Flight Crew Operating Manual

FCOM

A320

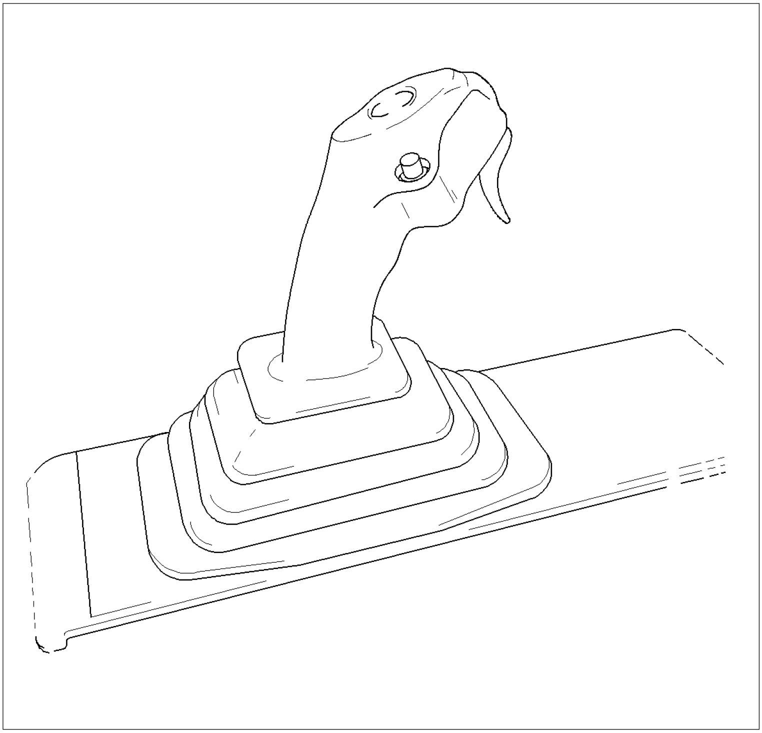
Volume 3

Customer Services

AIRBUS

A318/A319/A320/A321

FLIGHT CREW OPERATING MANUAL



FLIGHT OPERATIONS

3

AIRBUS®

R **ORGANIZATION OF THE MANUAL**

R **FOREWORD**

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

R **COMMENTS - QUESTIONS - SUGGESTIONS**

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

AIRBUS - BP N°33
1 ROND POINT MAURICE BELLONTE
31707 BLAGNAC CEDEX - FRANCE
TELEX TLSBI7X or 530526F
FAX 33.5.61.93.29.68
ATTN. Flight Operations Support - STL
EMAIL : fltops.fbwstd@airbus.com

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
EMAIL : sb.reporting@airbus.com

FOR PRINTING AND DISTRIBUTION

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R **CONTENT**

The Flight Crew Operating Manual (FCOM), and the associated Quick Reference Handbook (QRH), are developed specifically for flight crews, in order to provide them with all of the necessary information about the operational, technical, procedural, and performance characteristics that are required for the safe and efficient aircraft operation. These manuals take into account all of the operational procedures to be applied during normal and abnormal/emergency situations that may occur on ground or in flight.
The manuals are not designed to provide basic airmanship skills or piloting techniques. They are intended for flight crews that have already been trained to fly this type of aircraft, and are familiar with the aircraft's handling characteristics.
In addition, the purpose of the FCOM is to :
- Be used as a comprehensive reference guide during initial and refresher flight crew training. Practical and training-related information is addressed in the Flight Crew Training Manual (FCTM).
- Provide Airbus operators with a basis for their development of a customized airline operations manual, in accordance with applicable requirements.

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).

R **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.

R **WARNINGS, CAUTIONS AND NOTES**

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

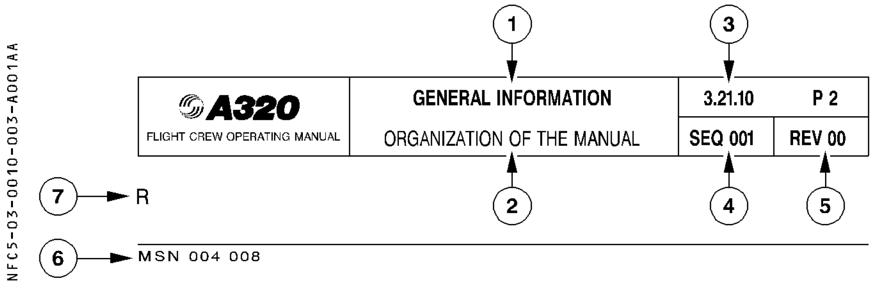
R **COMPLEMENTARY INFORMATION**

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.

R **OPTIONAL EQUIPMENT**

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

R **PAGINATION**



1. Chapter title

2. Subchapter title

3. FCOM volume number, Chapter number, Section number, Page number

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

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

6. Aircraft MSN
   – 004 008 means that the page is applicable to aircraft MSN 004 and MSN 008
   – 010-014 means that the page is applicable to aircraft MSN 010 to MSN 014
   – ALL means that the page is applicable to all aircraft covered by the manual.
   Correspondance between MSN and registration may be found in the cross reference table

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

R **REVISIONS**

R **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.

R **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.

R **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.

