68.0 .538 1267 271 136.7 347	71.9 .587 1210 269 153.4 371	74.4 .625 1184 270 165.2 391	75.9 .645 1154 268 173.5 400	77.4 .667 1130 266 181.8 411
56	66.2 .516 1415 286 119.7 339	68.7 .543 1295 274 135.1 350	72.7 .596 1243 273 151.6 377	75.2 .634 1216 275 163.1 397	76.8 .656 1190 273 170.9 407	78.0 .672 1154 268 179.3 414
58	66.8 .521 1442 289 118.6 342	69.4 .549 1324 277 133.5 354	73.7 .609 1286 280 149.8 385	76.1 .643 1249 278 161.0 402	77.6 .664 1222 276 168.6 412	78.4 .674 1172 269 176.9 415
60	67.3 .525 1466 291 117.4 344	70.1 .554 1352 279 131.9 357	74.7 .620 1326 285 148.0 392	76.9 .651 1281 282 158.9 407	78.3 .671 1251 280 166.5 417	78.8 .675 1190 270 174.6 415
62	67.9 .529 1492 293 116.3 347	70.9 .562 1390 284 130.4 362	75.4 .629 1359 289 146.3 398	77.6 .660 1315 286 156.8 413	78.7 .674 1272 281 164.4 418	79.4 .680 1219 272 171.8 419
64	68.5 .534 1520 296 115.2 350	71.8 .572 1431 289 128.8 369	76.1 .636 1392 293 144.6 403	78.3 .666 1345 289 155.0 417	79.1 .675 1289 281 162.4 419	80.1 .688 1255 275 168.8 424
66	69.1 .538 1547 298 114.1 353	72.7 .583 1474 295 127.3 375	76.8 .643 1423 296 143.0 407	78.9 .672 1373 292 153.2 421	79.5 .676 1308 282 160.4 420	80.8 .696 1292 279 166.0 429
68	69.6 .543 1576 301 112.9 356	73.5 .592 1514 299 125.9 381	77.5 .650 1453 299 141.5 411	79.3 .675 1393 293 151.4 422	80.0 .682 1339 284 158.0 423	81.5 .705 1330 283 163.2 434
70	70.2 .547 1604 303 111.8 359	74.2 .599 1547 303 124.7 386	78.2 .658 1490 303 139.7 416	79.7 .676 1411 293 149.7 423	80.7 .689 1376 288 155.5 428	82.2 .715 1371 287 160.5 440
72	70.8 .551 1633 306 110.7 362	75.2 .612 1598 310 123.5 395	78.8 .664 1519 306 138.3 420	80.0 .676 1429 294 148.0 423	81.3 .697 1412 291 153.0 432	83.0 .724 1411 291 157.9 446
74	71.4 .555 1661 308 109.6 364	76.0 .622 1638 315 122.3 401	79.4 .670 1549 309 136.8 424	80.5 .681 1458 296 146.0 426	82.0 .704 1450 294 150.7 437	83.5 .731 1448 294 155.4 450
76	72.0 .562 1698 312 108.5 369	76.5 .628 1671 318 121.1 405	79.9 .675 1577 311 135.4 427	81.1 .688 1495 299 143.9 430	82.6 .713 1491 298 148.4 443	84.0 .738 1486 297 152.9 454

LOW AIR CONDITIONING

ΔFUEL = -0.6 %

ENGINE ANTI ICE ON

ΔFUEL = +2.5 %

TOTAL ANTI ICE ON

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 1042 256 196.5 409	77.7 .673 987 246 206.4 408	79.1 .695 975 244 214.2 417	80.8 .723 972 243 221.7 431	82.3 .750 973 242 228.6 445	84.4 .776 981 240 234.6 460	
52	77.7 .673 1061 257 193.6 411	78.5 .681 1020 250 202.3 413	80.1 .707 1013 248 209.6 425	81.5 .733 1008 247 216.7 437	83.1 .762 1013 246 223.1 452	85.0 .782 1014 242 228.5 464	
54	78.1 .673 1077 258 190.9 411	79.3 .691 1056 254 198.3 419	81.0 .719 1053 253 205.2 432	82.2 .745 1048 251 211.7 444	83.9 .773 1053 250 217.7 458	85.6 .785 1047 243 222.2 465	
56	78.6 .678 1102 259 187.8 414	80.1 .701 1092 257 194.3 425	81.7 .729 1090 257 200.9 438	82.9 .754 1085 255 207.2 449	84.6 .780 1089 253 212.5 463	86.2 .784 1078 243 215.8 465	
58	79.4 .687 1138 263 184.2 419	81.0 .713 1133 262 190.6 432	82.4 .739 1128 261 196.7 444	83.6 .766 1127 259 202.5 456	85.1 .783 1118 253 207.5 464	86.9 .785 1115 243 208.9 466	
60	80.2 .695 1174 267 180.9 425	81.9 .723 1172 266 186.9 438	83.0 .748 1167 264 192.7 450	84.3 .776 1167 263 198.0 462	85.7 .786 1153 255 202.2 466	87.5 .786 1152 243 202.2 466	
62	80.9 .703 1209 270 177.6 430	82.4 .731 1207 269 183.4 443	83.7 .758 1205 268 188.9 455	85.0 .781 1201 265 193.8 465	86.2 .785 1182 254 196.9 465		
64	81.7 .714 1249 274 174.5 436	83.1 .741 1248 273 179.8 449	84.3 .769 1248 272 185.0 462	85.4 .783 1230 266 189.6 467	86.8 .785 1219 254 191.1 466		
66	82.5 .724 1289 278 171.4 442	83.6 .749 1285 277 176.6 454	85.0 .778 1289 276 181.3 467	86.0 .786 1264 267 185.2 468	87.4 .786 1256 255 185.5 466		
68	83.0 .731 1326 282 168.4 447	84.2 .757 1323 280 173.4 459	85.5 .781 1321 277 177.7 469	86.4 .785 1294 266 180.8 468	88.0 .785 1292 254 180.2 465		
70	83.6 .740 1366 285 165.4 452	84.8 .767 1367 284 170.1 465	86.0 .783 1351 278 174.2 471	87.0 .786 1330 267 176.0 468	88.1 .761 1279 246 176.3 451		
72	84.1 .748 1405 289 162.6 457	85.4 .776 1408 287 166.9 470	86.5 .785 1383 279 170.6 472	87.5 .786 1367 267 171.3 468			
74	84.7 .755 1442 292 160.0 461	86.0 .781 1443 289 163.9 473	86.9 .787 1416 279 166.8 473	88.1 .786 1407 267 166.6 469			
76	85.2 .765 1486 296 157.2 467	86.4 .783 1473 290 161.0 474	87.4 .786 1448 279 163.0 472	88.3 .773 1408 262 163.6 461			
LOW AIR CONDITIONING ΔFUEL = -0.6 %				ENGINE ANTI ICE ON ΔFUEL = +2.5 %		TOTAL ANTI ICE ON ΔFUEL = +4.5 %	

LONG RANGE CRUISE
**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)	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
 $\Delta FUEL = -0.6 \%$
ENGINE ANTI ICE ON
 $\Delta FUEL = +2.5 \%$
TOTAL ANTI ICE ON
 $\Delta FUEL = +4.5 \%$

R

LONG RANGE CRUISE

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	78.0 .669 1051 256 196.4 413	78.5 .672 997 246 206.2 411	79.9 .694 985 244 213.9 421	81.6 .723 984 243 221.3 435	83.2 .750 985 242 228.1 449	85.3 .775 993 239 234.0 465			
52	78.4 .671 1070 257 193.5 414	79.3 .680 1030 249 202.1 416	80.8 .704 1022 248 209.3 428	82.4 .733 1021 247 216.2 441	84.0 .761 1025 246 222.5 456	85.9 .781 1027 242 228.0 468			
54	78.9 .672 1088 257 190.6 415	80.1 .690 1066 253 198.0 422	81.8 .717 1063 252 204.8 436	83.1 .745 1061 251 211.2 448	84.8 .773 1067 250 217.1 463	86.5 .785 1061 243 221.6 470			
56	79.4 .676 1113 259 187.5 417	80.9 .700 1104 257 194.0 428	82.5 .727 1101 256 200.5 442	83.8 .754 1099 255 206.7 454	85.5 .780 1103 253 212.0 468	87.1 .784 1092 242 215.2 470			
58	80.2 .686 1150 263 184.0 423	81.8 .711 1143 261 190.3 435	83.2 .738 1141 260 196.2 448	84.5 .765 1141 259 202.0 461	86.0 .783 1133 253 207.0 469	87.3 .768 1096 237 210.2 460			
60	81.0 .694 1187 266 180.5 428	82.7 .722 1184 266 186.6 442	83.9 .748 1181 264 192.2 454	85.2 .775 1181 263 197.6 467	86.6 .786 1168 255 201.7 471	87.4 .724 1080 222 201.0 434			
62	81.7 .703 1224 270 177.3 434	83.3 .731 1222 269 183.0 447	84.5 .757 1220 268 188.4 460	85.9 .781 1216 265 193.3 470	87.1 .785 1198 254 196.3 470				
64	82.5 .714 1265 274 174.1 440	83.9 .741 1263 273 179.4 453	85.2 .768 1264 272 184.5 466	86.3 .783 1246 265 189.1 471	87.7 .785 1235 254 190.6 471				
66	83.3 .723 1305 278 171.0 446	84.5 .749 1301 277 176.1 458	85.9 .777 1304 275 180.8 471	86.9 .786 1281 267 184.7 473	87.8 .765 1226 247 186.9 458				
68	83.9 .731 1342 281 168.0 451	85.1 .757 1340 280 172.9 463	86.4 .781 1337 277 177.3 474	87.3 .785 1311 266 180.2 473					
70	84.4 .739 1382 285 165.0 456	85.7 .767 1383 284 169.6 469	86.9 .783 1368 278 173.7 475	87.9 .785 1348 266 175.5 473					
72	85.0 .748 1422 288 162.2 461	86.3 .775 1424 287 166.5 474	87.3 .785 1401 279 170.1 477	88.0 .773 1351 262 172.2 465					
74	85.5 .755 1459 291 159.5 466	86.8 .780 1461 289 163.5 478	87.8 .786 1435 279 166.4 477	88.1 .742 1336 250 167.2 447					
76	86.1 .764 1504 295 156.7 471	87.3 .782 1492 290 160.5 479	88.0 .780 1448 277 163.6 474						
LOW AIR CONDITIONING ΔFUEL = -0.6 %				ENGINE ANTI ICE ON ΔFUEL = +2.5 %		TOTAL ANTI ICE ON 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 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 Δ fuel consumption : - 40 kg per 1000 kg below reference

R Δ fuel : - 40 $\times$ (60 - 55) = - 200 kg

– Temperature correction :

Δ fuel consumption : + 0.005 kg per 1° above ISA and per 1 NM Air distance

Δ fuel : + 0.005 $\times$ 10 $\times$ 880 = 44 kg

Result :

R Fuel : 4022 - 200 + 44 = 3866 kg

Time : 2 h 07 min

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
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 ΔFUEL = - 0.6 %			ENGINE ANTI ICE ON ΔFUEL = + 3 %			TOTAL ANTI ICE ON ΔFUEL = + 6 %			

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

ISA

FUEL CONSUMED (KG)

NORMAL AIR CONDITIONING

CG = 33.0 %

ANTI-ICING OFF

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 ΔFUEL = - 0.6 %		ENGINE ANTI ICE ON ΔFUEL = + 3 %				TOTAL ANTI ICE ON ΔFUEL = + 6 %			

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
ISA
FUEL CONSUMED (KG)
NORMAL AIR CONDITIONING
CG = 33.0 %
ANTI-ICING OFF
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	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 ΔFUEL = - 0.6 %		ENGINE ANTI ICE ON ΔFUEL = + 3 %				TOTAL ANTI ICE ON ΔFUEL = + 6 %			

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

ISA

FUEL CONSUMED (KG)

NORMAL AIR CONDITIONING

CG = 33.0 %

ANTI-ICING OFF

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	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 ΔFUEL = - 0.6 %			ENGINE ANTI ICE ON ΔFUEL = + 3 %			TOTAL ANTI ICE ON ΔFUEL = + 6 %			

**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
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 $\Delta FUEL = - 0.6 \%$			ENGINE ANTI ICE ON $\Delta FUEL = + 3 \%$			TOTAL ANTI ICE ON $\Delta FUEL = + 6 \%$			

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				ISA		FUEL CONSUMED (KG)					
NORMAL AIR CONDITIONING				CG = 33.0 %		TIME (H.MIN)					
ANTI-ICING OFF											
AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)				
	100	150	200	230	250	270	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 ΔFUEL = - 0.6 %			ENGINE ANTI ICE ON ΔFUEL = + 3 %			TOTAL ANTI ICE ON ΔFUEL = + 6 %					

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)					
AIR DIST.		FLIGHT LEVEL					TIME (H.MIN)		
(NM)		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 ΔFUEL = - 0.6 %		ENGINE ANTI ICE ON ΔFUEL = + 3 %				TOTAL ANTI ICE ON ΔFUEL = + 6 %			

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
ISA
FUEL CONSUMED (KG)
NORMAL AIR CONDITIONING
CG = 33.0 %
ANTI-icing OFF
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 ΔFUEL = - 0.6 %		ENGINE ANTI ICE ON ΔFUEL = + 3 %				TOTAL ANTI ICE ON ΔFUEL = + 6 %			

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)			
AIR DIST. (NM)							TIME (H.MIN)		
	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	100	150	200	230	250	270	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 ΔFUEL = - 0.6 %			ENGINE ANTI ICE ON ΔFUEL = + 3 %			TOTAL ANTI ICE ON ΔFUEL = + 6 %			

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
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 $\Delta FUEL = - 0.6 \%$		ENGINE ANTI ICE ON $\Delta FUEL = + 3 \%$				TOTAL ANTI ICE ON $\Delta FUEL = + 6 \%$			

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
ISA
FUEL CONSUMED (KG)
NORMAL AIR CONDITIONING
CG = 33.0 %
ANTI-ICING OFF
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 0.99	1622 0.99	1595 0.99	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 ΔFUEL = - 0.6 %			ENGINE ANTI ICE ON ΔFUEL = + 3 %			TOTAL ANTI ICE ON ΔFUEL = + 6 %			

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

ISA

FUEL CONSUMED (KG)

NORMAL AIR CONDITIONING

CG = 33.0 %

ANTI-ICE OFF

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	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 ΔFUEL = - 0.6 %		LOW AIR CONDITIONING ΔFUEL = + 3 %				TOTAL ANTI ICE ON ΔFUEL = + 6 %			

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

ISA

FUEL CONSUMED (KG)

NORMAL AIR CONDITIONING

CG = 33.0 %

ANTI-ICING OFF

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 ΔFUEL = - 0.6 %			ENGINE ANTI ICE ON ΔFUEL = + 3 %			TOTAL ANTI ICE ON ΔFUEL = + 6 %			

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
ISA
FUEL CONSUMED (KG)
NORMAL AIR CONDITIONING
CG = 33.0 %
ANTI-icing OFF
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 ΔFUEL = - 0.6 %		ENGINE ANTI ICE ON ΔFUEL = + 3 %				TOTAL ANTI ICE ON ΔFUEL = + 6 %			

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
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 $\Delta FUEL = - 0.6 \%$			ENGINE ANTI ICE ON $\Delta FUEL = + 3 \%$			TOTAL ANTI ICE ON $\Delta FUEL = + 6 \%$			

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 ΔFF = - 0.3 %	ENGINE ANTI ICE ON ΔFF = + 6 %		TOTAL ANTI ICE ON ΔFF = + 10 %		PER 1° ABOVE ISA ΔFF = + 0.3 %		STRAIGHT LINE 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 $\Delta FF = - 0.3 \%$	ENGINE ANTI ICE ON $\Delta FF = + 6 \%$		TOTAL ANTI ICE ON $\Delta FF = + 10 \%$		PER 1° ABOVE ISA $\Delta FF = + 0.3 \%$		STRAIGHT LINE $\Delta FF = - 5 \%$	

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 ΔFF = - 0.3 %	ENGINE ANTI ICE ON ΔFF = + 6 %		TOTAL ANTI ICE ON ΔFF = + 10 %		PER 1° ABOVE ISA ΔFF = + 0.3 %		STRAIGHT LINE 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 ΔFF = - 0.3 %	ENGINE ANTI ICE ON ΔFF = + 6 %		TOTAL ANTI ICE ON ΔFF = + 10 %		PER 1° ABOVE ISA ΔFF = + 0.3 %		STRAIGHT LINE 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			ISA		MAXIMUM CABIN RATE OF DESCENT 350FT/MIN				
NORMAL AIR CONDITIONING			CG=33.0%						
ANTI-ICING OFF									
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			ISA		AIRBRAKES EXTENDED				
NORMAL AIR CONDITIONING			CG=33.0%						
ANTI-ICING OFF									
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 %.

– 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.

R

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
PRESSURE ALTITUDE (ft)

OAT (°C)	-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
 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

APPROACH CLIMB LIMITING WEIGHT (1000 LB)	Gradient : 2.1%	CONF 3
ONE ENGINE OUT	High Air Conditioning	
ONE ENGINE AT GO AROUND THRUST	Anti ice OFF V = 1.23 Vs	

PRESSURE ALTITUDE (ft)												
OAT (°C)	-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

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APPROACH CLIMB LIMITING WEIGHT (1000 KG)	Gradient : 2.5%	CAT II
ONE ENGINE OUT	High Air Conditioning	
ONE ENGINE AT GO AROUND THRUST	Anti ice OFF	CONF 2

PRESSURE ALTITUDE (FT)												
OAT (°C)	-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

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APPROACH CLIMB LIMITING WEIGHT (1000 KG)	Gradient : 2.5%	CAT II
ONE ENGINE OUT	High Air Conditioning	
ONE ENGINE AT GO AROUND THRUST	Anti ice OFF	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				

OCTO 12.0.1 AD112A02 A319-112

 A319 A320 A321 FLIGHT CREW OPERATING MANUAL	IN FLIGHT PERFORMANCE		3.05.35	P 8
	GO AROUND		SEQ 001	REV 26

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 A319 A320 A321 FLIGHT CREW OPERATING MANUAL	IN FLIGHT PERFORMANCE		3.05.35	P 11
	GO AROUND		SEQ 001	REV 29

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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
 $0.015 \text{ (kg/}^{\circ}\text{C/NM)} \times \Delta\text{ISA (}^{\circ}\text{C)} \times \text{Air Distance (NM)}$
or $0.033 \text{ (lb/}^{\circ}\text{C/NM)} \times \Delta\text{ISA (}^{\circ}\text{C)} \times \text{Air Distance (NM)}$

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.