R **OPERATIONS ENGINEERING BULLETINS**

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

R **HOW TO INSERT A REVISION**

R **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.

R **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".

R **BEST WAY TO GET UPDATED DOCUMENTATION**

The best way to ensure timely receipt of getting correct updated documentation is to advise :
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ATTN : Customer Service Directorate – Technical Documentation Services (AI/SE – D) as soon as any change has been completed on any airplane.

MAIN FCOM CHANGES

The purpose of this section is to provide Operators with general information about the major changes that are introduced in the current revision of FCOM Volume 3 and the QRH.
For FCOM changes that are not linked to a technical modification covered by a MOD number, the flight crew can refer to the section MAIN TOPICS OF CURRENT REVISION.
For FCOM changes that are linked to a technical modification covered by a MOD number, the flight crew can refer to the associated Modification Operational Impact (MOI) document available in the Flight Operations community at www.airbusworld.com.
It is also possible to download additional documents that are related to FCOM changes (e.g. Operational Liaison Meeting (OLM) presentations), when available, from the Flight Operations community at www.airbusworld.com.
The information provided in this section is for all Operators, and is not customized. In addition to this section, every revised FCOM page has a highlight (HL) that indicates the change(s) made to the page. These HLs can be found in FCOM subchapter 3.00.75.

MAIN TOPICS OF CURRENT REVISION

Rejected TakeOff (RTO) (FCOM 3.02.10 P2)

The conditions that should result in the decision to reject the takeoff between 100 knots and V1 are revised :
- The FCOM now indicates that any ECAM warning should result in the decision to reject the takeoff. The ECAM cautions that should result in the decision to reject the takeoff are listed.
- It is clarified that exceeding the EGT red line should not result in the decision to reject the takeoff at high speed.

SMOKE/EMER ELEC (FCOM 3.02.26 P 7 and QRH 1.09)

The SMOKE/FUMES/AVNCS SMOKE paper procedure in the FCOM and QRH is updated to remove the electrical shedding. The reason for this change is to eliminate the possibility to loose the DC 1+2 power for the remaining of the flight. This could occur when at least one battery is charging and at the same time the flight crew performs the electrical shedding procedure.

After this change, the flight crew can directly set the electrical emergency configuration if:

- The smoke source cannot be determined or,
- The smoke source still continues or,
- Avionics/electrical smoke is suspected.

In addition, the SMOKE/FUMES/AVNCS SMOKE paper procedure in the FCOM is updated to clarify that two different ELEC EMER CONFIG procedures can be displayed on the ECAM:

- If the alert AVIONICS SMOKE is not triggered, the ECAM displays the ELEC EMER CONFIG procedure described in FCOM 3.02.24. The flight crew must apply the ECAM without performing the GEN 1+2 reset. This is also indicated in the QRH 1.09 with the wording :
  "APPLY ECAM PROCEDURE, BUT DO NOT RESET GEN, EVEN IF REQUESTED BY ECAM"
- If the alert AVIONICS SMOKE is triggered, the ECAM displays a specific "smoke" ELEC EMER CONFIG procedure that is described in FCOM 3.02.26.

Besides, it is said that, in order to minimize the possible smoke source reactivation, the flight crew restores the generators only a few minutes before landing. This is also indicated in the QRH 1.09 with the wording : "JUST BEFORE L/G EXTENSION".

BOMB on board (FCOM 3.02.80 p10a, QRH 2.28)

The paper procedure BOMB ON BOARD is updated in order to ensure that the cabin lighting remains on while the cabin crew prepares the Least Risk Bomb Location (LRBL) and secures the bomb. However, the flight crew must shed the other cabin systems before the LRBL preparation, as mentioned in the procedure before the revision 42 :

- On aircraft equipped with the GALY&CAB pushbutton, the GALY&CAB...OFF procedure line is introduced instead of the GALLEY/COMMERCIAL...OFF procedure line. This is because when the flight crew sets the GALY&CAB pushbutton to OFF, the cabin lighting remains on, and the following systems are shed :
  - The main and secondary galleys
  - The in-seat power supply (if installed)
  - The IFE system (if installed).
- On aircraft equipped with the COMMERCIAL pushbutton, the flight crew must set the COMMERCIAL pushbutton to OFF only after the cabin crew secured the bomb at the Least Risk Bomb Location (LRBL).

In addition, to recover minimum cabin lighting, the flight crew must set the EMER EXIT LT pushbutton to ON before setting the COMMERCIAL pushbutton to OFF.
Furthermore, on aircraft equipped with the GALLEY pushbutton, but not equipped with the COMMERCIAL pushbutton, the GALLEY...OFF procedure line is introduced instead of the GALLEY/COMMERCIAL...OFF procedure line in order to better reflect the aircraft configuration.

Flight Control Check following ELAC/SEC reset on A320 (FCOM 3.04.24 p5 and QRH 2.38)

The computer-reset table is updated in order to indicate that the flight crew must perform a Flight Control check after they reset an ELAC or SEC on ground. This is because the Flight Control Computers detect some specific failures only if the flight crew moves the Flight Control Surfaces.

New VAPP Calculation in ABNORMAL/EMERGENCY Configuration (QRH 2.31)

The method to calculate the VAPP after a failure in flight is updated.
This new method takes into account the possible use of the auto-thrust at landing regardless of the △VREF value.
Furthermore, the layout of the VAPP calculation method is also enhanced : Only one calculation flow is used regardless of the △VREF value.
Moreover, in order to avoid any misunderstanding, the "NORM" indication of the table on the QRH page 2.32 is clarified. The table provides the △VREF values and landing distance factors for the landing configurations CONF3 and CONF FULL.

Note : *The description of the VAPP calculation performed by the FMGS is transferred to the QRH page 4.00A (IN FLIGHT PERFORMANCE). In addition, the Airbus recommendation on the minimum VAPP that the flight crew should use in the case of strong or gusty crosswind greater than 20 knots is detailed.*

Reference :
New VAPP Calculation Process, 15th Performance & Operations Conference in Puerto-Vallarta, Mexico (April 23-27, 2007) : www.airbusworld.com/Flight Operations community.

Emergency descent (FCOM 3.02.80 P7 and QRH 1.25)

The EMER DESCENT paper procedure is modified to :
- Indicate that the flight crew must turn on the signs before they initiate the emergency descent to ensure that the cabin is secured
- Indicate the target altitude (MAX FL100/MEA) at the end of the procedure, to ensure an efficient and safe descent
- Clarify that the flight crew must contact the cabin crew to confirm that the passenger oxygen masks are released.

New action flows in the SOPs

The concept of flow is created in order to facilitate the memorization of some actions. It groups some activities in clusters, and establishes a routine. As a first step, Airbus introduced the concept of flows in its training policy, in both the “Procedure Data Package“, and the Flight Crew Training Manual (FCTM), for all Airbus fly-by-wire models. Airbus observed that pilots, especially beginners, attribute importance to the flows, and appreciate their efficiency.
Based on this observation, Airbus decided to make a review of normal procedures, to see how the order of the actions could be enhanced, in order to :
Enhance the efficiency of the flows themselves (more intuitive order of actions)
Enhance operational communality among the several Airbus models (including A380, and future models).
These new flows lead to a new order of the actions to be performed in some parts of the SOPs, in particular :
– Cockpit Preparation (3.03.06)
– After Start (3.03.09)
– Before Takeoff (3.03.11).
The order of action lines in these SOP phases is changed in order to be in line with the upcoming new flows that will be published in the next revision of the FCTM, and associated Training Data.

Removal of explicit Callouts in the SOPs flight phases sections

In previous versions of the Standard Operating Procedures (SOPs), callouts were actions lines in the main text of the SOPs. For example :
“ANNOUNCE........ROTATE“.
Several customers noted that this was redundant with the list of the recommended callouts that is provided in the FCOM 3.03.90 section. Besides, such a duplication of information was not considered necessary, and was possibly leading to inconsistencies in the documentation.
In order to simplify this, and leave more flexibility for operators’ customization of their own callouts, it was decided to remove the explicit callouts from the main text of the SOPs (flight phase sections) and replace them by generic action lines. For example : “ROTATION...ANNOUNCE“ replaces “ANNOUNCE...ROTATE“.
With this change, the list of the Airbus recommended callouts is only in the FCOM 3.03.90 section : “Standard Callouts“.

OEB Review during Preliminary Cockpit Preparation

Before this general revision, a new dedicated section was introduced in the QRH to provide a complete list of the applicable OEBs, their entry point (ECAM alert, or other conditions) and their associated procedures (OEB PROC).
In order to highlight the importance of a thorough review of the OEBs applicable to the aircraft, a new action was introduced in the Preliminary Cockpit Preparation to recommend that both crewmembers review the applicable OEBs at that stage, and particularly the red OEBs.

TCAS set before lining up/TCAS in the BEFORE TAKEOFF checklist

In-service experience and analysis of several incidents in the aviation industry show that the use of TCAS can help the flight crew to enhance their awareness of surrounding traffic when the aircraft enters the takeoff runway.
In addition to the visual check, the TCAS display of intruders on the ND can help to locate the traffic in final approach, particularly in low visibility operations.
Therefore, it was decided to move up the action "TCAS...TA OR TA/RA", before the "APPROACH PATH CLEAR OF TRAFFIC...CHECK". This enables the flight crew to take advantage of the additional assistance of the TCAS during the check of the approach path, before the aircraft lines up on the runway.
Moreover, a new line "TCAS...TA OR TA/RA" was added in the BEFORE TAKEOFF checklist "BELOW THE LINE", to further ensure that TCAS is not inadvertently left in STBY mode for takeoff.