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						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	100	120	140	160	180	200	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 ΔFUEL = - 3 %			ENGINE ANTI ICE ON ΔFUEL = + 4 %			TOTAL ANTI ICE ON ΔFUEL = + 6 %			

**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)		
AIR DIST. (NM)	FLIGHT LEVEL					TIME (H.MIN) CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	230	270	310	350	390	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 ΔFUEL = - 3 %			ENGINE ANTI ICE ON ΔFUEL = + 4 %			TOTAL ANTI ICE ON 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-NO-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-NO-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-NO-03-50-004-210

06.00 CONTENTS

06.10 GENERAL

- INTRODUCTION 1
- FLIGHT PREPARATION 1
- STRATEGY 1

06.20 CEILINGS

06.30 STANDARD STRATEGY

- PROCEDURE 1
- EXAMPLE 2
- DESCENT M.78/300KT 3
- LONG RANGE CRUISE 4
- IN CRUISE QUICK CHECK AT LONG RANGE SPEED 12

06.40 OBSTACLE STRATEGY

- PROCEDURE 1
- EXAMPLE 2
- GROSS FLIGHT PATH DESCENT AT GREEN DOT SPEED 3

06.50 FIXED SPEED STRATEGIES

- PROCEDURE 1
- EXAMPLE 2
- DESCENT M.80/350KT MCT 3
- DESCENT M.78/320KT MCT 4
- CRUISE MCT/VMO 5
- CRUISE MCT/320KT 9
- IN CRUISE QUICK CHECK AT FIXED SPEEDS 13
- IN CRUISE QUICK CHECK VMO 14
- IN CRUISE QUICK CHECK 320 KT 15

06.55 HOLDING

06.60 DESCENT TO LANDING

06.70 GROUND DISTANCE / AIR DISTANCE CONVERSION

- GENERAL 1
- LONG RANGE SPEED 2
- FIXED SPEEDS 3

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 :

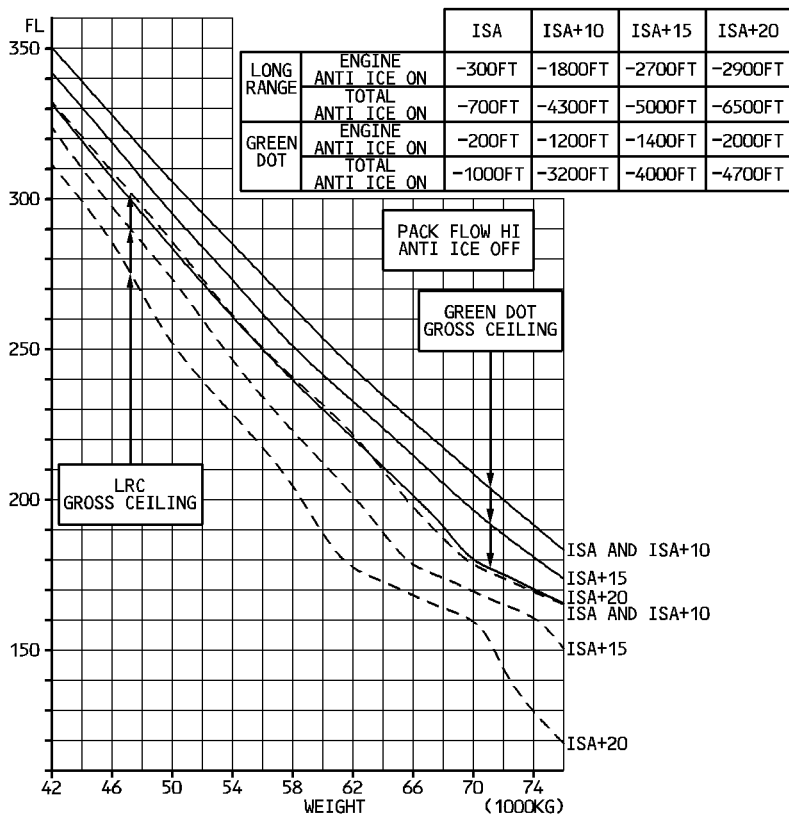
	STANDARD STRATEGY	OBSTACLE STRATEGY	FIXED SPEED STRATEGIES	
			320 KT	VMO
DESCENT TO CEILING	· M.78/300KT · MCT	· Green Dot Speed · MCT	· M.78/320KT · MCT	· M.80/350KT · MCT
CRUISE	LR ceiling LR speed	– Obstacle not cleared: Maintain Green Dot Speed at MCT – Obstacle cleared : Revert to standard strategy	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



Note : If severe icing conditions are encountered, ice formation may build up on non

heated structure and therefore the ceiling will be reduced by :

- 4000 feet for aircraft weight below or equal to 60000 kg
- 7500 feet for aircraft weight above or equal to 75000 kg
- 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 :

BEFORE DESCENT
(DECELERATION NOT BELOW GREEN DOT)

1. START ECAM ACTIONS AND SIMULTANEOUSLY SET MCT
2. A/THR : OFF
3. DETERMINE CRUISE FL (LRC CEILING FROM 3.06.20)
4. NOTIFY ATC

DESCENT M.78/300KT

1. SPD ON FCU : M.78/300KT - PULL.
 2. ALT ON FCU : SET LRC CEILING-PULL
- NOTE: THE THRUST IS FIXED AT MCT, THE SPEED IS CONTROLLED BY THE ELEVATOR

CRUISE LONG RANGE SPEED

1. SPD ON FCU : SET ACCORDING TO 3.06.30 p4 TO 11
 2. A/THR : ON
- NOTE: THE SPEED IS CONTROLLED BY THE A/THR

DESCENT TO LANDING

IDLE
M.78/300KT/250KT

NFCS-03-0630-001-A125AA

ENGINE
FAILURE

FUEL AND TIME

CHECK 3.06.30 p3

FUEL AND TIME

CHECK 3.06.30 p13

* 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
 $\Delta\text{Fuel} = + 23$ kg per 1000 kg above reference weight
R $\Delta\text{Fuel} = + 23$ kg $\times (69.3 - 55) \sim 329$ 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				ISA		MINIMUM RATE OF DESCENT 500FT/MIN			
PACK FLOW HI				CG=33.0%					
ANTI-ICING OFF									
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 (%) KG/H NM/1000KG	MACH IAS (KT) TAS (KT)
WEIGHT (1000KG)	FL100	FL120	FL140	FL160	FL180	FL200	
48	75.8 .459 1951 254 150.2 293	77.3 .474 1912 252 157.0 300	78.8 .489 1881 251 163.6 308	79.7 .498 1821 246 170.8 311	81.3 .516 1803 245 177.1 319	82.1 .524 1751 239 183.9 322	
50	76.6 .465 2001 257 148.2 297	78.6 .484 1987 258 154.5 307	79.5 .494 1928 253 161.1 311	80.7 .507 1889 250 167.5 316	82.1 .521 1857 248 173.8 323	82.8 .528 1801 241 180.1 324	
52	77.8 .474 2072 262 146.0 303	79.3 .490 2042 261 152.0 310	80.2 .498 1975 256 158.6 313	81.7 .515 1953 254 164.4 321	82.7 .524 1904 249 170.5 325	83.7 .537 1872 245 176.1 330	
54	79.0 .484 2149 268 143.8 309	80.0 .494 2089 263 149.8 313	81.1 .506 2043 260 155.8 318	82.6 .521 2014 258 161.5 325	83.2 .527 1950 251 167.4 326	84.7 .546 1947 249 172.1 335	
56	79.8 .489 2205 271 141.7 312	80.6 .497 2134 265 147.7 315	82.1 .514 2110 264 153.1 323	83.1 .524 2061 259 158.7 327	84.0 .534 2019 254 163.9 331	85.5 .553 2015 253 168.5 340	
58	80.4 .493 2253 273 139.8 315	81.4 .504 2197 269 145.3 319	83.0 .521 2174 267 150.5 327	83.6 .527 2106 260 156.0 329	84.9 .542 2091 258 160.6 336	86.1 .557 2074 255 165.0 342	
60	80.9 .496 2297 275 137.9 317	82.3 .511 2264 273 143.0 324	83.5 .524 2224 269 148.1 329	84.3 .532 2168 263 153.1 332	85.8 .550 2166 262 157.3 341	86.7 .560 2131 256 161.5 344	
62	81.6 .501 2353 278 136.0 320	83.1 .518 2330 276 140.8 328	84.0 .526 2271 270 145.7 331	85.1 .539 2241 267 150.2 336	86.4 .555 2229 264 154.2 344	87.4 .565 2195 259 158.1 347	
64	82.4 .508 2422 281 133.9 324	83.8 .523 2389 279 138.6 331	84.5 .529 2318 272 143.4 332	85.9 .547 2316 271 147.3 341	87.0 .559 2286 266 151.3 346	88.1 .571 2271 262 154.5 351	
66	83.2 .515 2490 285 131.9 329	84.3 .525 2438 280 136.5 333	85.2 .535 2387 275 140.9 336	86.6 .553 2387 274 144.6 345	87.5 .562 2348 268 148.3 348	88.7 .574 2330 263 151.2 352	
68	84.0 .521 2556 288 130.0 332	84.7 .528 2485 282 134.5 334	85.9 .542 2462 279 138.4 341	87.2 .557 2446 276 142.1 348	88.2 .567 2415 270 145.4 351	88.7 .563 2321 258 148.9 346	
70	84.6 .524 2611 291 128.2 335	85.2 .531 2538 283 132.5 336	86.7 .548 2535 282 136.0 345	87.7 .560 2503 277 139.6 349	88.7 .570 2474 272 142.6 353	88.7 .547 2310 250 145.5 336	
72	85.0 .527 2659 292 126.4 336	85.9 .537 2610 287 130.3 340	87.3 .554 2607 285 133.7 348	88.2 .563 2566 279 137.0 352	88.7 .561 2466 267 140.8 347	88.7 .513 2288 234 137.7 315	
74	85.4 .528 2704 293 124.7 337	86.6 .543 2685 290 128.2 344	87.8 .557 2666 287 131.5 351	88.8 .567 2631 281 134.5 354	88.7 .548 2455 261 138.2 339		
ENGINE ANTI ICE ON ΔFUEL = + 3 %					TOTAL ANTI ICE ON ΔFUEL = + 6 %		

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS
PACK FLOW HI
ANTI-ICING OFF

ISA
CG=33.0%

N1 (%)
KG/H
NM/1000KG

MACH
IAS (KT)
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 $\Delta FUEL = + 3 \%$							TOTAL ANTI ICE ON $\Delta FUEL = + 6 \%$					

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF					ISA +10 CG=33.0%	N1 (%) KG/H NM/1000KG	MACH IAS (KT) TAS (KT)
WEIGHT (1000KG)	FL100	FL120	FL140	FL160	FL180	FL200	
48	77.0 .456 1978 252 150.0 297	78.6 .471 1941 251 156.7 304	80.2 .487 1913 250 163.2 312	81.1 .496 1854 245 170.2 316	82.8 .514 1837 244 176.5 324	83.7 .522 1787 238 183.1 327	
50	77.9 .462 2028 255 148.0 300	79.9 .482 2017 257 154.1 311	80.9 .492 1963 252 160.6 315	82.2 .505 1926 250 166.9 321	83.6 .520 1895 247 173.1 328	84.4 .527 1839 240 179.3 330	
52	79.1 .471 2102 261 145.7 306	80.7 .487 2075 260 151.6 315	81.6 .496 2011 255 158.1 318	83.3 .513 1994 254 163.8 327	84.2 .523 1944 248 169.8 330	85.3 .535 1913 244 175.3 335	
54	80.4 .482 2182 266 143.5 313	81.4 .492 2127 262 149.3 318	82.6 .504 2081 259 155.2 323	84.1 .520 2056 257 160.8 331	84.8 .526 1993 250 166.6 332	86.3 .544 1989 249 171.3 341	
56	81.1 .487 2241 270 141.3 317	82.0 .495 2173 264 147.2 320	83.6 .512 2149 263 152.5 328	84.7 .523 2104 258 158.0 332	85.7 .534 2065 254 163.1 337	87.2 .551 2062 252 167.6 346	
58	81.8 .492 2295 272 139.3 320	82.9 .503 2241 268 144.8 324	84.5 .519 2218 267 149.9 332	85.2 .525 2151 260 155.3 334	86.6 .542 2141 258 159.7 342	87.8 .556 2123 254 164.1 348	
60	82.4 .495 2341 274 137.4 322	83.8 .510 2311 272 142.4 329	85.0 .522 2270 268 147.4 335	85.9 .531 2215 262 152.4 338	87.4 .549 2217 261 156.5 347	88.4 .560 2183 256 160.6 351	
62	83.1 .500 2400 277 135.4 325	84.7 .517 2380 276 140.1 333	85.5 .525 2319 270 145.0 336	86.7 .538 2289 266 149.4 342	88.1 .554 2280 264 153.4 350	89.1 .564 2250 258 157.1 354	
64	83.9 .507 2470 281 133.3 329	85.4 .521 2440 278 137.9 336	86.1 .528 2369 271 142.7 338	87.5 .545 2366 270 146.6 347	88.6 .558 2339 265 150.5 352	89.8 .571 2329 261 153.6 358	
66	84.7 .513 2540 284 131.3 334	85.8 .524 2490 280 135.8 338	86.8 .534 2443 275 140.1 342	88.3 .552 2441 273 143.8 351	89.2 .561 2404 267 147.5 354	90.3 .571 2379 262 150.5 358	
68	85.6 .519 2609 288 129.4 338	86.3 .526 2536 281 133.8 339	87.5 .541 2518 278 137.6 347	88.8 .556 2503 275 141.2 353	89.9 .566 2473 270 144.5 357	90.3 .560 2370 256 148.0 351	
70	86.1 .523 2664 290 127.5 340	86.8 .530 2594 283 131.8 342	88.3 .548 2596 282 135.2 351	89.4 .559 2562 277 138.7 356	90.3 .568 2527 271 141.8 358	90.3 .543 2357 248 144.3 340	
72	86.5 .525 2715 291 125.7 341	87.5 .535 2667 286 129.6 346	89.0 .553 2667 285 132.9 354	89.9 .563 2628 279 136.2 358	90.3 .558 2518 266 139.9 352	90.3 .502 2330 229 134.8 314	
74	86.9 .527 2761 292 124.0 342	88.2 .542 2744 289 127.4 350	89.5 .556 2728 286 130.7 357	90.5 .567 2699 281 133.6 361	90.3 .545 2506 259 137.3 344		
ENGINE ANTI ICE ON ΔFUEL = + 3 %					TOTAL ANTI ICE ON 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 (%)
KG/H
NM/1000KG

MACH
IAS (KT)
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 ΔFUEL = + 3 %							TOTAL ANTI ICE ON 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 (%) KG/H NM/1000KG	MACH IAS (KT) TAS (KT)	
WEIGHT (1000KG)	FL100	FL120	FL140	FL160	FL180	FL200		
48	77.7 .455 1993 252 149.8 299	79.2 .470 1956 250 156.5 306	80.9 .486 1929 249 163.0 314	81.9 .495 1871 244 169.9 318	83.5 .513 1854 243 176.2 327	84.5 .522 1806 238 182.7 330		
50	78.5 .460 2042 254 147.8 302	80.6 .481 2035 256 153.9 313	81.6 .491 1981 252 160.3 318	83.0 .504 1944 249 166.6 324	84.4 .519 1914 246 172.7 331	85.2 .526 1861 240 178.9 333		
52	79.7 .470 2117 260 145.5 308	81.4 .486 2092 259 151.4 317	82.4 .495 2031 254 157.7 320	84.0 .513 2015 253 163.4 329	85.0 .522 1963 248 169.4 333	86.1 .534 1933 244 174.8 338		
54	81.0 .480 2200 266 143.2 315	82.1 .491 2145 262 149.1 320	83.4 .503 2102 258 154.9 326	84.9 .519 2077 256 160.4 333	85.6 .525 2014 250 166.2 335	87.1 .543 2010 248 170.9 343		
56	81.8 .486 2260 269 141.1 319	82.7 .494 2192 264 146.9 322	84.3 .511 2172 262 152.1 331	85.5 .522 2128 258 157.6 335	86.5 .533 2088 253 162.7 340	88.0 .551 2084 252 167.1 348		
58	82.5 .491 2318 272 139.0 322	83.6 .502 2261 267 144.5 327	85.3 .518 2241 266 149.5 335	86.0 .524 2174 259 154.9 337	87.4 .541 2164 257 159.3 345	88.6 .555 2146 254 163.6 351		
60	83.1 .494 2362 273 137.1 324	84.6 .509 2334 272 142.0 332	85.8 .521 2292 268 147.0 337	86.7 .530 2242 262 151.9 341	88.3 .549 2243 261 156.0 350	89.2 .559 2209 256 160.1 354		
62	83.8 .499 2424 276 135.1 328	85.4 .516 2404 275 139.8 336	86.3 .524 2342 269 144.7 339	87.5 .537 2316 266 149.0 345	88.9 .554 2308 264 152.9 353	89.9 .564 2277 258 156.6 357		
64	84.7 .506 2496 280 133.0 332	86.1 .521 2465 278 137.6 339	86.8 .527 2394 271 142.3 341	88.3 .545 2393 270 146.1 350	89.5 .557 2367 265 150.0 355	90.0 .556 2278 254 154.3 352		
66	85.5 .513 2567 284 131.0 336	86.6 .523 2516 279 135.5 341	87.6 .533 2468 274 139.7 345	89.1 .551 2467 273 143.4 354	89.9 .558 2412 266 147.4 355	90.0 .542 2267 248 151.4 343		
68	86.3 .518 2636 287 129.0 340	87.1 .525 2564 280 133.5 342	88.3 .540 2545 278 137.2 349	89.6 .555 2530 275 140.8 356	89.9 .549 2405 261 145.4 350	90.0 .520 2251 238 146.3 329		
70	86.8 .522 2690 289 127.2 342	87.6 .529 2624 283 131.4 345	89.1 .547 2625 281 134.8 354	90.2 .558 2592 277 138.3 358	89.9 .536 2396 255 142.6 342			
72	87.3 .524 2740 290 125.4 344	88.3 .535 2698 286 129.2 348	89.8 .553 2698 284 132.5 357	90.7 .562 2660 279 135.7 361	89.9 .516 2382 245 138.1 329			
74	87.7 .526 2789 291 123.7 345	89.0 .541 2776 289 127.0 353	90.3 .556 2761 286 130.3 360	91.3 .566 2732 281 133.1 364				
ENGINE ANTI ICE ON ΔFUEL = + 3 %				TOTAL ANTI ICE ON 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 (%)
KG/H
NM/1000KG

MACH
IAS (KT)
TAS (KT)

WEIGHT (1000KG)	FL210		FL220		FL230		FL240		FL250		FL260	
48	85.0	.527	85.7	.536	86.6	.546	87.1	.552	87.6	.557	88.2	.563
	1786	236	1785	235	1786	235	1775	233	1758	230	1751	228
	185.8	332	188.5	337	191.2	342	193.9	344	196.5	346	198.8	348
50	85.9	.535	86.8	.545	87.4	.552	87.9	.557	88.4	.563	89.1	.570
	1859	240	1861	239	1852	238	1835	235	1826	232	1824	230
	181.5	337	184.0	342	186.5	346	189.1	347	191.2	349	193.0	352
52	86.9	.544	87.6	.552	88.1	.557	88.6	.562	89.3	.570	89.8	.571
	1935	244	1928	242	1911	239	1901	237	1902	235	1881	231
	177.2	343	179.7	346	182.1	348	184.3	350	185.9	354	187.5	353
54	87.8	.551	88.3	.556	88.8	.562	89.5	.570	89.8	.567	89.9	.557
	2005	247	1987	244	1977	242	1980	240	1942	234	1882	225
	173.2	347	175.6	349	177.7	351	179.3	355	181.4	352	182.9	344
56	88.4	.556	89.0	.560	89.7	.568	89.9	.565	89.8	.551	89.9	.522
	2066	249	2051	246	2053	245	2008	238	1930	227	1860	210
	169.5	350	171.5	352	173.1	355	175.4	352	177.0	342	173.4	322
58	89.1	.560	89.7	.567	89.9	.563	89.9	.549	89.8	.512		
	2130	251	2126	249	2074	242	1997	231	1907	210		
	165.6	353	167.3	356	169.9	352	171.4	342	166.5	317		
60	89.8	.565	90.0	.561	89.9	.548	89.9	.515				
	2201	254	2142	246	2063	236	1975	216				
	161.8	356	164.4	352	166.2	343	162.3	321				
62	90.0	.558	89.9	.547	89.9	.517						
	2210	250	2130	240	2043	222						
	159.2	352	161.2	343	158.3	323						
64	90.0	.545	89.9	.520								
	2198	244	2112	228								
	156.1	343	154.6	326								
66	90.0	.521										
	2181	233										
	150.6	328										
68												
70												
72												
74												
ENGINE ANTI ICE ON $\Delta FUEL = + 3 \%$							TOTAL ANTI ICE ON $\Delta FUEL = + 6 \%$					

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF				ISA +20 CG=33.0%	N1 (%) KG/H NM/1000KG	MACH IAS (KT) TAS (KT)
WEIGHT (1000KG)	FL100	FL120	FL140	FL160	FL180	FL200
48	78.3 .454 2009 251 149.6 301	79.9 .468 1969 249 156.3 308	81.6 .485 1945 249 162.7 316	82.6 .494 1887 244 169.6 320	84.3 .512 1874 243 175.8 329	85.3 .521 1826 238 182.3 333
50	79.1 .459 2058 254 147.6 304	81.3 .480 2052 256 153.6 315	82.3 .490 1999 251 160.0 320	83.7 .503 1962 249 166.2 326	85.2 .518 1933 246 172.3 333	86.0 .526 1882 240 178.4 336
52	80.4 .469 2134 259 145.3 310	82.1 .485 2111 259 151.1 319	83.1 .495 2050 254 157.4 323	84.8 .512 2034 253 163.0 332	85.8 .521 1983 247 169.0 335	86.9 .534 1955 244 174.3 341
54	81.7 .479 2217 265 143.0 317	82.8 .490 2165 261 148.7 322	84.1 .503 2124 258 154.5 328	85.6 .518 2098 256 160.0 336	86.4 .524 2033 249 165.8 337	87.9 .543 2033 248 170.4 346
56	82.5 .485 2278 268 140.8 321	83.4 .494 2213 263 146.6 324	85.1 .511 2196 262 151.8 333	86.2 .521 2149 258 157.2 338	87.3 .532 2111 253 162.2 342	88.8 .550 2107 251 166.7 351
58	83.2 .490 2338 271 138.7 324	84.4 .501 2284 267 144.1 329	86.0 .518 2265 266 149.1 338	86.7 .524 2197 259 154.4 339	88.2 .540 2188 257 158.8 347	89.4 .554 2170 254 163.1 354
60	83.8 .493 2384 273 136.8 326	85.3 .508 2356 271 141.7 334	86.6 .521 2316 267 146.6 340	87.5 .530 2267 262 151.5 343	89.0 .548 2266 261 155.6 353	89.6 .550 2187 251 160.6 351
62	84.6 .499 2448 276 134.8 330	86.2 .515 2427 275 139.4 338	87.1 .523 2365 269 144.3 341	88.3 .537 2342 266 148.5 348	89.4 .547 2299 260 153.1 352	89.6 .539 2178 246 157.9 344
64	85.4 .506 2522 280 132.6 335	86.9 .520 2489 277 137.2 341	87.6 .526 2418 270 141.9 343	89.1 .544 2421 269 145.7 353	89.4 .538 2294 256 150.9 346	89.6 .522 2167 238 153.8 333
66	86.3 .512 2593 283 130.6 339	87.4 .522 2541 279 135.1 343	88.4 .533 2495 274 139.3 348	89.9 .551 2496 273 142.9 357	89.4 .527 2287 250 148.1 339	89.5 .487 2150 222 144.7 311
68	87.1 .518 2662 287 128.7 343	87.8 .525 2591 280 133.1 345	89.1 .540 2575 278 136.8 352	90.4 .555 2560 275 140.3 359	89.4 .509 2278 242 143.8 328	
70	87.6 .521 2717 289 126.8 345	88.4 .529 2654 282 131.0 348	89.9 .546 2653 281 134.4 356	91.0 .557 2619 276 137.9 361	89.4 .477 2270 226 135.0 307	
72	88.0 .523 2770 290 125.0 346	89.1 .535 2729 286 128.7 351	90.6 .552 2728 284 132.0 360	91.0 .550 2613 272 136.3 356		
74	88.5 .525 2819 291 123.3 348	89.8 .541 2808 289 126.6 356	90.7 .548 2738 282 130.5 357	90.9 .539 2604 267 134.2 349		
ENGINE ANTI ICE ON ΔFUEL = + 3 %				TOTAL ANTI ICE ON 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 (%)
KG/H
NM/1000KG

MACH
IAS (KT)
TAS (KT)

WEIGHT (1000KG)	FL210		FL220		FL230		FL240		FL250		FL260	
48	85.8	.527	86.5	.535	87.4	.545	88.0	.552	88.5	.556	89.1	.562
	1807	236	1804	235	1805	234	1794	232	1779	229	1772	227
	185.3	335	188.1	339	190.7	344	193.4	347	196.0	349	198.2	351
50	86.8	.535	87.6	.545	88.2	.552	88.7	.556	89.3	.562	89.5	.560
	1880	239	1883	239	1873	237	1857	234	1848	232	1805	226
	181.0	340	183.5	345	186.0	348	188.5	350	190.7	352	193.7	350
52	87.8	.544	88.4	.552	88.9	.556	89.5	.562	89.4	.553	89.5	.543
	1958	244	1952	242	1934	239	1924	237	1852	228	1793	219
	176.7	346	179.1	350	181.6	351	183.7	353	187.1	347	189.1	339
54	88.6	.551	89.1	.556	89.6	.559	89.5	.550	89.4	.534	89.5	.502
	2028	247	2012	244	1990	241	1917	232	1839	220	1769	202
	172.7	350	175.1	352	177.4	353	180.6	346	182.0	335	177.0	313
56	89.3	.555	89.6	.556	89.5	.547	89.5	.532	89.4	.485		
	2089	249	2056	244	1982	235	1904	223	1814	199		
	169.0	353	171.4	352	174.4	346	175.6	334	167.4	304		
58	89.6	.553	89.6	.545	89.5	.529	89.4	.486				
	2121	248	2048	239	1969	227	1880	204				
	165.8	352	168.6	345	169.7	334	162.6	306				
60	89.6	.542	89.6	.527	89.5	.486						
	2113	243	2035	231	1947	208						
	163.1	345	164.1	334	157.8	307						
62	89.6	.525	89.5	.487								
	2101	235	2015	213								
	158.8	334	153.2	309								
64	89.5	.487										
	2082	217										
	148.9	310										
66												
68												
70												
72												
74												
ENGINE ANTI ICE ON							TOTAL ANTI ICE ON					
$\Delta FUEL = + 3 \%$							$\Delta FUEL = + 6 \%$					

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) × Δ ISA (°C) × air distance (NM) or 0.033 (lb/°C/NM) × Δ 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							CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
DIST.	FLIGHT LEVEL								
(NM)	100	150	200	220	240	250	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 ΔFUEL = + 2.5 %					TOTAL ANTI ICE ON ΔFUEL = + 5 %				

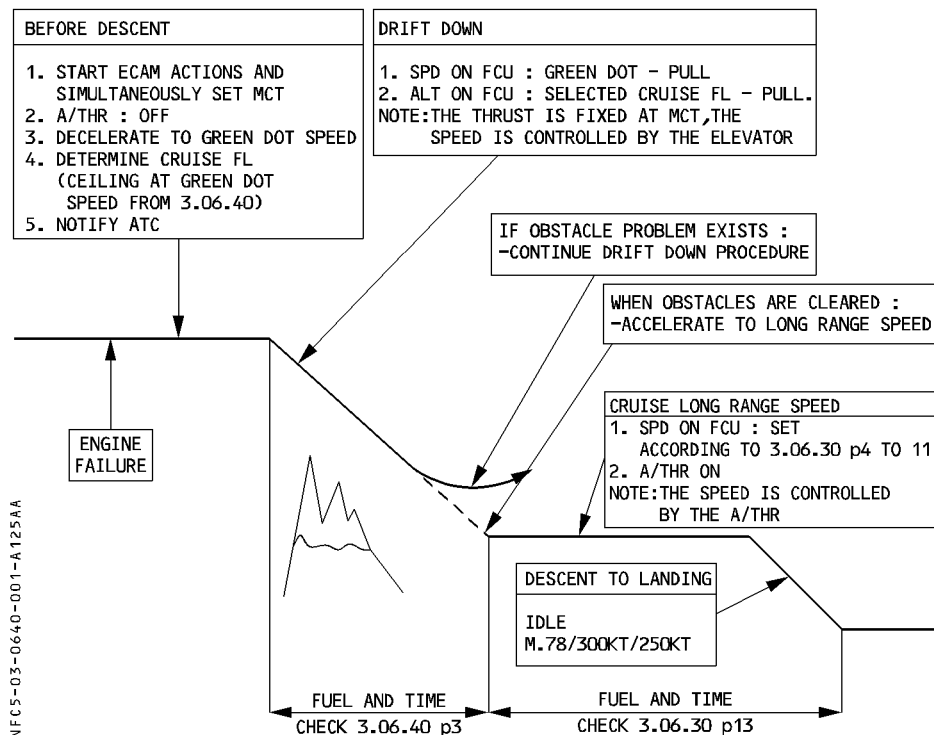
PROCEDURE

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



NFC5-03-0640-001-A125AA

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
(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
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 $\Delta\text{Fuel} = + 65 \text{ kg per } 1000 \text{ kg above reference weight}$
- R $\Delta\text{Fuel} = + 65 \text{ kg} \times (70 - 55) = 325 \text{ kg}$

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) INITIAL SPEED(KT)		TIME (MIN) FUEL(1000KG)	
INIT. GW (1000KG)				LEVEL OFF (FT)					
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) INITIAL SPEED(KT)		TIME (MIN) FUEL(1000KG)	
INIT. GW (1000KG)				LEVEL OFF (FT)					
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) INITIAL SPEED(KT)		TIME (MIN) 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) INITIAL SPEED(KT)		TIME (MIN) 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.

BEFORE DESCENT
(DECELERATION NOT BELOW GREEN DOT)

1. START ECAM ACTIONS AND SIMULTANEOUSLY SET MCT.
2. NOTIFY ATC.

DESCENT AT SELECTED SPEED (*)

1. A/THR : OFF
2. SPD ON FCU : SET SELECTED SPEED (*) AND PULL
3. ALT ON FCU : SET SELECTED ALTITUDE (**) AND PULL

NOTE : THR THRUST IS FIXED AT MCT, THE SPEED IS CONTROLLED BY THE ELEVATOR

CRUISE AT SELECTED SPEED (*) AND ALTITUDE (**)

A/THR : ON

NOTE : THE SPEED IS CONTROLLED BY THE A/THR

DESCENT TO LANDING

IDLE
M.78/300KT/250KT

ENGINE FAILURE

FUEL AND TIME
CHECK 3.06.50 p3 or 4

FUEL AND TIME
CHECK 3.06.50 p14 or 15

* 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.

NFCS-03-0650-001-A125AA

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 = $\Delta\text{Fuel} + 2 \text{ kg per } 1000 \text{ kg above reference weight}$
R $\Delta\text{Fuel} = + 2 \text{ kg} \times (69.5 - 55) \sim 29 \text{ kg}$

Result :

R Total Fuel = $2573 + 29 + 580 = 3182$ kg
R Time = $1\text{h}13 \text{ min} + 12 \text{ min} = 1 \text{ h } 25 \text{ min}$

R

DESCENT - M.80/350KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS				ISA		MINIMUM RATE OF DESCENT 500FT/MIN			
PACK FLOW HI				CG=33.0%					
ANTI-ICING OFF									
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				ISA		MINIMUM RATE OF DESCENT 500FT/MIN			
PACK FLOW HI				CG=33.0%					
ANTI-ICING OFF									
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 ΔFUEL = + 1.5 %				TOTAL ANTI ICE ON ΔFUEL = + 3.5 %			

R

CRUISE - MCT/340KT - 1 ENGINE OUT												
MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF						ISA + 10 CG = 33.0%		N1 (%) KG/H NM/1000KG		MACH IAS (KT) 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 ΔFUEL = + 1.5 %						TOTAL ANTI ICE ON ΔFUEL = + 3.5 %						

R

CRUISE - MCT/332KT - 1 ENGINE OUT

 MAX. CONTINUOUS THRUST
 PACK FLOW HI
 ANTI-ICING OFF

 ISA +15
 CG=33.0%

 N1 (%)
 KG/H
 NM/1000KG

 MACH
 IAS (KT)
 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 ΔFUEL = + 1.5 %							TOTAL ANTI ICE ON 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 (%) KG/H NM/1000KG	MACH IAS (KT) TAS (KT)
WEIGHT (1000KG)	FL100	FL150	FL160	FL180	FL200	FL220	
48	90.1 .582 3048 323 126.2 385	90.9 .598 2718 303 143.2 389	91.0 .602 2657 299 146.7 390	89.4 .582 2319 277 161.3 374	89.7 .587 2216 269 169.1 375	89.6 .585 2078 258 178.5 371	
50	90.1 .580 3047 322 126.0 384	90.9 .596 2716 302 142.7 388	91.0 .599 2657 298 146.2 388	89.4 .579 2318 276 160.6 372	89.7 .583 2212 267 168.2 372	89.6 .580 2074 255 177.2 367	
52	90.1 .579 3046 321 125.7 383	90.9 .594 2714 301 142.3 386	91.0 .597 2655 296 145.7 387	89.4 .575 2315 274 159.8 370	89.7 .578 2208 265 167.1 369	89.6 .573 2069 252 175.6 363	
54	90.1 .577 3045 320 125.4 382	90.9 .591 2712 299 141.8 385	91.0 .594 2652 295 145.1 385	89.4 .571 2313 272 158.8 367	89.7 .573 2204 262 165.9 366	89.6 .565 2063 248 173.7 358	
56	90.1 .575 3043 319 125.1 381	90.9 .589 2710 298 141.3 383	91.0 .591 2649 293 144.6 383	89.4 .566 2310 270 157.7 364	89.7 .566 2199 259 164.4 361	89.6 .556 2056 244 171.4 352	
58	90.1 .573 3042 318 124.8 379	90.9 .586 2707 296 140.7 381	91.0 .588 2646 292 143.9 381	89.4 .561 2307 267 156.4 361	89.6 .559 2193 256 162.6 357	89.6 .545 2048 239 168.6 345	
60	90.1 .571 3040 317 124.4 378	90.9 .583 2704 295 140.1 379	91.0 .584 2643 290 143.2 379	89.4 .554 2303 264 154.8 357	89.6 .550 2187 251 160.6 351	89.6 .527 2035 231 164.1 334	
62	90.1 .569 3039 316 124.0 377	90.9 .579 2701 293 139.4 376	91.0 .580 2639 288 142.4 376	89.4 .547 2299 260 153.1 352	89.6 .539 2178 246 157.9 344	89.5 .487 2015 213 153.2 309	
64	90.1 .567 3037 315 123.5 375	90.9 .575 2698 291 138.6 374	91.0 .576 2635 285 141.5 373	89.4 .538 2294 256 150.9 346	89.6 .522 2167 238 153.8 333		
66	90.1 .565 3035 313 123.1 374	90.9 .571 2694 288 137.7 371	91.0 .570 2630 283 140.5 369	89.4 .527 2287 250 148.1 339	89.5 .487 2150 222 144.7 311		
68	90.1 .562 3033 312 122.6 372	90.8 .565 2690 286 136.6 368	91.0 .564 2625 279 139.2 366	89.4 .509 2278 242 143.8 328			
70	90.1 .559 3031 310 122.0 370	90.8 .559 2685 282 135.5 364	91.0 .557 2619 276 137.9 361	89.4 .477 2270 226 135.0 307			
72	90.1 .556 3028 308 121.4 368	90.8 .553 2679 279 134.1 359	91.0 .550 2613 272 136.3 356				
74	90.1 .552 3026 306 120.7 365	90.8 .545 2673 275 132.5 354	90.9 .539 2604 267 134.2 349				
ENGINE ANTI ICE ON ΔFUEL = + 1.5 %					TOTAL ANTI ICE ON 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 2843 320 129.4 368	89.9 .631 2901 320 136.3 395	90.0 .635 2839 316 139.6 396	88.7 .620 2511 296 152.8 384	88.6 .622 2364 286 161.6 382	88.6 .623 2225 275 170.6 379
50	86.5 .576 2856 320 128.8 368	90.0 .630 2907 319 135.8 395	90.0 .633 2839 315 139.2 395	88.7 .617 2510 295 152.3 382	88.6 .619 2362 284 160.9 380	88.6 .619 2223 273 169.7 377
52	86.6 .576 2871 320 128.1 368	90.0 .628 2907 318 135.4 394	90.0 .631 2838 314 138.8 394	88.7 .614 2508 294 151.7 380	88.6 .615 2360 283 160.1 378	88.6 .614 2220 271 168.6 374
54	86.7 .576 2887 320 127.4 368	90.0 .626 2906 317 135.0 392	90.1 .629 2837 313 138.4 393	88.7 .612 2507 292 151.0 379	88.7 .612 2358 281 159.3 376	88.6 .609 2218 269 167.4 371
56	86.9 .576 2904 320 126.7 368	90.0 .624 2906 316 134.6 391	90.1 .627 2837 312 137.9 391	88.7 .608 2506 291 150.3 377	88.7 .607 2356 279 158.4 373	88.7 .603 2215 266 166.0 368
58	87.0 .576 2921 320 125.9 368	90.0 .622 2906 315 134.1 390	90.1 .624 2836 310 137.4 390	88.7 .605 2504 289 149.6 375	88.7 .603 2353 277 157.3 370	88.7 .596 2210 263 164.4 363
60	87.2 .576 2939 320 125.2 368	90.0 .620 2905 314 133.6 388	90.1 .622 2835 309 136.9 388	88.7 .601 2502 287 148.7 372	88.7 .597 2349 274 156.1 367	88.7 .588 2203 259 162.6 358
62	87.4 .576 2958 320 124.4 368	90.0 .617 2905 313 133.1 387	90.1 .619 2834 308 136.3 386	88.7 .597 2499 285 147.8 369	88.7 .590 2343 271 154.7 362	88.7 .578 2196 254 160.4 352
64	87.5 .576 2979 320 123.5 368	90.0 .615 2904 311 132.6 385	90.1 .616 2833 306 135.7 384	88.7 .591 2494 282 146.8 366	88.7 .582 2337 267 153.1 358	88.6 .566 2187 249 157.6 345
66	87.7 .576 2999 320 122.7 368	90.1 .612 2904 310 132.0 383	90.1 .613 2832 304 135.0 382	88.7 .585 2488 279 145.6 362	88.7 .574 2330 263 151.2 352	88.6 .546 2173 240 153.2 333
68	87.9 .576 3021 320 121.8 368	90.1 .609 2903 308 131.3 381	90.2 .609 2831 303 134.3 380	88.7 .578 2481 275 144.2 358	88.7 .563 2321 258 148.9 346	
70	88.1 .576 3043 320 120.9 368	90.1 .605 2902 306 130.6 379	90.2 .605 2829 300 133.4 377	88.7 .570 2474 272 142.6 353	88.7 .547 2310 250 145.5 336	
72	88.3 .576 3067 320 120.0 368	90.1 .601 2901 304 129.8 377	90.2 .600 2828 298 132.4 374	88.7 .561 2466 267 140.8 347	88.7 .513 2288 234 137.7 315	
74	88.5 .576 3092 320 119.0 368	90.1 .596 2897 302 129.0 374	90.2 .594 2822 295 131.4 371	88.7 .548 2455 261 138.2 339		
ENGINE ANTI ICE ON ΔFUEL = + 2 %				TOTAL ANTI ICE ON ΔFUEL = + 5 %		

R

CRUISE - MCT/320KT - 1 ENGINE OUT									
MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF					ISA +10 CG=33.0%	N1 (%) KG/H NM/1000KG	MACH IAS (KT) TAS (KT)		
WEIGHT (1000KG)	FL100		FL150		FL160		FL180		FL220
48	88.0	.576	91.6	.631	91.7	.634	90.3	.618	90.3 .621
	2916	320	2974	320	2906	315	2567	296	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
	2929	320	2974	319	2906	314	2566	294	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
	2945	320	2974	318	2905	313	2565	293	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 .607
	2961	320	2974	317	2904	312	2564	292	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
	2979	320	2974	316	2903	311	2562	290	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
	2996	320	2973	315	2902	310	2560	288	2260 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
	3015	320	2973	313	2901	309	2558	286	2259 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
	3035	320	2973	312	2900	307	2553	284	2253 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
	3055	320	2972	311	2899	306	2548	281	2238 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
	3077	320	2972	309	2898	304	2542	278	2239 242
	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	2230 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	2237 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	2230 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 ΔFUEL = + 2 %					TOTAL ANTI ICE ON ΔFUEL = + 5 %				