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

	CODE	DESIGNATION
	0001	CFM 56-5-B3 = (Mod 31707 + CFM 56–5–B1) = Mod 34818 + CFM 56-5-B1)
	0002	Mod : (21678+26377) = (21678+26999) = (21678+26377+26999)
	0003	Mod : (20268+24917+56-5-B3) = (20268+24917+31701+56-5-B1) = (20268+24917+34818+56-5-B1)
R	0004	Mod : (32088+36414) = (32090+36414) = (32088+38111) = (32090+38111)
	0005	Mod : 20268 = (20268+26999+28495)
R R	0006	Mod : 35220 = (35220+37999) = (26728+31283+35220) = (26728+31283+35220+37999)
	0007	STD = Mod : (31283+34861) = (31283+34862) = (31283+34864)
R R	0008	Mod : 20075 = 21776 = 24266 = 24267 = 37536 = 36873 = (20075+24267) = (24266+24267) = (24266+27979+37536) = (24266+32310+37536)
R	0009	Mod : (22013+35220) = (22013+35220+37999)
	0011	Mod : (21054+22013+25199) = (21054+22013+25200)
R	0012	Mod : (30020+35220) = (30020+35220+37999)
R	0013	Mod : (20024+35220) = (20024+35220+37999)
R R R	0014	Mod : (20075+26925) = (21776+26925) = (24266+26925) = (24267+26925) = (26925+37536) = (26925+36873) = (24266+26925+27979+37536) = (24266+26925+32310+37536)
	0015	STD = Mod : (30660+34861) = (30660+34864)
	0016	Mod : 28479 = 28702 = 28916 = (28479+34861) = (28479+34862)
R	0017	Mod : (20024+22013+35220) = (20024+22013+35220+37999)
R R R	0018	Mod : 30363 = 31896 = 31897 = (26999+28495+35119) = (28479+30363+34864) = (26999+28495+31896+32332+35119)
	0019	Mod : (28479+30363) = (28702+30363) = (28916+30363) = (28479+30363+34861) = (28479+30363+34862)
	0020	Mod : 24105 = (24105+30660+34861) = (24105+30660+34864)
	0021	Mod : (24105+30660) = (24105+30660+34862)
R	0022	Mod : (20024+24105+35220) = (20024+24105+35220+37999)
	0023	Mod : 22013 = (22013+31283+34861) = (22013+31283+34862) = (22013+31283+34864)
R	0024	Mod : 28951 = (28238+28951) = (28238+28951+32635+35649)
R	0025	Mod : (20024+30020+35220) = (20024+30020+35220+37999)
	0026	Mod : 20268 = (20268+25800)
	0027	Mod : 25720 = 26609 = (25720+26609)
R	0030	Mod : (24105+30020+35220) = (24105+30020+35220+37999)
	0031	Mod : (22013+26999+30626+31283+35220+33100) = (22013+26999+27646+30626+31283+35220+33100)
R R	0032	Mod : (28238+32650) = (28238+34035) = (28238+32650+32651+34035) = (28238+32635+32650+34065+35649)
	0033	Mod : (26999+30626+31283+33300+35220) = (26999+30626+31283+33100+35220) = (26999+27646+30626+31283+33100+35220) = (26999+27646+30626+31283+33300+35220)
	0034	Mod : (26999+31283+33100+35220) = (27646+31283+33100+35220) = (26999+27646+31283+33100+35220)
	0035	Mod : (21678+24105) = (21678+26335+28160) = (21678+24105+32207+35100) = (21678+26335+28160+32207+35100)

	CODE	DESIGNATION
	0036	Mod : 21988 = (21988+22013) = (21988+24105)
R	0037	Mod : (28238+32635+32650) = (28238+32635+34035) = (28238+32635+32650+32651+34035)
	0038	STD = (32619+28307) = (27725+32239)
R	0039	Mod : (22013+26401+35220) = (22013+26401+35220+37999)
	0040	Mod : 25871 = 25887 = 25893 = 26149 = 26338 = 26608
	0041	Mod : (20031+26723) = (20063+27639) = (20063+26723) = (20047+20063+27639) = (20047+20063+27410) = (20047+20063+26723) = (20047+20063+30277)
	0042	Mod : (25871+30660) = (25887+30660) = (25893+30660) = (26149+30660) = (26338+30660) = (26608+30660)
	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 : (33239+30660) = (32619+30660) = (34156+30660)
	0046	Mod : 23661 = 24783 = (23661+24783)
R	0047	Mod : (26925+35220) = (26925+35220+37999)
R	0048	Mod : (24105+35220) = (24105+35220+37999)
	0049	(20057+20059) = (20057+20059+20082+20084+36856)
R	0052	Mod : (35220+35485) = (35220+35485+37999)
	0053	Mod : 28479 = 28702 = 28916 = (28479+34861) = (28479+34862)
	0054	Mod : 24349 = 24785 = 24852 = (23779+24349) = (23779+24785) = (23779+24852) = (23779+24349+24785) = (23779+24785+24852)
	0056	Mod : (24511+28479) = (24511+28702) = (24511+28916) = (24511+28479+34861) = (24511+28479+34862)
R	0057	Mod : (31070+35220) = (31105+35220) = (31070+35220+37999) = (31105+35220+37999)
	0059	Mod : 35426 = (20141+20802+27112+35426)
R	0061	Mod : 27620 = 28658 = (27620+28658) = (27620+37285) = (27620+33497+37285) = (27620+28658+35220+37999)
	0062	Mod : (24511+26401+28479) = (24511+26401+28916) = (24511+26401+28479+34861) = (24511+26401=28479+34862)
	0063	Mod : 22536 = 23227 = 23529 = (22536+23529)
	0064	Mod : (21615+27942) = (20141+20802+21615+22269+23264+23900+27942)
	0066	STD = Mod : (31283+34861) = (31283+34862) = (31283+34864)
	0067	STD = Mod : (20024+22013) = (20024+22013+31283+34861) = (20024+22013+31283+34862) = (20024+22013+31283+34864)
	0068	Mod : 20024 = (20024+31283+34861) = (20024+31283+34862) = (20024+31283+34864)
R	0069	Mod : (21678+26017+33100) = (21678+26017+33100+35220+37999)
	0070	Mod : (20024+22013) = (20024+22013+31283+34861) = (20024+22013+31283+34862) = (20024+22013+31283+34864)
R	0071	Mod : 27620 = (27620+37285) = (27620+33497+37285)
R	0072	Mod : (33125+27620) = (33125+27620+37285) = (33125+27620+33497+37285)
	0074	Mod : 22013 = (22013+31283+34861) = (22013+31283+34862) = (22013+31283+34864)