R

CRUISE - MCT/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF				ISA + 15 CG = 33.0%		N1 (%) KG/H NM/1000KG	MACH IAS (KT) 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	90.0	.604
	2953 320	2840 311	2775 307	2446 287	2317 277	2177 266	2177	266
	128.0 378	139.3 396	142.8 396	156.5 383	164.8 382	174.1 379	174.1	379
50	88.9 .576	91.3 .612	91.4 .615	89.9 .598	90.0 .600	90.0 .599	90.0	.599
	2967 320	2840 310	2775 306	2444 285	2316 276	2174 264	2174	264
	127.4 378	138.9 395	142.3 395	155.9 381	164.0 380	173.0 376	173.0	376
52	89.1 .576	91.3 .610	91.4 .613	89.9 .595	90.0 .597	90.0 .594	90.0	.594
	2982 320	2841 309	2775 305	2441 284	2313 274	2170 262	2170	262
	126.8 378	138.4 393	141.8 394	155.3 379	163.1 377	171.9 373	171.9	373
54	89.2 .576	91.3 .608	91.4 .611	89.9 .591	90.0 .592	90.0 .587	90.0	.587
	2999 320	2842 308	2776 304	2438 282	2309 271	2164 259	2164	259
	126.1 378	138.0 392	141.3 392	154.5 377	162.2 374	170.4 369	170.4	369
56	89.4 .576	91.3 .606	91.4 .609	89.9 .587	90.0 .587	90.0 .580	90.0	.580
	3016 320	2842 307	2776 302	2435 280	2304 269	2157 255	2157	255
	125.3 378	137.4 391	140.7 391	153.7 374	161.1 371	168.7 364	168.7	364
58	89.5 .576	91.3 .604	91.4 .606	89.9 .583	90.0 .580	90.0 .571	90.0	.571
	3034 320	2843 306	2776 301	2431 278	2299 266	2150 251	2150	251
	124.6 378	136.9 389	140.1 389	152.8 371	159.7 367	166.8 359	166.8	359
60	89.7 .576	91.3 .601	91.4 .603	89.9 .578	90.0 .573	90.0 .561	90.0	.561
	3053 320	2844 304	2777 300	2427 275	2293 263	2142 246	2142	246
	123.8 378	136.3 388	139.5 387	151.7 368	158.2 363	164.4 352	164.4	352
62	89.9 .576	91.3 .599	91.5 .600	89.9 .572	90.0 .565	89.9 .547	89.9	.547
	3073 320	2843 303	2777 298	2423 273	2286 259	2130 240	2130	240
	123.0 378	135.7 386	138.8 385	150.5 364	156.4 358	161.2 343	161.2	343
64	90.0 .576	91.3 .595	91.5 .596	89.9 .565	90.0 .556	89.9 .520	89.9	.520
	3094 320	2840 301	2773 296	2417 269	2278 254	2112 228	2112	228
	122.2 378	135.1 384	138.1 383	149.0 360	154.3 352	154.6 326	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 ΔFUEL = + 2 %				TOTAL ANTI ICE ON ΔFUEL = + 5 %				

R

CRUISE - MCT/320KT - 1 ENGINE OUT																	
MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF							ISA +20 CG=33.0%		N1 (%) KG/H NM/1000KG		MACH IAS (KT) 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 ΔFUEL = + 2 %							TOTAL ANTI ICE ON ΔFUEL = + 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)			
AIR							TIME (H.MIN)		
DIST.	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	(NM)	100	150	160	180	200	220	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 ΔFUEL = + 2.5 %					TOTAL ANTI ICE ON 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)			
AIR		FLIGHT LEVEL					CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
DIST.							FL100 FL150	FL160 FL180	FL200 FL220
(NM)	100	150	160	180	200	220			
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	7566 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 ΔFUEL = + 2.5 %					TOTAL ANTI ICE ON ΔFUEL = + 5 %				

HOLDING
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 $\Delta FF = + 3 \%$			TOTAL ANTI ICE ON $\Delta FF = 7 \%$			PER 1° ABOVE ISA $\Delta FF = + 0.3 \%$		

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				IAS (KT)	
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1		
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 :

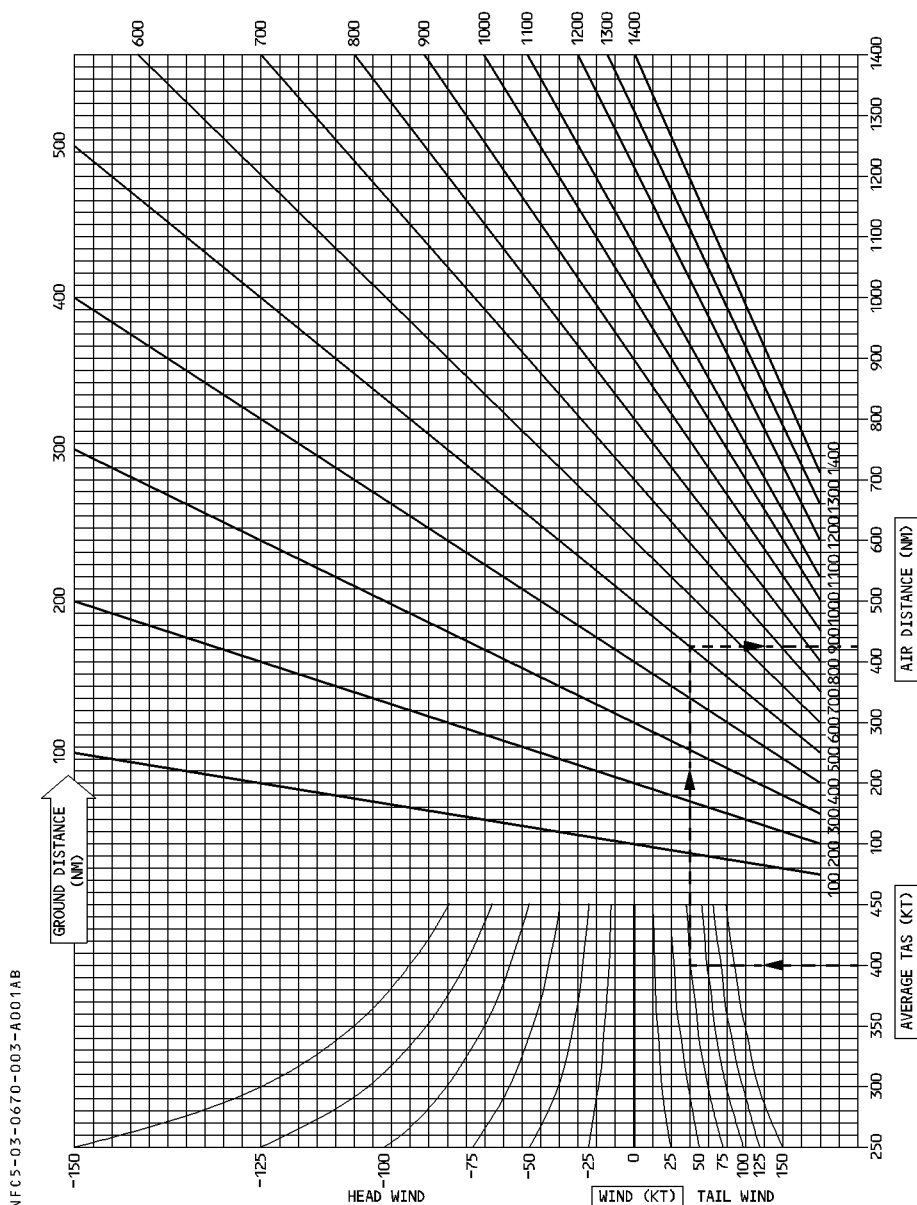
- LONG RANGE SPEED
- FIXED SPEEDS

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

07.00	CONTENTS	1/2
07.10	GENERAL DESCRIPTION	1/2
07.20	LIST OF EFFECTIVE OEB	
07.30	STATUS	1 to 2

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.

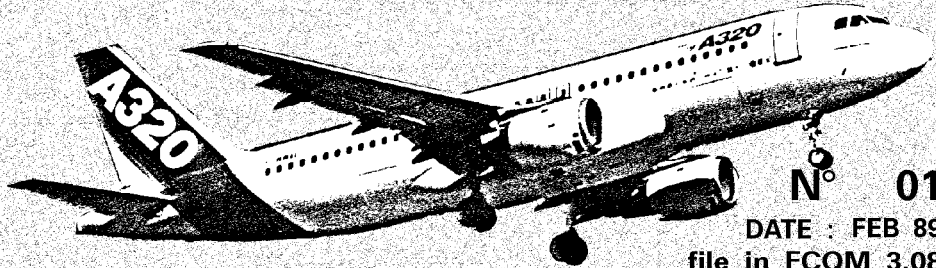
COMPLIANCE

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



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 updated.

A318/A319/A320/A321 - FCOM BULLETIN



DATE : JUL 02
file in FCOM 3.08

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

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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
54/2	AIRCRAFT HANDLING IN FINAL APPROACH
55/1	USE OF RUDDER ON TRANSPORT CATEGORY AIRPLANES



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.



N° 05/2

DATE : APR 99

file in FCOM 3.08

SUBJECT : OPERATION IN WINDSHEAR / DOWNBURST CONDITIONS

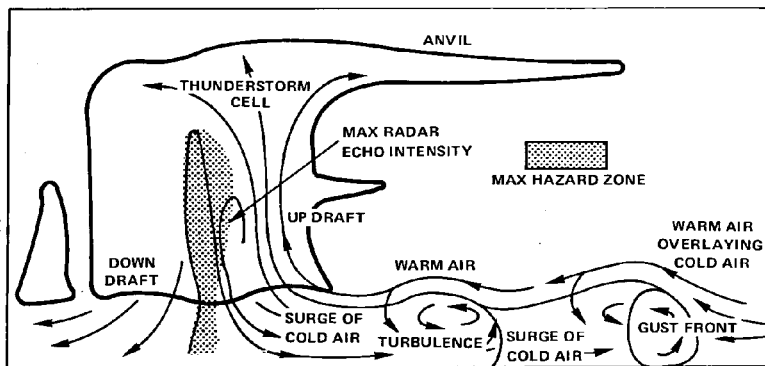
GENERALITY

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.

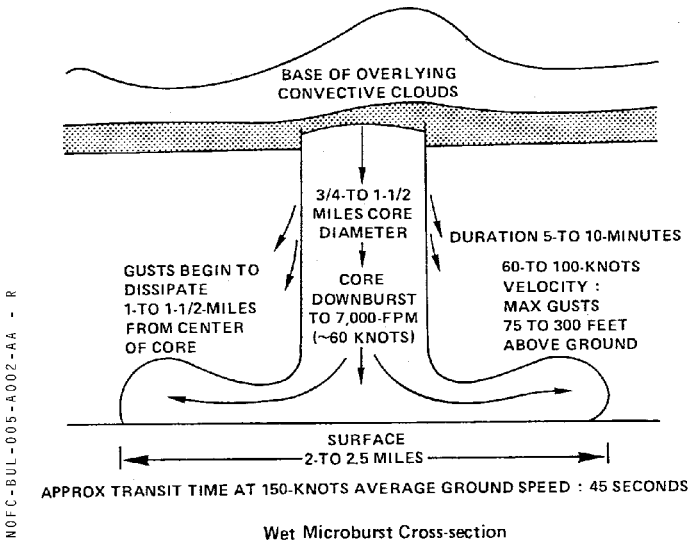
WINDSHEAR ASSOCIATED WITH CONVECTIVE CLOUDS AND STORM CELLS

- 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

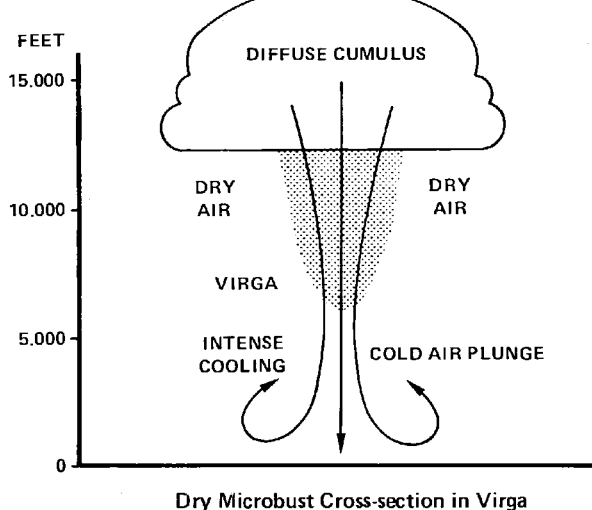
- Frontal thunderstorms are usually more tilted in the vertical, allowing precipitation to fall away from the updraft and airflow intensity within the storm accelerating much more than for the simple air-mass thunderstorm, sometimes resulting in a tornado.
- Microbursts consist of intense, non rotating, 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.



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-existent 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)



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,

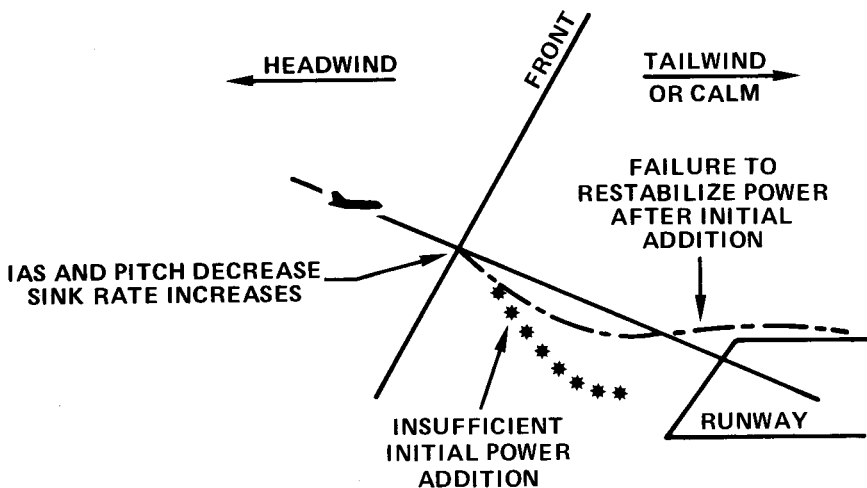
INFLUENCE OF WINDSHEAR ON AIRCRAFT PERFORMANCE

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,

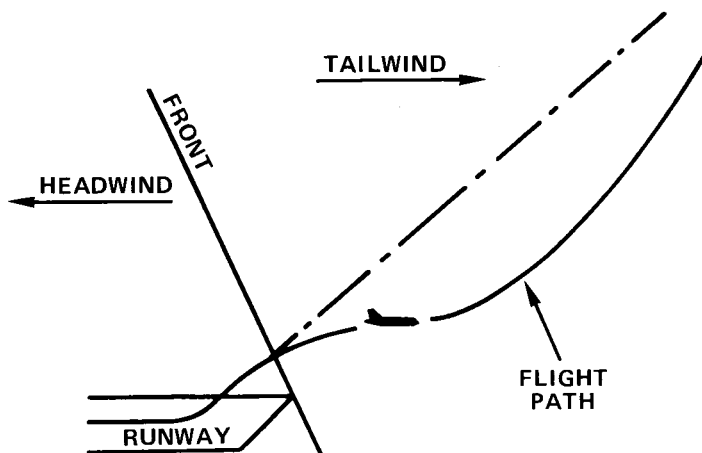
In this case the A/C is both slow and low in a « power deficient » state.

Consequences :

- If the pilot pulls the nose up to recapture the glide slope without selecting sufficient power : the A / C will lose 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

N0FC-BUL-005-A008-AA - R



- . airspeed decreases, lift decreases,
- . A / C nose begins to pitch down,
- . A / C drops below its nominal flight path,

Consequences :

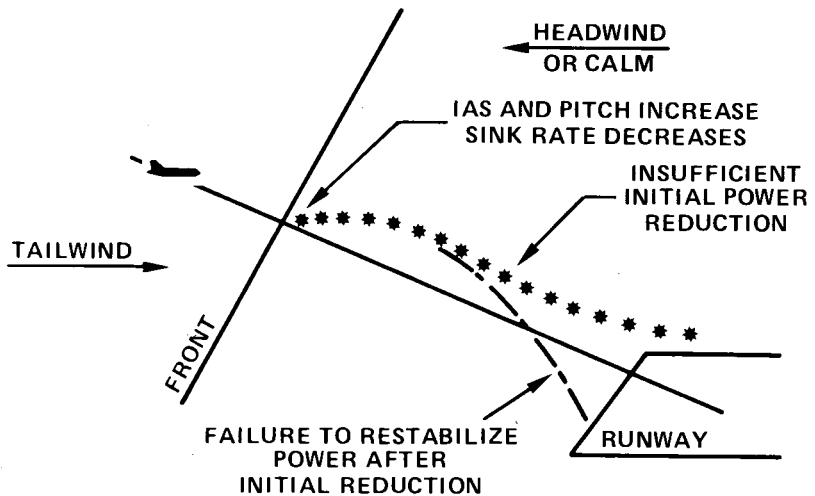
- . Because of aircraft inertia, attitude and ground speed will be initially maintained upon encountering windshear but airspeed will decrease, causing a reduction in lift which will result in a downward acceleration and a nose down pitching moment.
- . If there is no pilot action, the aircraft will 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

M0FC-BUL-005-A009-AA - R



The reverse of the previous case prevails :

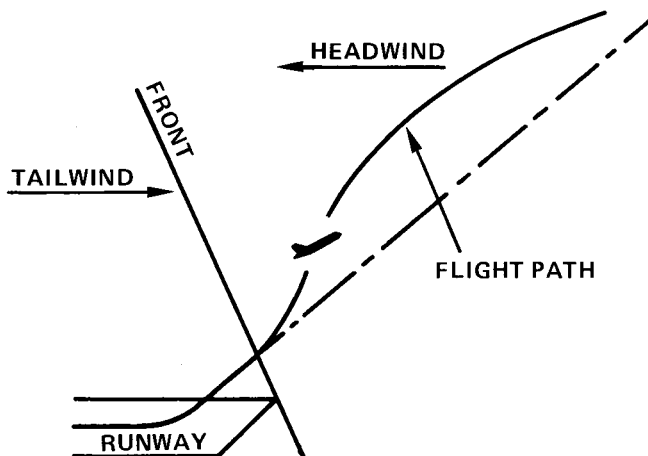
- airspeed increases, lift increases,
- A / C nose begins to pitch up,
- A / C balloons above the glide slope,

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



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

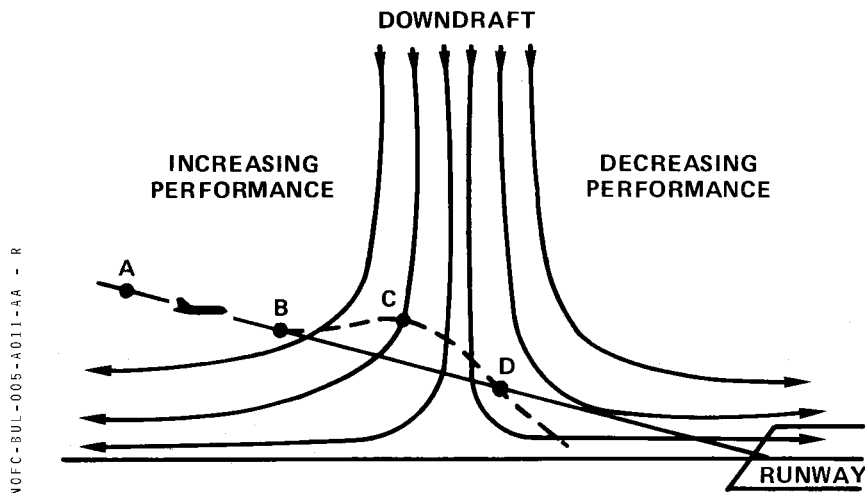
Note

- . 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.