	CODE	DESIGNATION
R	0075	Mod : STD = (22013+24044) = (25951+32239)
R	0076	Mod : (36847+56-5-A1/A3/B4) = (36311+36847+56-5-B6) = (22562+36847+V2500A1) = (36847+36297/56-5-B5) = (28160+28917+36847+56-5-A1/A3/B4) (28160+36297+36847/56-5-B5) = (36311+28160+28917+36847+56-5-B6) = (22562+28160+28917+36847+V2500A1) = (28160+28917+36297+36847/56-5-B5)
R	0077	Mod : (36847+56-5-A4/A5/B1/B2/B3/B5/B6/B7/B8/B9/PW ALL) = (28160+36847+56-5-A3/B4) = (36311+28160+36847+56-5-B6) = (22562+28160+36847+V2500A1) = (28160+36297+36847/56-5-B5)
	0078	Mod : (20024+22013) = (20024+22013+31283) = (20024+22013+31283+34861) = (20024+22013+31283+34862) = (20024+22013+31283+34864)
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	0080	Mod : 24645 = (24645+28479+34864)
	0081	Mod : (24645+28479) = (24645+28702) = (24645+28916) = (24645+28479+34861) = (24645+28479+34862)
	0082	Mod : (20268+36311) = (20268+36297) = (20268+36885)= (20268+25800+36311) = (20268+25800+36297) = (20268+25800+36885) = (20268+25530+26505+36311) = (20268+25530+26505+36297) = (20268+25530+26505+36885) = (20268+25800+25530+26505+36297) = (20268+25800+25530+26505+36885) = (20268+25800+25530+26505+36311)
R	0083	Mod : (20268+36847+56-5-A1/A3/B4) = (20268+36297+36847+56-5-B5) = (20268+36311+36847+56-5-B6)
	0084	Mod: (24645+26925+28479) = (24645+28702+26925) = (24645+28916+26925) = (24645+26925+28479+34861) = (24645+26925+28479+34862)
	0085	Mod: (36310+20268) = (36310+20268+25800)
	0086	Mod: 22013=24105=28160=24701=(24701+28160+28917)
	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
R	0088	Mod : 25615 = 38140 = (25615+25888+27609) = (22562+25072+25615+28897)
	0091	Mod : 28479 = 28916 = (28479+34861)
	0092	Mod : (22013+28479) = (22013+28916) = (25951+28479) = (25951+28916) = (22013+28479+34861) = (22013+28479+34862) = (25951+28479+34861) = (25951+28479+34862)
R	0093	Mod : (32401+37999) = (32402+37999) = (32475+37999) = (32929+37999)
	0094	Mod : 28479 = 28916 = (26017+28916) = (28160+28479+28917) = (28160+28916+28917) = (25410+26017+28916)+CFM
	0095	Mod : (20268+24917+56-5-B4) = (20268+24917+36311+56-5-B6) = (20268+24917+36885+56-5-B6) = (20268+24917+36297+56-5-B5)
	0096	STD = Mod : (22013+24044) = (25951+32239) = (31283+34864) = (22013+24044+31283+34864) = (25954+32239+31283+34864)
	0097	Mod : 22013 = 25951 = (22013+31283+34864) = (25951+31283+34864)
	0098	Mod : 28479 = 28702 = 28916 = 30660 = (31283+34861) = (31283+34862) = (28479+25951+32239) = (28702+25951+32239) = (28916+25951+32239) = (30660+25951+32239) = (28479+22013+24044) = (28702+22013+24044) = (28916+22013+24044) = (30660+22013+24044) = (25951+32239+31283+34861) = (25951+32239+31283+34862) = (22013+24044+31283+34861) = (22013+24044+31283+34862)