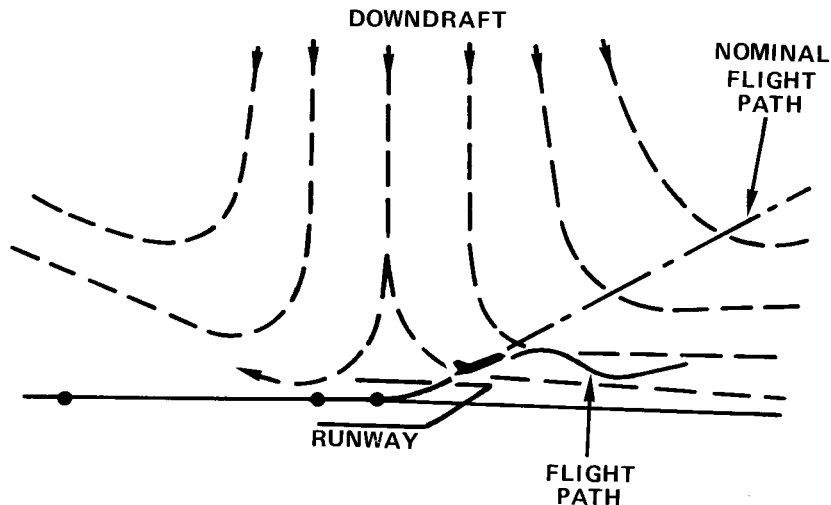
But between C and D the headwind ceases, a strong downdraft is entered and the tailwind begins to increase. The skin rate occurs rapidly and ground impact may become difficult to avoid.

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

NOFC-BUL-005-A012-AA - R



- 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.

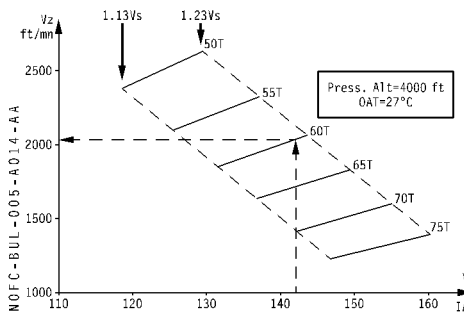
If the horizontal shear exceeds the flight level acceleration, the airspeed will decrease and will descend unless pitch attitude is increased.

b) Climb gradient maintainability

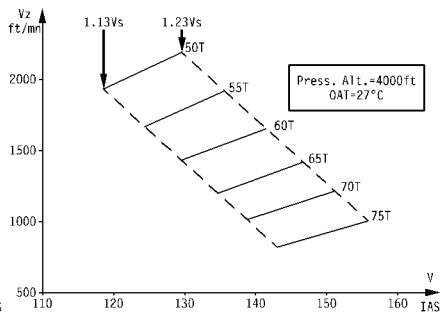
In downburst conditions, level flight will be maintained with the climb gradient maintainability. In the following example (CFM 56-5A1, a/c weight = 60 000 kg (132 300 lb) pressure altitude 4 000 ft, OAT = 27° C, V = 142 kts), the aircraft has the capability to maintain level flight in a 2 040 ft/mn 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.

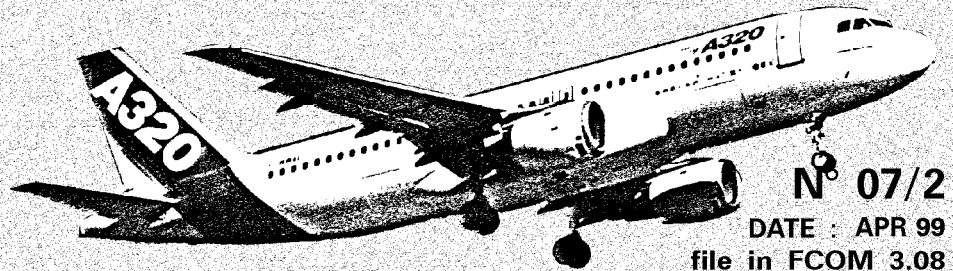
For information, a typical example :

CFM 56-5A1



IAE V2500-A1





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

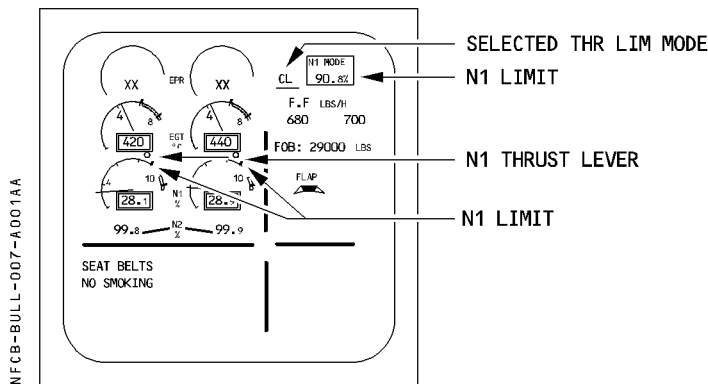
OPERATIONAL CONSEQUENCES

- 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 .



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 subsequently 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.

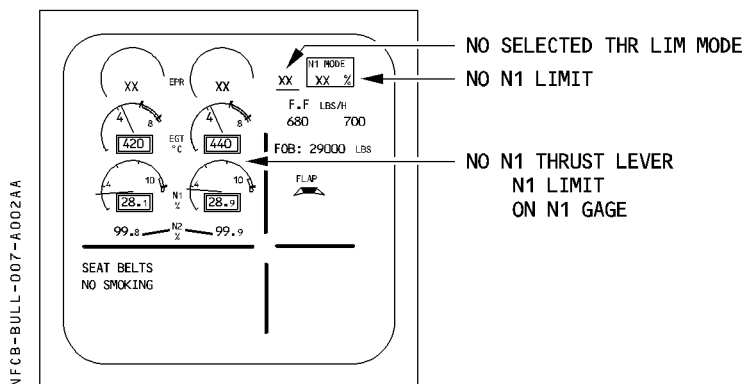
Furthermore SINGLE ENG DRIFT ON NET CEILING penalties will be also published there.

- 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.

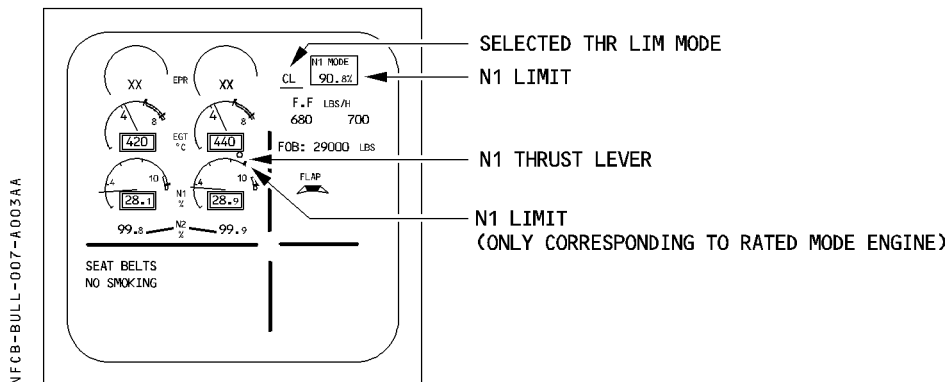
Single engine cruise drift down net ceiling penalties should also be used, in case that a subsequent engine failure occurs.

- 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

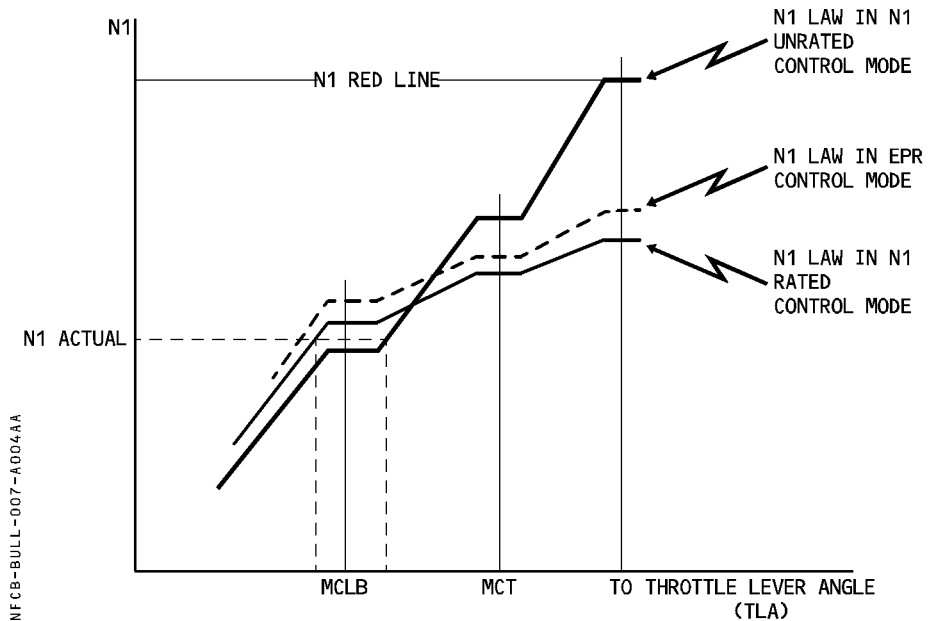
2 FADEC N1 DEGRADED MODE



MIXED CASE : Eng 1 Degraded, Eng 2 Rated mode



N1 COMMAND VERSUS THRUST LEVER POSITION 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.



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.



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).



	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 VR-10 knots (2 engines) and VR-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	VR-10 knots 2 engines	5.8°/s	12.5°
	63 440	21.3 %	Conf 2	VR-5 knots 1 engine-out	5.9°/s	12.8°
A320	67 200	17.8%	Conf 2	VR-10 knots 2 engines	5.8°/s	9.5°
	65 300	16.5%	Conf 2	VR-5 knots 1 engine-out	5.4°/s	9.0°
A321 IAE	75 950	14.9 %	Conf 2	VR-10 knots 2 engines	6.3°/s	8.5°
	73 720	15 %	Conf 2	VR-5 knots 1 engine-out	5.4°/s	9.0°

Note : VR represents the speed at aircraft rotation in order to obtain V2 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 V_{app} 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 V_{app} 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.

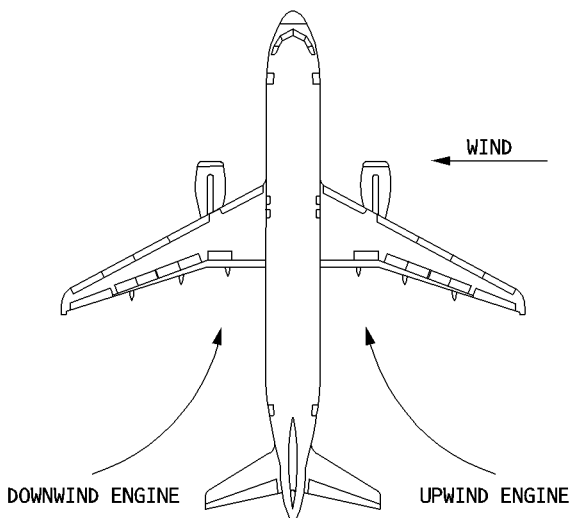


Figure 1. Definition of terms

OPERATION OF THE APU BLEED SUPPLY SYSTEM

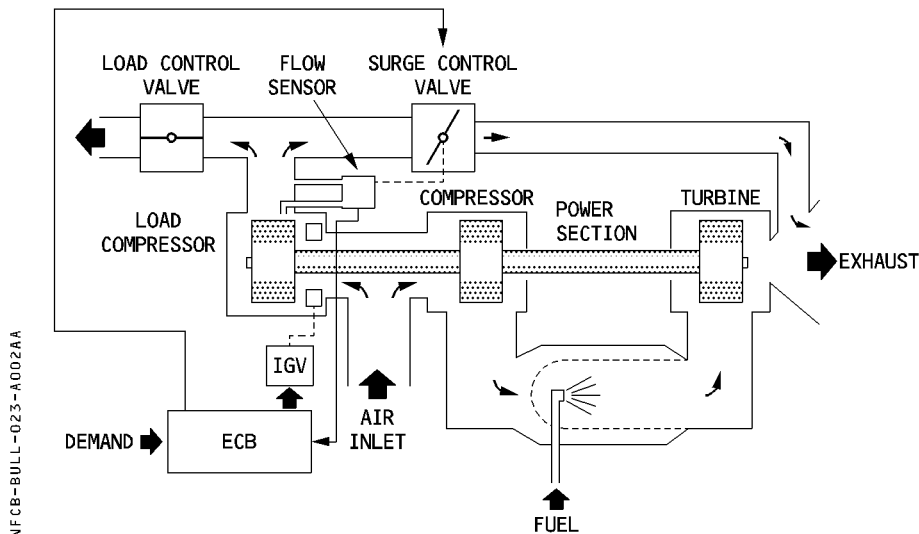


Figure 2. Schematic of the APU pneumatic system

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.

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 ($P_r/\Delta p$) 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.

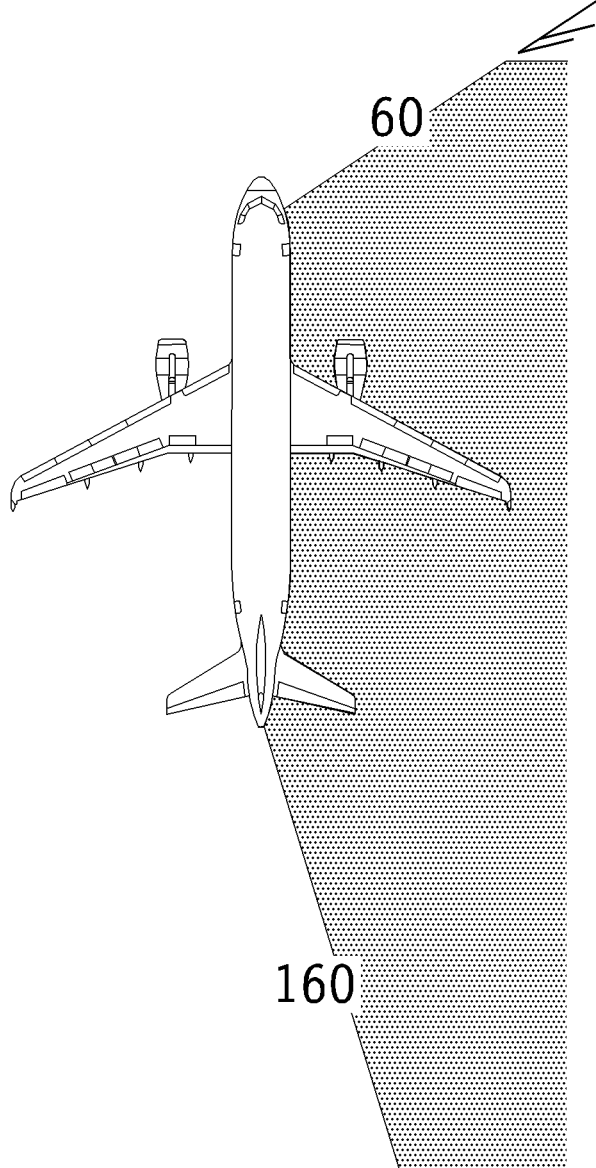


Figure 3. Critical crosswind range for the leeward engine

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 developed. 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).



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.

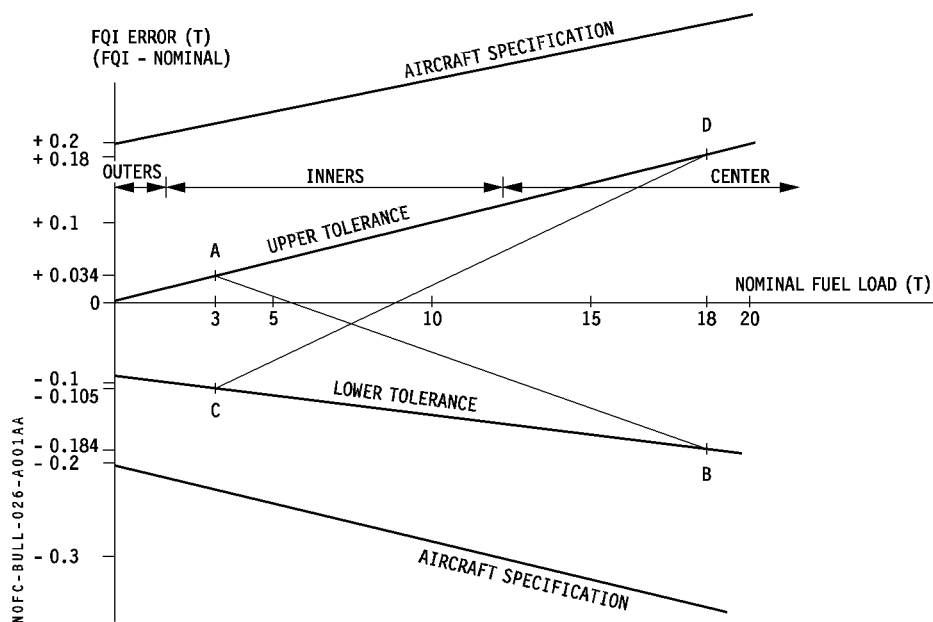


FIGURE 1

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.

$$\begin{aligned}\text{Max discrepancy } (\Delta) &= \text{Fuel load [per bowser]} - \text{Fuel added [FQI end} - \text{FQI start]} \\ &= \pm \text{FQI error (end)} \pm \text{FQI error (start)} \pm \text{Bowser Qty and Density} \\ &\quad \text{error} + \text{APU fuel burn (during refueling)}\end{aligned}$$

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 $\pm 0.5 \%$
- Density error due to both temperature accuracy and density reading : $\Delta d = \pm 0.002$. Or $\pm 0.25 \%$ on tolerance at any fuel loading.

Total bowser quantity and density error = $\pm 15\,000 \times 0.75 \% \approx \pm 115 \text{ kg. (253 lbs)}$

- **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. $\pm 1 \%$ of maximum tank capacity $\pm 1 \%$ of actual fuel quantity.

Assuming a maximum fuel capacity of 19 tonnes (418 000 lb) :

FQI at start = 3 tonnes $\pm$ 220 kg (6600 lb $\pm$ 484 lb)

FQI at end = 18 tonnes $\pm$ 370 kg (39600 lb $\pm$ 814 lb)

$$\Delta 1 = \pm 220 \text{ kg} \pm 370 \text{ kg} \pm 115 \text{ kg} \pm 50 \text{ kg} (\Delta 1 = \pm 484 \text{ lb} \pm 814 \text{ lb} \pm 253 \text{ lb} \pm 110 \text{ lb})$$

$$\Delta 1 \text{ max} \approx \pm 755 \text{ kg (1661 lb)}$$

- 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 Δ 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.

$$\text{Maximum positive } \Delta = 15,000 - [(18,000 - 185) - (3,000 + 35)] + 115 + 50 = + 385 \text{ kg}$$

Conversely, maximum negative Δ is obtained when particular aircraft calibration curve runs from C to D.

$$\text{Maximum negative } \Delta = 15,000 - [(18,000 + 180) - (3,000 - 105)] - 115 + 50 = -350 \text{ kg}$$

$$\Delta 2 \text{ max} \approx \pm 385 \text{ kg (847 lb)}$$

- 3) Particular aircraft FQI calibration curve is available.