	CODE	DESIGNATION
	0099	Mod: (20268+36311) = (20268+36297) = (20268+36885) = (20268+24946+26965+36311) = (20268+24946+27773+36311) = (20268+25951+26965+36311) = (20268+25951+27773+36311) = (20268+26760+26965+36311) = (20268+26760+27773+36311) = (20268+26965+32150+36311) = (20268+26965+32238+36311) = (20268+26965+32239+36311) = (20268+26965+32311+36311) = (20268+27773+32150+36311) = (20268+27773+32238+36311) = (20268+27773+32239+36311) = (20268+27773+32311+36311) = (20268+26965+35040+36311) = (20268+27773+35040+36311) = (20268+24946+26965+36297) = (20268+24946+27773+36297) = (20268+25951+26965+36297) = (20268+25951+27773+36297) = (20268+26760+26965+36297) = (20268+26760+27773+36297) = ”(20268+26965+32150+36297) = (20268+26965+32238+36297) = (20268+26965+32239+36297) = (20268+26965+32311+36297) = (20268+27773+32150+36297) = (20268+27773+32238+36297) = (20268+27773+32239+36297) = (20268+27773+32311+36297) = (20268+26965+35040+36297) = (20268+27773+35040+36297) = (20268+24946+26965+36885) = (20268+24946+27773+36885) = (20268+25951+26965+36885) = (20268+25951+27773+36885) = (20268+26760+26965+36885) = (20268+26760+27773+36885) = (20268+26965+32150+36885) = (20268+26965+32238+36885) = (20268+26965+32239+36885) = (20268+26965+32311+36885) = (20268+27773+32150+36885) = (20268+27773+32238+36885) = (20268+27773+32239+36885) = (20268+27773+32311+36885) = (20268+26965+35040+36885) = (20268+27773+35040+36885)”
R	0100	Mod : (26526+26999+28479+37999) = (26526+26999+28382+28479+28495+37999)
	0101	Mod : 24511 = (24511+28479+34864)
	0102	Mod : (36310+20268) = (36310+20268+25800)
R R	0103	Mod : 37999 = (31896+32332+37999) = (31896+32402+37999) = (31897+32333+37999) = (31897+32401+37999)
	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
R	0108	Mod : (28162+33323) = (28162+30748+33323)
	0109	Mod : (31896+36481/56-5-B4) = (32475+36481/56-5-B4) = (31896+33910/56-5-B5) = (32475+33910/56-5-B5) = (31896+36481/56-5-B6) = (32475+36481/56-5-B6) = (31896+36481/56-5-B7) = (32475+36481/56-5-B7) = (31896+36481/56-5-B9) = (32475+36481/56-5-B9) = (31896+32332+32475+36481/56-5-B4) = (31896+32332+32475+33910/56-5-B5) = (31896+32332+32475+36481/56-5-B6) = (31896+32332+32475+36481/56-5-B7) = (31896+32332+32475+36481/56-5-B9)
	0110	Mod : (31896+36481) = (32475+36481) = (31896+32332+32475+36481)
	0111	Mod : (21678+21858) = (20117+21678+21858)
	0113	Mod : 26149 = 26608 = (26149+26608) = IAE V2522 = V2524 = V2527 = V2527E = V2527M = V2530 = V2533
R	0114	Mod : (31896+37999) = (31897+37999) = (31897+32401+35651)
	0115	IAE V2500 = V2522 = V2524 = V2527 = V2527E = V2527M = (V2500 = V2522 = V2524 = V2527 = V2527E = V2527M+US) = (26346+IAE V2500 = V2524 = V2527 = V2527M)
R R R	0116	STD = Mod: 31896 = 31897 = 32401 = 32402 = 32929 = 32475 = (31896+32332+32475) = (31897+32333+32929) = (20586+22013+30422) = (22013+30422+37565)
	0117	STD = IAE = Mod : 26017 = (26017+IAE)
R R R	0118	Mod : (21678+22013) = (21678+24105) = (21678+28160) = (21678+22013+31283+34861) = (21678+22013+31283+34864) = (21678+28160+31283+34861) = (21678+24105+31283+34861)
	0119	Mod : 33100 = 33300 = (33100+32650+32651) = (33300+32650+32651)

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	0120	Mod : (33909/V2522) = (35932/V2524) = (35932/V2527) = (35932/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)
	0124	Mod : (26284+30206) = (26285+30206) = (26284+36136) = (26285+36136)
	0128	Mod : 22013 = (22013+27846) = (22013+28960) = (22013+28479) = (22013+28916) = (22013+28479+28960) = (22013+27846+28916)
R	0129	Mod : (21678+22013+30660) = (21678+24105+30660) = (21678+28160+30660)
	0130	Mod : (28160+30660) = (25888+28160+30660) = (25888+28160+30660+35864)
	0131	Mod : (22562+30660) = (30660+35864) = (22562+30660+34862) = (22562+30660+35864)
	0132	Mod : (25888+30660) = (25888+34862+30660) = (25888+30660+35864)
	0133	Mod : 25404 = (25404+30660+34861) = (25404+30660+34864)
	0134	Mod : 30660 = (30660+27725+33239) = (30660+28307+32619)
	0135	Mod : (28307+30660) = (27725+30660)
	0136	Mod : (28307+32619) = (27725+33239)
	0137	Mod : 20063 = (20031+20047) = (20047+20063)
R	0139	Mod : (27650+28244+34825+37999) = (26999+27650+28244+37999) = (25205+27650+28244+37999) = (26111+27650+28244+37999) = (27650+28244+28382+37999) = (27650+28244+30241+37999) = (26999+27650+28244+28382+28495+37999)
R	0140	Mod : (26999+28244+33505+34825+37999) = (26999+28244+30170+34660+37999) = (26999+34637+34660+35350+37999) = (26999+28244+34660+34825+37999) = (26999+28244+33253+34825+37999) = (26999+28244+33505+34637+35350+37999) = (26999+28244+33253+34637+35350+37999)
	0142	Mod : (22562+31112+31495) = (20151+22562+31495) = (22562+31495+23092) = (20063+20151+22562+31495) = (20063+22562+31112+31495) = (20063+20151+31495+35864) = (20063+31115+31495+35864) = (20063+20151+22562+31495+35864) = (20063+22562+31112+31495+35864)
R	0143	Mod : 37999 = (31364+31897+37999) = (24105+31364+37999) = (24105+31365+37999) = (24105+31896+37999) = (24105+31897+37999) = (24105+32929+37999) = (24105+31379+37999)
	0144	Mod : 22013+27276+30748+34540
	0145	Mod : 22013+27276+33323+34540
	0146	Mod : 34637 = (26526+34637) = (26526+27046+31375+34637) = (26526+31375+34637+36720)
R	0147	Mod : (30020+37999) = (26925+30020+37999)
	0148	STD = Mod : 25072 = 27609 = (22562+25072) = (25888+27609) = (22562+25072+28897)
	0149	Eng : (V2522A5/V2524A5/V2527A5/V2527EA/V2530A5/V2533A5)
	0150	Mod : 35864 = (22562+28897) = (30784+35864) = (22562+25888+27609+28897)
	0151	Mod : 25888 = (22562+25888) = (25072+25888) = (25888+30784) = (25888+35864) = (22562+25072+25888) = (25888+30784+35864) = (25615+25888+35864)
	0152	Mod : STD = (20056+33129) = (20056+34664)
	0153	Mod : STD = 22190 = 34664 = (20056+22190) = (20056+33129) = (30626+35110) = (20056+34664)
	0154	Mod : 30626 = (20056+30626+33129) = (20056+30626+34664)
	0156	Mod : 25863 = (25863+28551+34195)
	0157	Mod : (25863+ACA) = (25863+28551+34195+ACA)