In this case, although the reported discrepancy can be of the same magnitude as $\Delta 2$ 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.

$$\Delta 3 \text{ max} \approx \pm 165 \text{ kg (363 lb)}$$

• Conclusion

- When comparing bowser uplift versus FQI readings on ground, the maximum difference is :

$$\Delta 1 \text{ max} = [\text{FQI over-read (start)}] - [\text{FQI under-read(end)}] + \text{bowser error} + \text{APU burn}$$

- Difference can be significant when FQI over/underreadings before and after refueling are very different.
- An aircraft presenting a $\Delta \approx 0$ 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 :

$$\text{Block Fuel} = \text{FOB} + \text{FU} \pm 815 \text{ kg (1793 lb)} + \text{APU FU if any}$$

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 :

$$\text{Block Fuel} = \text{FOB} + \text{FU} \pm 450 \text{ kg (990 lb)} + \text{APU FU if any}$$

- 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 $\pm 5 \%$ 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 generally 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 = $\pm 1.5 \%$). 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 $\pm \frac{1}{100}$ (3 t + 19 t) = 3 t ± 220 kg

(FOB = 6600 lb $\pm \frac{1}{100}$ (6600 lb + 41800 lb) = 6600 lb ± 484 lb)

– FU = 15 tonnes $\times (\pm 1.5 \%)$ = 15 t ± 225 kg

(FU = 33000 lb $\times (\pm 1.5 \%)$ = 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 contingency 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.

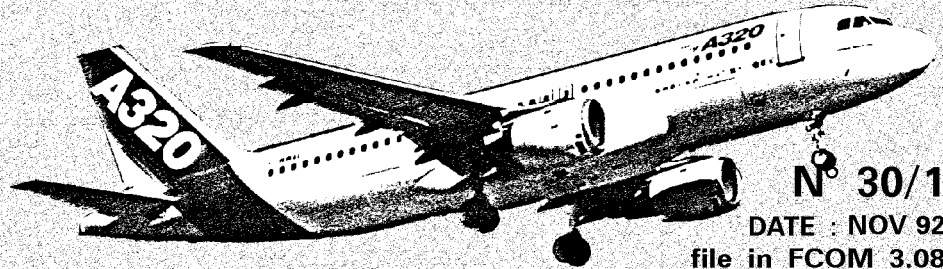
Taking into account the difficulty of measuring the weight of a liquid stored in complex-shaped tanks always moving, FQI system installed on Airbus aircraft has a good accuracy, well within specifications and international standards.

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.



**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 committee.
- 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.



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) :

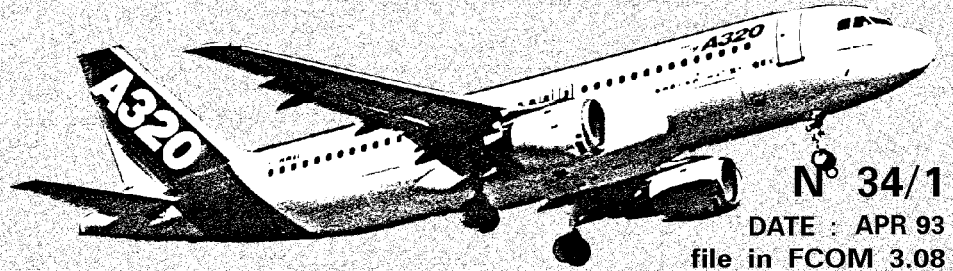
The N1 rate limit is 2 %/sec (IS8) and 1 %/sec (full standard). Both rates were selected to preclude speed excursion and improve passenger comfort (smooth attitude variation during transition).

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.



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.



**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

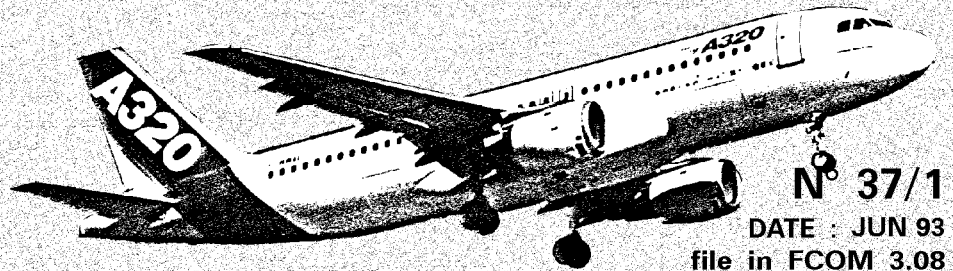
Very few cases of spurious radio altimeter indications have been reported to Airbus. Radio altimeter sensitivity issues have been tuned to the limits of improvement. There is no practical solution to cure the phenomenon without reducing system performance to an unsatisfactory level. Crews need to be 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.



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.

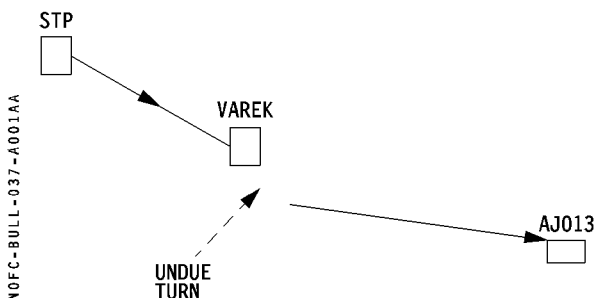
NAV DATA BASE INCORRECT CODING

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.

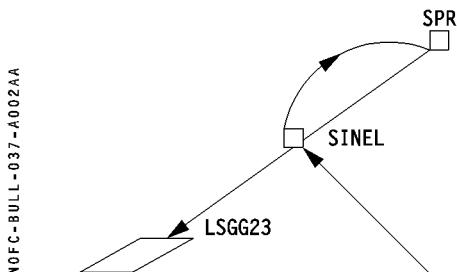


– 2nd example

STAR PERIK 1 and GORON 1 AT Genova (LSGG).

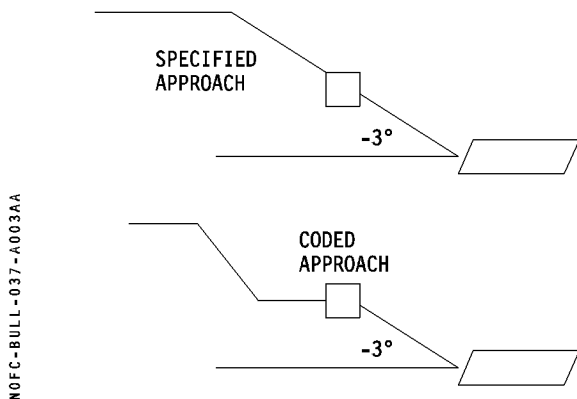
These STARs end at WPT SINEL located in the middle of the APPR 23.

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

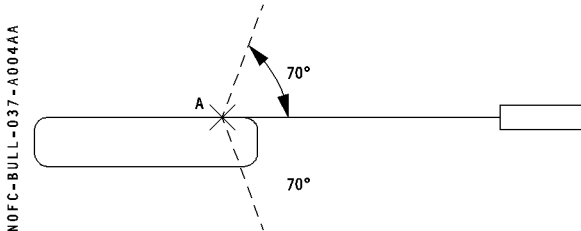
If an item is not specified in the ARINC 424, it will not be part of the Nav D.B.

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.

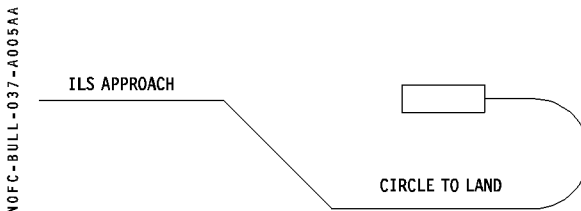
As a consequence, realistic coding of procedure turns should be requested.

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.

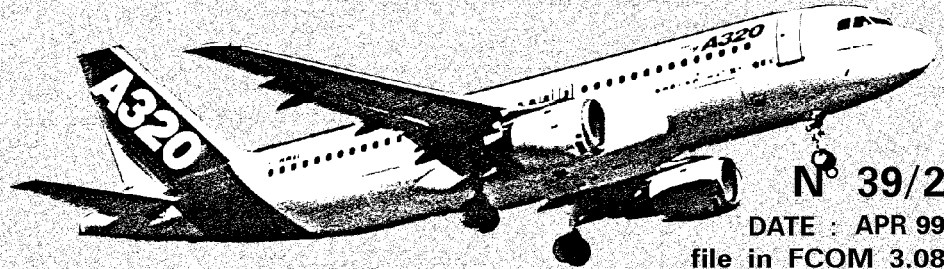
CONCLUSION

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.



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 transitioning 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.

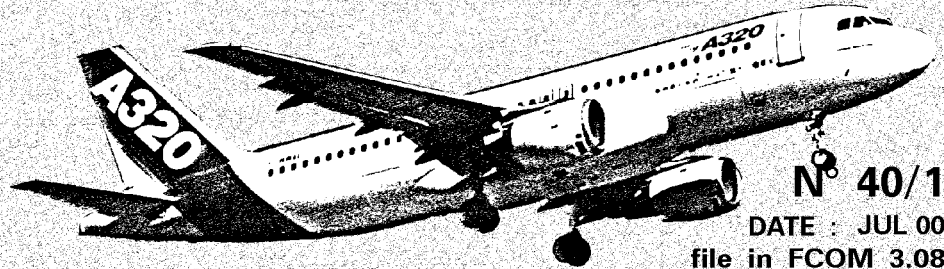
7. A/C POSITION INVALID

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.



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.



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, manoeuvring 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.

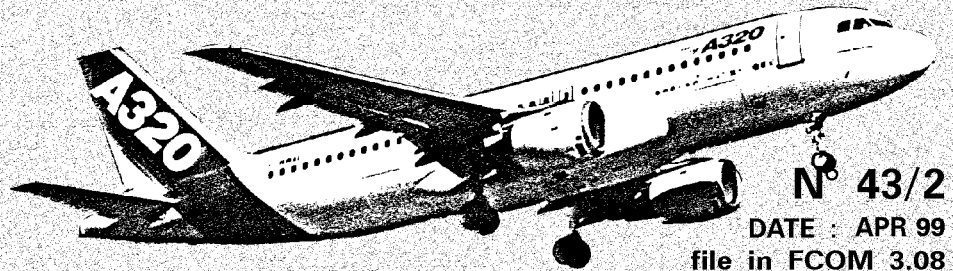
Per design, in DES mode or OP DES mode, autopilot authority is limited to 0.1 g compared to 0.15 g in EXPEDITE. This limitation was required by the launching customers for passenger’s comfort.

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.



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.

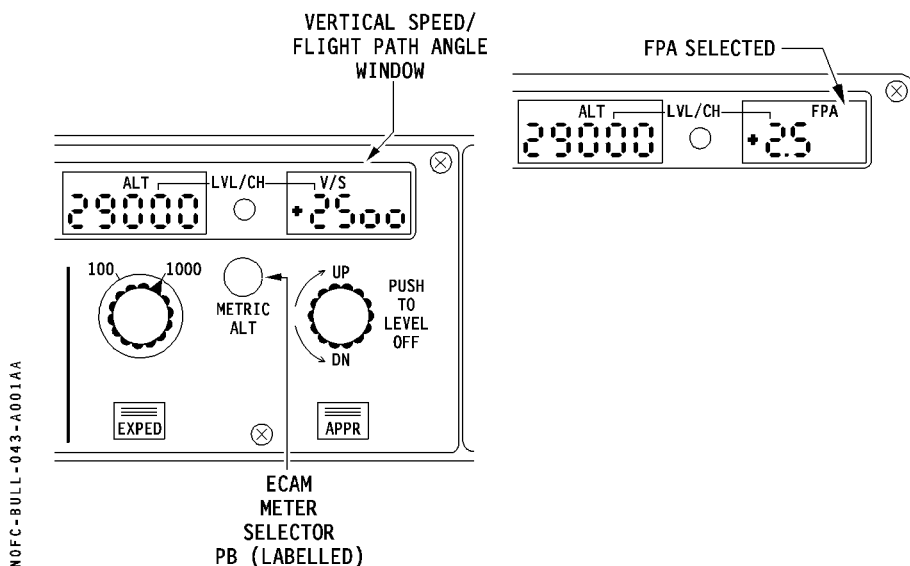
MODIFICATION DESCRIPTION

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.

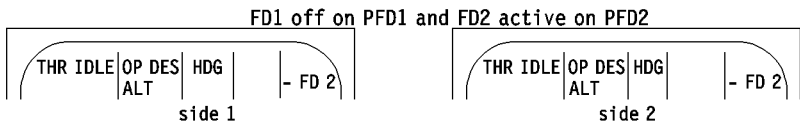
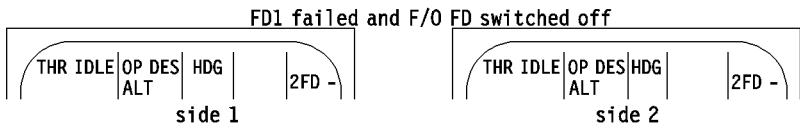
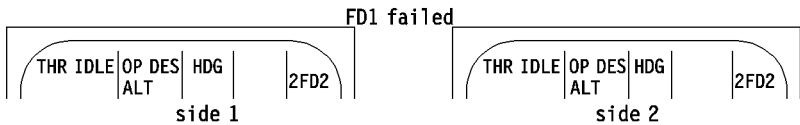
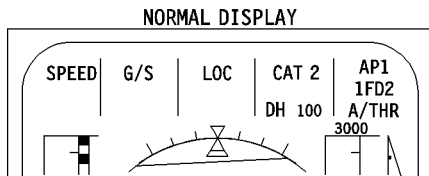


LOW ENERGY WARNING (FAC and FWC modification)

The low energy warning consists of an aural warning “speed speed speed” triggered every 5 seconds. This warning is available when $\text{conf} \geq 2$ and $100 \text{ ft} < \text{RA} < 2000 \text{ ft}$; 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.

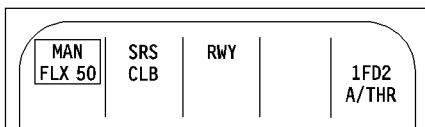
CPIP3 : FMA IMPROVEMENTS (DMC AND FWC MODIFICATION)

– Engagement status of both FDs are displayed on both PFDs :

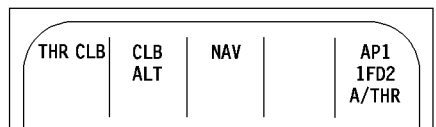


– A/THR annunciations are changed as follows :

- * 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 mode 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"

NOFC-BULL-043-A004A4

SPEED	V/S+800 ALT	NAV		AP1 1FD2 A/THR

ENERGY MANAGEMENT IMPROVEMENT

(FAC, FWC, DMC, FADEC modification)

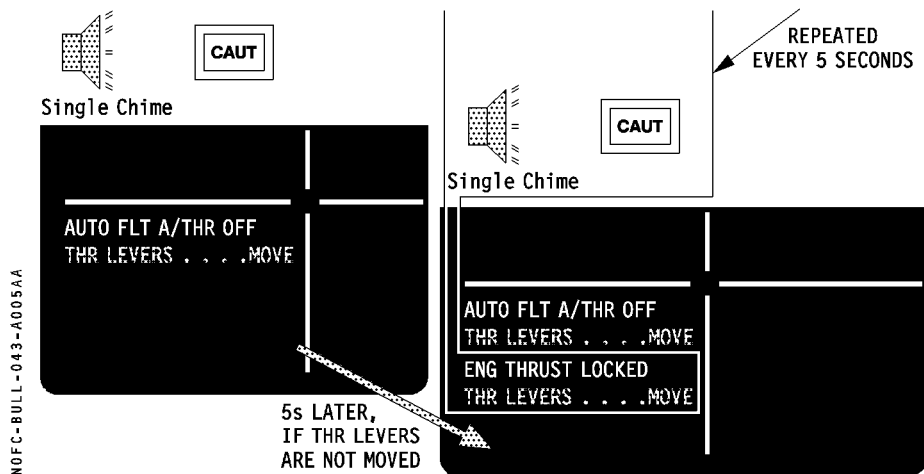
The ENERGY MANAGEMENT package is related to A/THR logic modification and additional ECAM announcements. The package eases the normal procedure of A/THR disconnection and improves the crew information on the current thrust setting.

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.

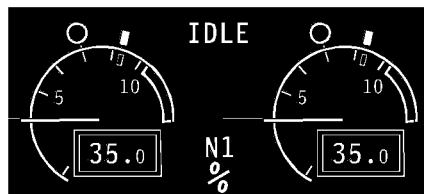
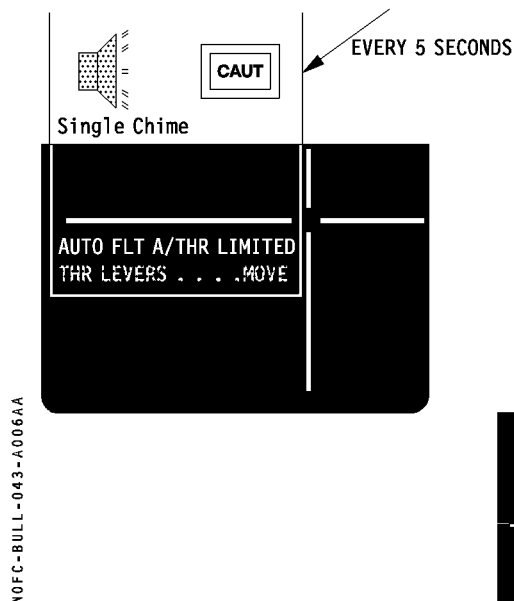
A/THR disconnection due to a failure or an action on the ATHR FCU P/B when illuminated green :



- 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 annunciations 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.

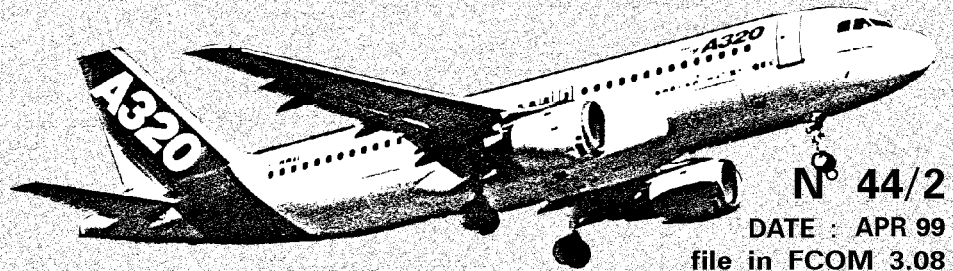
ENERGY MANAGEMENT

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.



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

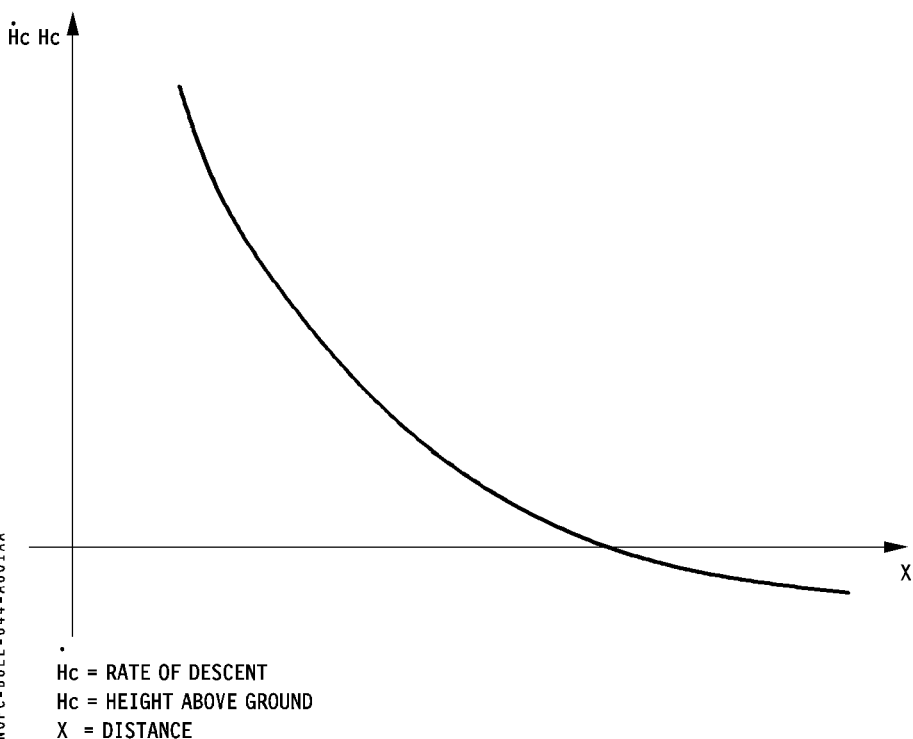
There has been long flares experienced at some airfields during autolands with A320 fitted with IAE engines.

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.



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 (V_z) 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 $\pm 0.8\%$ have to be considered, as well as a step of 20 ft occurring just before the threshold, and a rising slope of 12.5% occurring 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 certification 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 certification 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

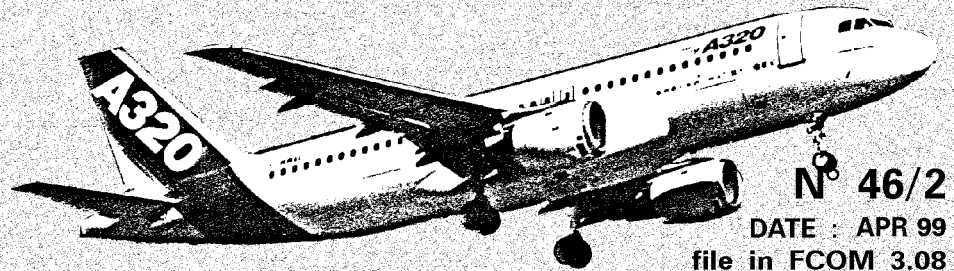
Variations in runway profile affect all autoland systems. In the case of the A320-IAE, a rising slope before the runway can cause the flare to be engaged at about 50 ft (instead of the mean value of 43 ft), and the aircraft may temporarily level out at about 20 ft with a relatively high nose-up attitude 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 prolonged. 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 susceptible to firm landings on up sloping runways whereas those systems which have soft touchdowns will be more susceptible 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.



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	FMGC COMPUTATION
Computed on current aircraft status and configuration.	Computed for take off, go around and landing.
VLS F S "O" Green Dot V α prot V α 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

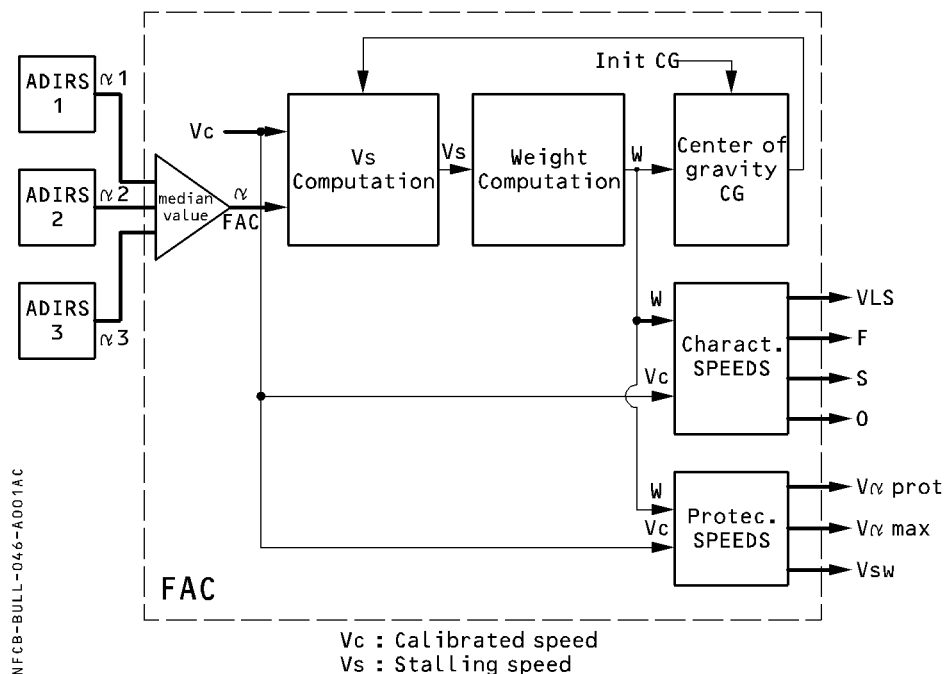
The algorithms used to compute the characteristic speeds are the same in both FAC and FMGC but as the inputs are different, the resulting values may differ.

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 (V_c)). It also uses THS position, SFCC data and FADEC data.

From these inputs, the FAC computes a stall speed V_s which is used to determine the aircraft weight.

The following sketch gives the basic architecture for FAC speed computation.

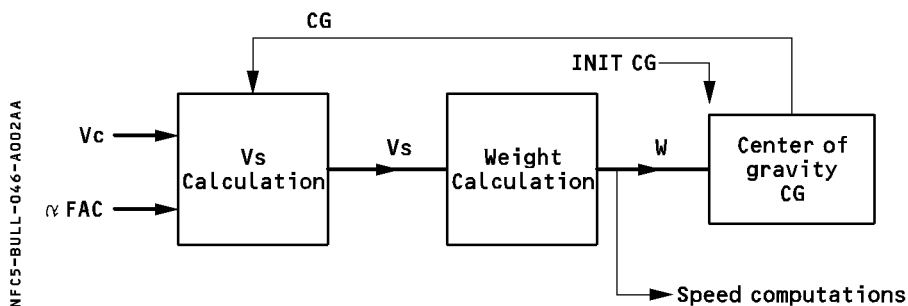


AOA DETERMINATION

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 (V_c) 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 V_c 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.

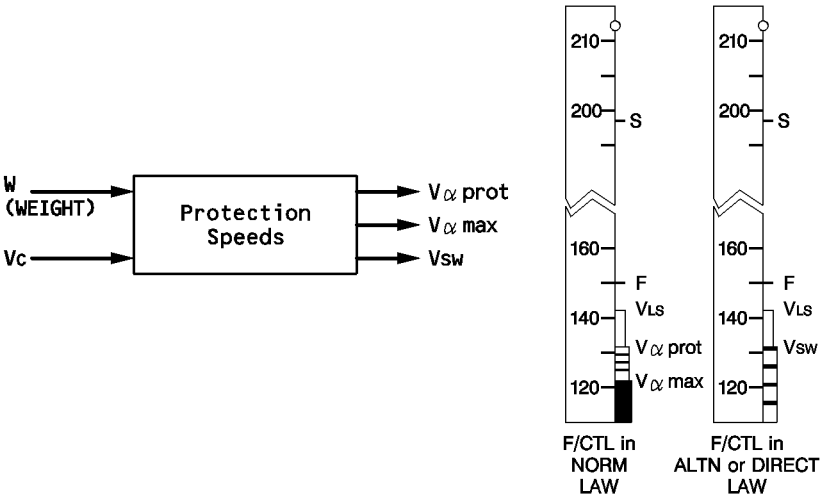
PROTECTION SPEEDS CALCULATED BY THE FAC

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).

Vsw, the stall warning speed is computed by the FAC in ALTN or DIRECT law. At Vsw speed, an audio warning (crickets – STALL synthetic voice) is triggered.

NFCS-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.

NFC5-BULL-046-A004AA

1L	DEST QNH	APPR FLP RETR	FINAL VOR33R	1R	1L	V1 FLP RETR	RWY 23	1R
2L	1015	F=163	MDA 645	2R	2L	VR SLT RETR	TO SHIFT	2R
3L	TEMP [] °	S=196	CLEAN	3R	3L	V2 SLT RETR	FLAPS/THS	3R
4L	MAG WIND [] ° / []	0=236	LDG CONF	4R	4L	TRANS ALT	FLEX TO TEMP	4R
5L	4000	VLS 127	FULL NEXT	5R	5L	4800	THR RED/ACC	ENG OUT ACC
6L	VAPP 135	PREV <PHASE	PHASE>	6R	6L	3000/4305	2865	NEXT PHASE>

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

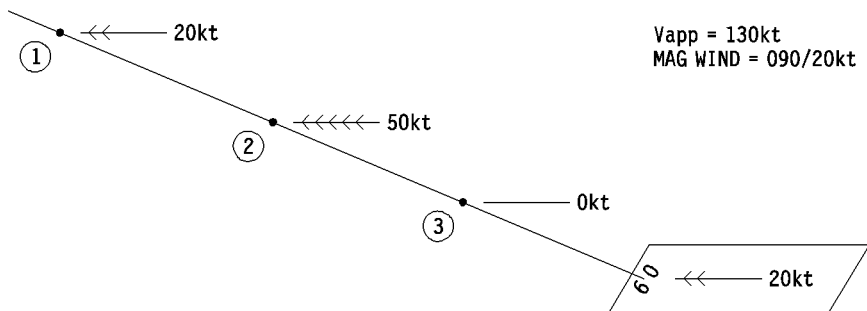
The minimum energy level is based upon the ground speed the aircraft should have at touchdown, when landing at VAPP with the expected wind. It is called "GROUND SPD MINI".

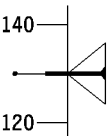
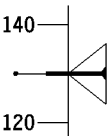
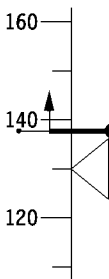
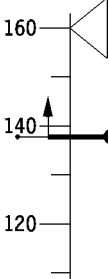
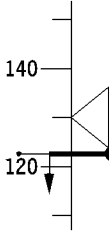
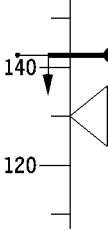
During the approach, the FMGS continuously computes the IAS target to keep the ground speed at or above the "Ground Speed Mini", based upon the actual winds.

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.

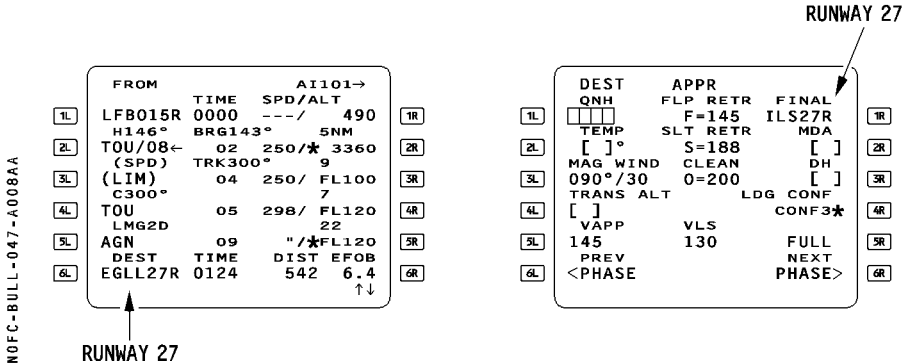
Ground speed mini function provides all the information necessary to manage the thrust smoothly and efficiently during the approach, in the event of gusts or horizontal windshears.

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	$VAPP = VLS + 5 \text{ kt} + \frac{1}{3} \text{ OF THE TOWER HEADWIND COMPONENT}$
A320 with Mod 25225 A319/ A321	$VAPP = VLS + \text{MAX} (5, \frac{1}{3} \text{ OF THE TOWER HEADWIND COMPONENT})$

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.

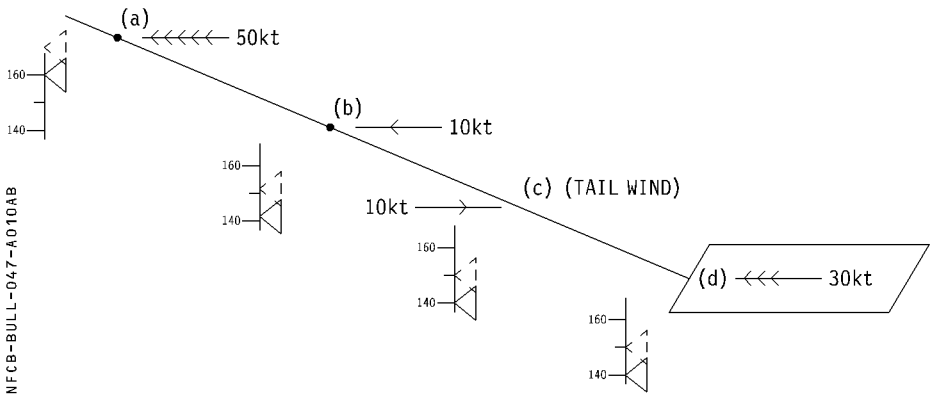
EXAMPLES

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	$VAPP = 130 + 5 + \frac{1}{3} \text{ of } 30$ $= 145\ kt$	$VAPP = 130 + MAX(5, \frac{1}{3} \text{ of } 30)$ $= 140\ kt$
GS Mini	$GS\ Mini = 145 - 30 = 115\ kt$	$GS\ Mini = 140 - 30 = 110\ kt$

Current wind in Approach	IAS target ($\angle \downarrow$) A320 (basic configuration)	IAS target ($\angle \downarrow$) A320 (with Mod 25225) A319, A321
(a) 090/50	MAX (VAPP, 115 + 50) = 165 kt	MAX (VAPP, 110 + 50) = 160 kt
(b) 090/10	MAX (VAPP, 115 + 10) = 145 kt	MAX (VAPP, 110 + 10) = 140 kt
(c) 270/10	MAX (VAPP, 115 - 10) = 145 kt	MAX (VAPP, 110 - 10) = 140 kt
(d) 090/30	MAX (VAPP, 115 + 30) = 145 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 :

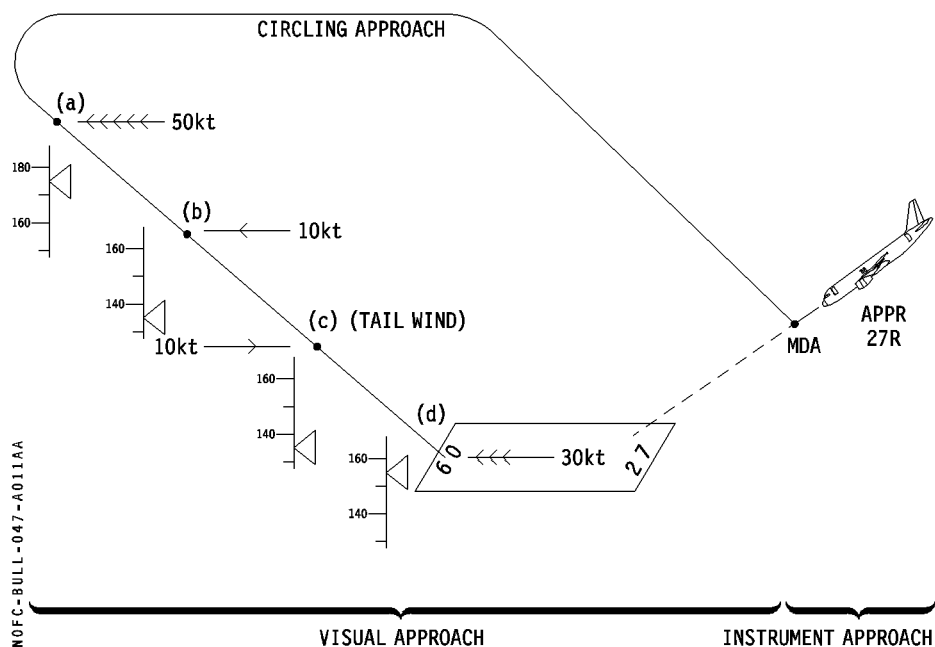
Instrument Approach on RWY 27

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 = $130 + 5 + \text{Zero}^* = 135 \text{ kt}$ for A320 basic configuration
= $130 + \text{MAX}(5\text{kt}, \text{Zero}^*) = 135 \text{ kt}$ 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 = $135 - 10 = 125 \text{ kt}$ (10 kt default wind value)
3. IAS target = $\text{MAX}(135, 125 + \text{current headwind component})$.



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

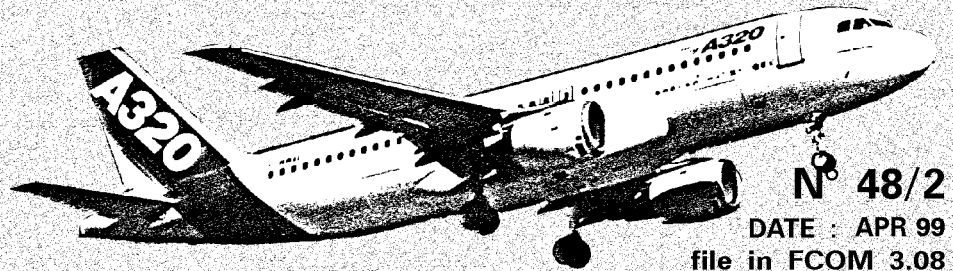
SELECTED RUNWAY IN F-PLN	VAPP VALUE (PERF APPR PAGE)	GS MINI	ENCOUNTERED WINDS	IAS TARGET IN FINAL FOR RUWAY 09
(1) RUNWAY 09 A320	145 kt	115 kt	(a) 090/50 (b) 090/10 (c) 270/10 (d) 090/30	165 kt 145 kt 145 kt 145 kt
(1) RUNWAY 27 A320 (Mod 25225) A319, A321	140 kt	110 kt	(a) 090/50 (b) 090/10 (c) 270/10 (d) 090/30	160 kt 140 kt 140 kt 140 kt
(2) RUNWAY 27	135 kt	125 kt	(a) 090/50 (b) 090/10 (c) 270/10 (d) 090/30	175 kt 135 kt 135 kt 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



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.



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.

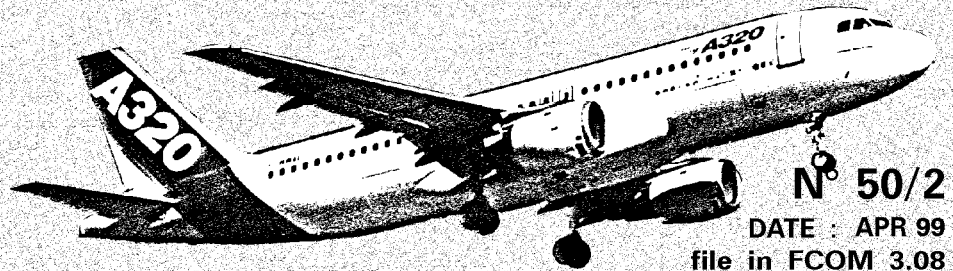
- * When the crew flies the ILS affected by this discrepancy, the aircraft is guided on a higher than normal glide slope but the touch down zone is not modified.
- * Aircraft landing performance are not affected by this discrepancy.

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.



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 extension.

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 foreign 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 recommended to inspect the lavatory smoke detectors for tampering before every flight. If foreign bodies or signs 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 valve 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 avionics bay.

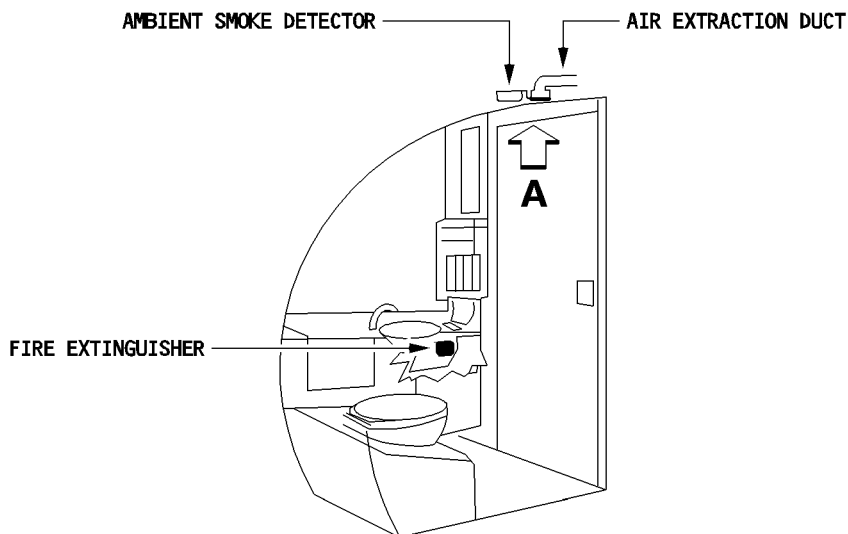
ACTION

Airbus Industrie has initiated a modification consisting of the introduction of an improved rinse valve.