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	0158	Mod : 25863 = (25863+ACA) = (25863+28551+34195) = (25863+28551+34195+ACA)
R	0161	Mod : (26999+27650+28244+37999) = (27650+28244+28382+37999) = (26999+27650+28244+28382+28495+37999)
R	0164	Mod : (25615+35864) = (35864+38140) = (22562+25615+28897) = (22562+28897+38140) = (22562+25615+25888+27609+28897)
	0165	Mod : (24105+27276) = (24105+31395) = (26334+27276) = (26334+31395) = (26335+27276) = (26335+31395) = (24105+27276+31395) = (26334+27276+31395) = (26335+27276+31395) = (24105+27276+30977+31395+32207+35100) = (26335+27276+30977+31395+32207+35100)
	0166	STD = Mod : (22013+33879) = (22013+30977) = (24105+33879) = (24105+30977) = (30977+35100)
	0167	Mod : 30020 = 30977 = 33879 = (24105+30020+30977)
	0170	STD = Mod : 24588 = 35216 = 36368 = (24215+24588) = (26925+35216) = (26925+36368) = (24215+24588+26925+36368) = (24215+24588+26925+35216)
	0171	Mod : 32088 = 32090 = (24588+32088) = (24588+32090) = (32088+32090) = (32088+35216) = (32090+35216) = (32088+36368) = (32090+36368) = (24215+24588+32088) = (24215+24588+32090) = (24588+32088+32090) = (26925+32090+36368) = (32088+26925+35216) = (26925+32090+35216) = (26925+32088+36368) = (24215+24588+32088+32090) = (24215+24588+26925+32088+32090+35216) = (24215+24588+26925+32088+32090+36368)
	0172	Mod : 28258 = 30470 = 26438 = 27624 = 23888 = 25829 = 32015 = 34330 = 34331 = 34332 = 34333 = 34334 = 35436 = (34330+34332) = (27624+28258) = (27624+30470)
	0173	STD = (22013+23219+23672) = (23672+24105+25294) = (23672+24105+25294+27620+33497)
R	0174	Mod : (26999+28244+33253+34825+37999) = (26999+28244+34637+34660+35350+37999) = (26999+28244+28382+28495+33253+34825+37999) = (26999+28244+34637+34660+34825+35350+37999) = (26999+28244+28382+28495+33253+34825+37999) = (26999+28244+28382+28495+34637+34660+37999) = (26999+28244+28382+28495+34637+34660+34825+37999) = (26999+28244+28382+28495+34637+34660+35350+37999) = (26999+28244+28382+28495+34637+34660+34825+35350+37999)
R	0175	Mod : (25205+37999) = (26111+37999) = (26485+37999) = (26999+37999) = (28382+37999) = (30241+37999) = (30631+37999) = (23885+26111+37999) = (23885+26999+37999) = (26999+28382+28495+37999)
R	0176	Mod : (37999 / V2500A1/A5/EA5/56-5-A1/A3) = (36297+56-5-B5/B4) = (36311+56-5-B6)
	0177	Mod : 34637 = (22013+23219+23672+34637) = (23672+24105+25294+34637)
R	0178	Mod : 28238 = (28238+32650+32651) = (28238+32635+35649)
	0179	Mod : (30020+26925) = (24105+26925+30020)
R	0180	Mod : (25241+37999) = (25242+37999) = (25241+25242+37999)
	0181	Mod : (25108+27620) = (35793+27620) = (22013+23672+27620) = (23672+24105+27620) = (24581+36529+27620) = (24785+36529+27620) = (25108+30020+27620) = (22013+23219+36529+27620) = (24105+25294+36529+27620) = (24105+25108+30020+27620) = (24581+30020+36529+27620) = (24785+30020+36529+27620) = (22013+23219+23672+35793+27620) = (22013+23219+23672+36529+27620) = (23672+24105+25294+35793+27620) = (23672+24105+25294+36529+27620)
	0182	Mod : 35220 = (28479+31283+35220)