PROCEDURE

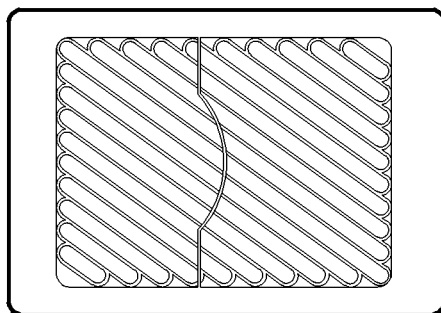
Pending the introduction of the improved rinse valve, it is recommended that the cabin crew perform a toilet flush in each lavatory before the first flight of the day. This should minimize the effect of possible overnight deposits inside the valve by draining the content.

The cabin crew should advise the maintenance if abnormal water accumulation is found.



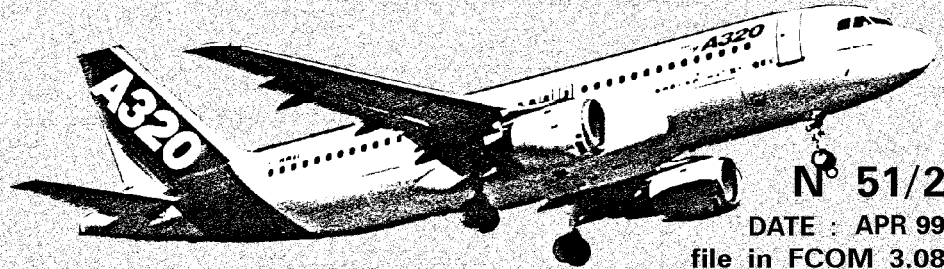
A

AIR INTAKE SCREEN (GRILL)



NFCB-BULL-050-A001AA

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.



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 information.

This FCOM Bulletin provides the following information :

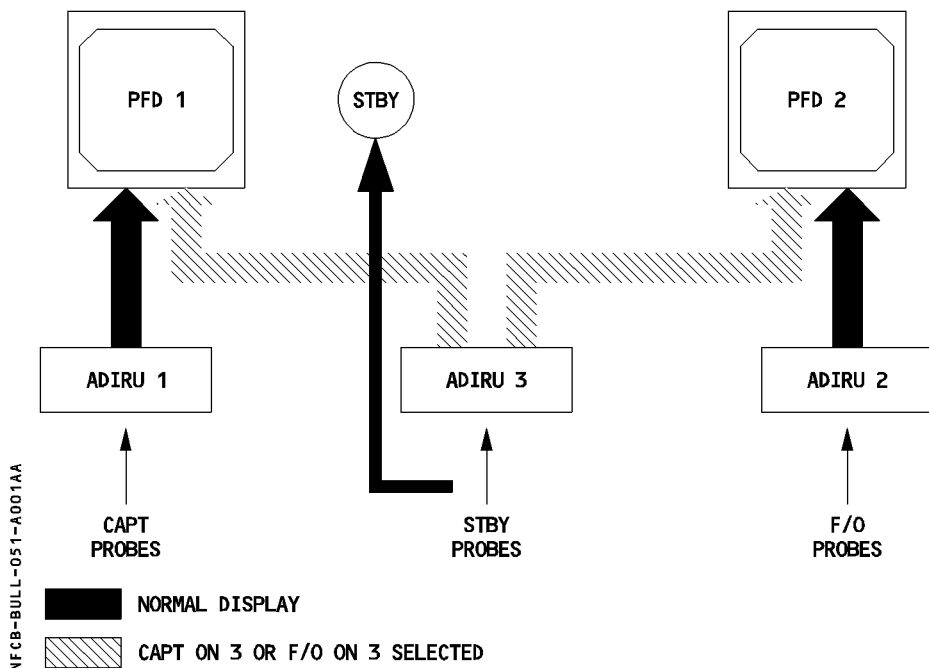
- 1 – Recall of pitot/static system layout
- 2 – Situations which may lead to erroneous airspeed/altitude indications
- 3 – Consequences of various failure cases
- 4 – Recall of AI recommended operational procedures

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 situation

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 VLS, no VSW and no VMAX 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 situations (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 unobstructed	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 :
ADRI, 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.

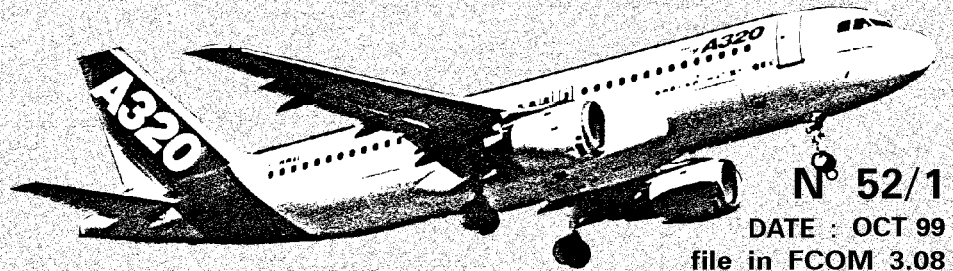
Flight crews should however be aware that in very extreme circumstances, it may happen that two, or even all three ADR may provide identical and erroneous data. Therefore the suspect ADR should only be switched OFF if it is positively confirmed that the two other ADR are correct. If in doubt :

**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.



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.

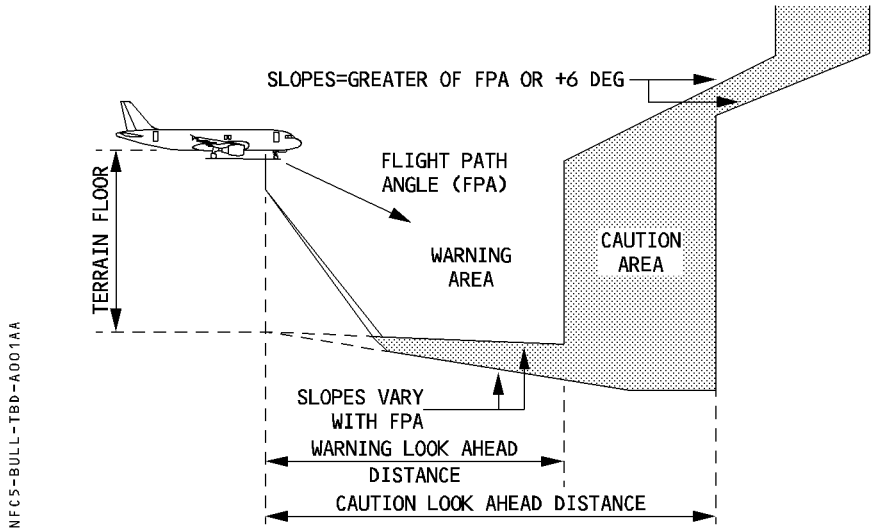
1. The Enhanced GPWS functions

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).

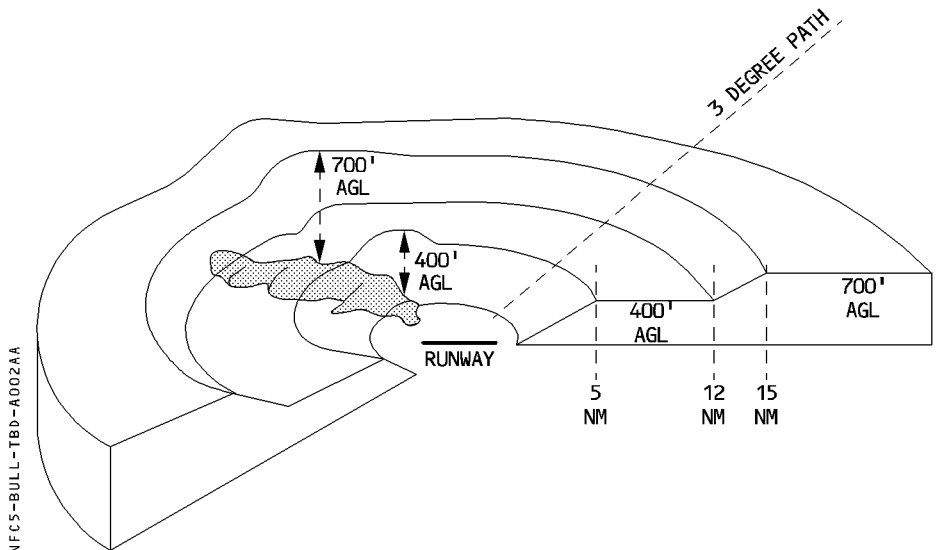
Two enhanced functions have been added to the basic modes of the GPWS. These functions are the following :

- 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 (whatever 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 occurrence 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.



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.

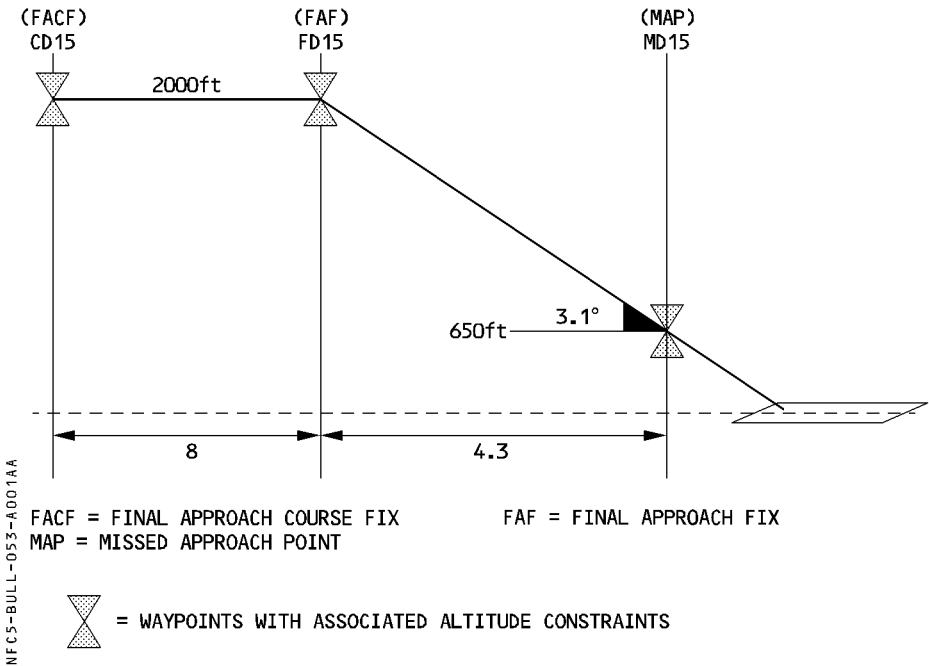
Airbus Industrie Flight Operations Support gives another method of validation in the document "Navigation Database Validation for FINAL APP mode use".

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 approach.
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 FAF, 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 FAF and the FAF must be aligned with the approach course.

If the FAF 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 ($\neq 0^\circ$) 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 ($\neq 0^\circ$) 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 : $FPA = 0^\circ$ at MAP**
 - **If MAP before or at runway threshold : $FPA \neq 0^\circ$ at MAP**
 - **For each Step Down Fix a $FPA \neq 0^\circ$ 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 FAF (inclusive) to RW or MAP.
Modification before FAF 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 FAF 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 FAF is permitted provided resulting change of flight path course at FAF 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 FAF 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 nav aids 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



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.

R 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.

R 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.

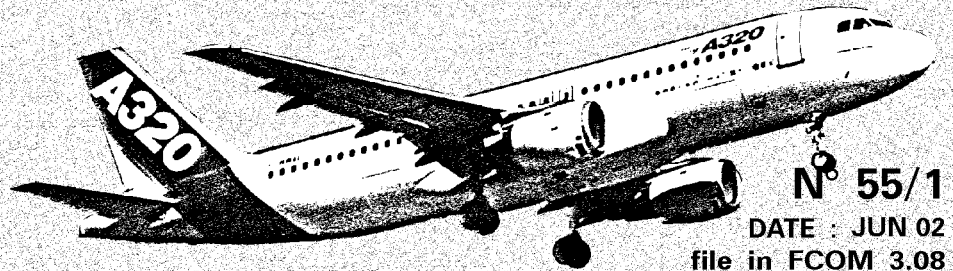
Use of rudder, combined with roll inputs, should be avoided, since this may significantly increase the pilot's lateral handling tasks. Rudder use should be limited to the "de-crab" maneuver in case of crosswind, while maintaining the wings level, with the sidestick in the roll axis.

(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.



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 V_{mcg} (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.

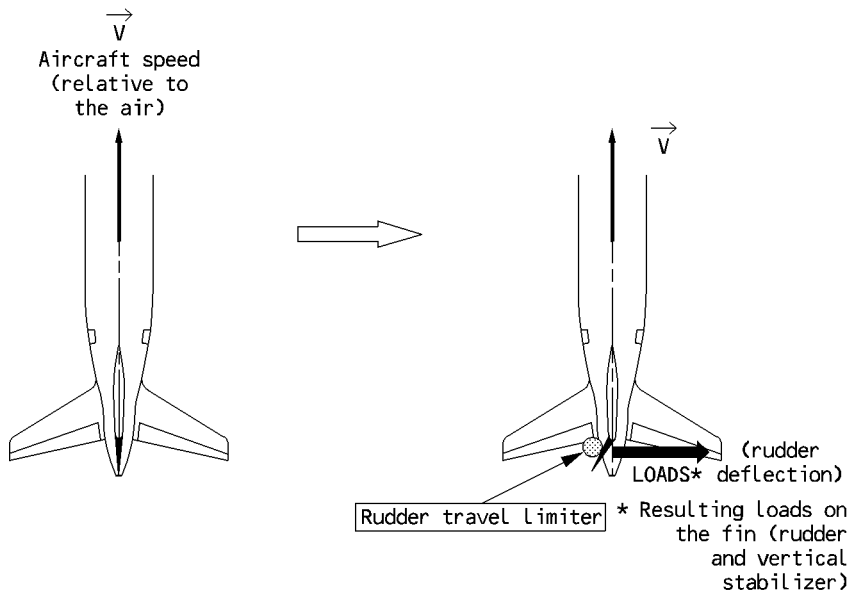
The rudder deflection, necessary to achieve these yawing moments, and the resulting sideslip angles can place significant aerodynamic loads on the rudder and on the vertical stabilizer.

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.

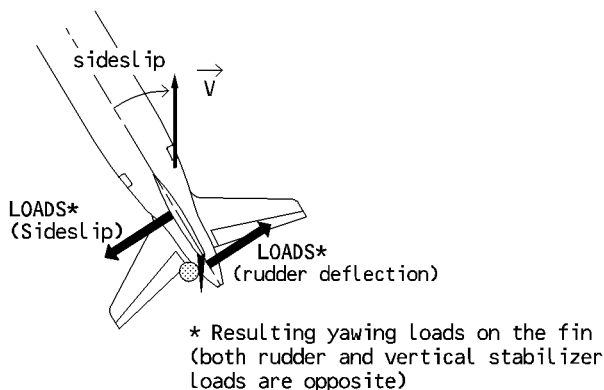
Certification requirements

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.

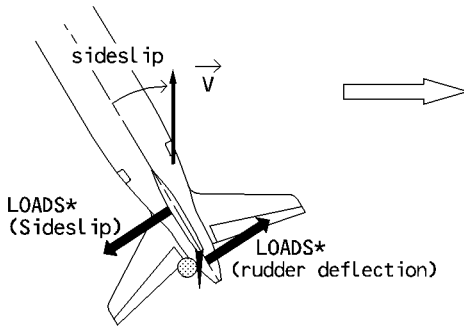


- 2 - With the rudder deflected as shown above, the aircraft yaws to the resulting overswing sideslip angle, and then stabilizes at a somewhat smaller steady-state sideslip angle.

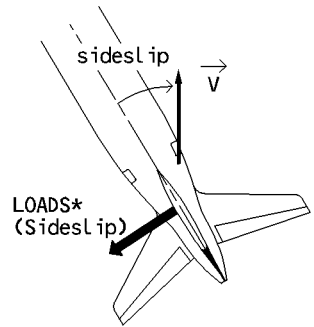


3 - With the airplane yawed to the steady-state (static) sideslip angle corresponding to the above rudder deflection, the certification regulations assume that the rudder pedal is released to neutral.

Note : Because the aircraft has natural yaw stability, returning the rudder to neutral will also result in returning the sideslip angle to neutral



* Resulting loads
on the fin
(both rudder and
vertical stabilizer
loads are opposite)



* Resulting loads
on the fin

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.

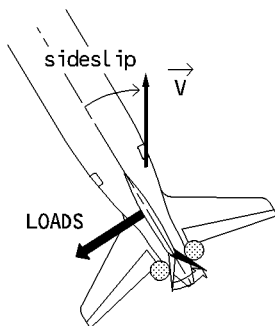
Higher loads could lead to structural failure.

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, V_A .

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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.

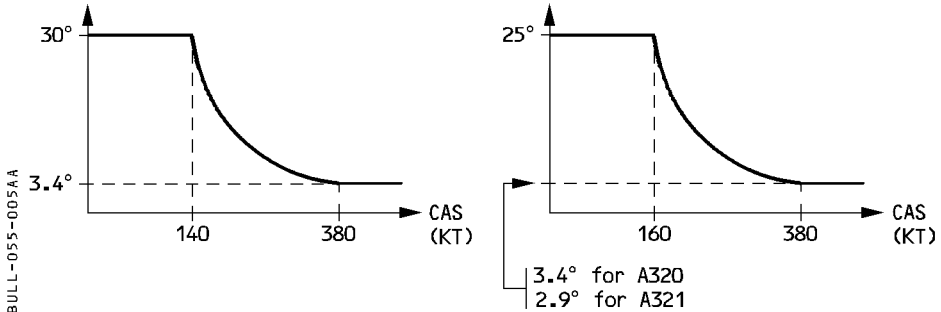
Rudder control

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.

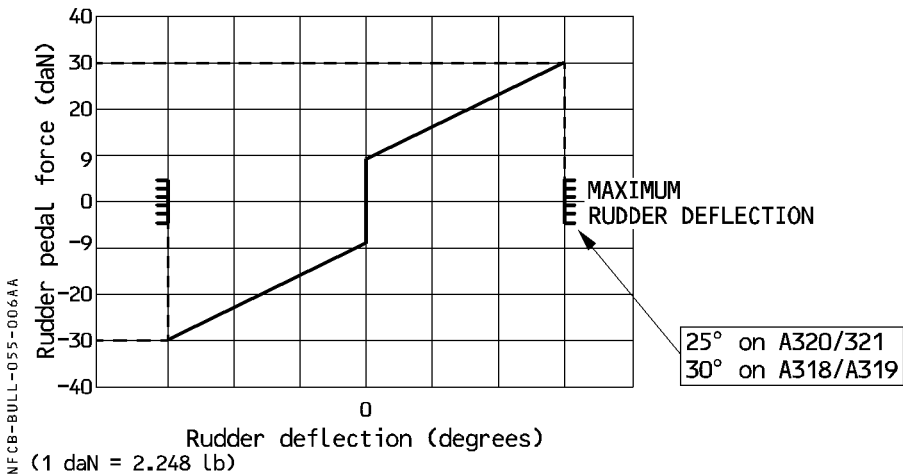
Rudder travel is limited as a function of the aircraft speed, as shown below :



- 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".