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	0183	Mod : 24105 = (24105+27846) = (24105+27846+28916) = (24105+27846+28479) = (24105+27846+28702)
	0184	Mod : (25108+34637) = (35793+34637) = (22013+23672+34637) = (23672+24105+34637) = (24581+36529+34637) = (24785+36529+34637) = (25108+30020+34637) = (22013+23219+36529+34637) = (24105+25294+36529+34637) = (24105+25108+30020+34637) = (24581+30020+36529+34637) = (24785+30020+36529+34637) = (22013+23219+23672+35793+34637) = (22013+23219+23672+36529+34637) = (23672+24105+25294+35793+34637) = (23672+24105+25294+36529+34637)
	0185	Mod : (25108+34637+27620) = (35793+34637+27620) = (22013+23672+34637+27620) = (23672+24105+34637+27620) = (24581+36529+34637+27620) = (24785+36529+34637+27620) = (25108+30020+34637+27620) = (22013+23219+36529+34637+27620) = (24105+25294+36529+34637+27620) = (24105+25108+30020+34637+27620) = (24581+30020+36529+34637+27620) = (24785+30020+36529+34637+27620) = (22013+23219+23672+35793+34637+27620) = (22013+23219+23672+36529+34637+27620) = (23672+24105+25294+35793+34637+27620) = (23672+24105+25294+36529+34637+27620)
R	0186	STD = Mod : (26999+28495) = (26999+28495+32929) = (26999+28495+32475) = (26999+28495+31896+32402) = (26999+28495+31897+32401)
R	0187	Mod : 25205 = 26111 = 26485 = 26999 = 28382 = 30241 = 30631 = (25205+26999+28495) = (26999+28382+28495) = (26999+31896+32332) = (26999+31897+32333) = (25205+31896+32332) = (25205+31897+32333) = (26111+31896+32332) = (26111+31897+32333) = (26485+31896+32332) = (26485+31897+32333) = (28382+31896+32332) = (28382+31897+32333) = (30241+31896+32332) = (30241+31897+32333) = (30631+31896+32332) = (30631+31897+32333) = (26999+28382+28495+31897+32333) = (25205+26999+28495+31896+32332) = (25205+26999+28495+31897+32333) = (26999+28382+28495+31896+32332) =
	0188	STD = Mod : 20062+22188
	0189	Mod : 24035 = 24160 = 24211 = (24035+24211)
	0190	Mod : (30368+32205+33125+35220) = (32205+33125+35220+35485)
	0191	Mod : (32205+33125+35220+35485) = (30368+32205+33125+35220)
	0194	Mod : (32205+33125+35220+35485+35871) = (30368+32205+33125+35220+35871)
	0195	Mod : (24105+31283+36847) = (30020+31283+36847)
	0196	Mod : (25205+35871) = (23885+35871) = (26999+35871) = (28382+35871) = (30241+35871) = (26485+35871) = (30631+35871) = (26999+28382+28495+35871) = (25205+26999+28495+35871)
R	0198	Mod : 25205 = 26111 = 26485 = 26999 = 28382 = 30241 = 30631 = (25205+26999+28495) = (26999+28382+28495) = (25205+31896+32332) = (25205+31897+32333) = (26111+31896+32332) = (26111+31897+32333) = (26485+31896+32332) = (26485+31897+32333) = (26999+31896+32332) = (26999+31897+32333) = (28382+31896+32332) = (28382+31897+32333) = (30241+31896+32332) = (30241+31897+32333) = (30631+31896+32332) = (30631+31897+32333) = (25205+26999+28495+31896+32332) = (25205+26999+28495+31897+32333) = (26999+28382+28495+31896+32332) = (26999+28382+28495+31897+32333)
	0199	Mod : 22013 = 24105 = 28160 = 24701 = (24701+28160+28917)
	0201	Mod : (22249+25529+31283+24105+36847) = (22249+26270+31283+24105+36847) = (22249+25529+26117+31283+24105+36847) = (22249+26117+26270+31283+24105+36847) = (22249+25529+31283+24105+36847)

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R	0202	Mod : (25205+31896) = (25205+31897) = (25205+35119) = (25205+32929) = (25205+32475) = (25205+31896+32332+32475) = (25205+31897+32333+32929) = (25205+31896+32332+35119) = (26111+31896) = (26111+31897) = (26111+35119) = (26111+35119) = (26111+32929) = (26111+32475) = (26111+31896+32332+32475) = (26111+31897+32333+32929) = (26111+31896+32332+35119) = (26485+31896) = (26485+31897) = (26485+35119) = (26485+32929) = (26485+32475) = (26485+31896+32332+32475) = (26485+31897+32333+32929) = (26485+31896+32332+35119) = (26999+31896) = (26999+31897) = (26999+35119) = (26999+32929) = (26999+32475) = (26999+31896+32332+32475) = (26999+31897+32333+32929) = (26999+31896+32332+35119) = (28382+31896) = (28382+31897) = (28382+35119) = (28382+32929) = (28382+32475) = (28382+31896+32332+32475) = (28382+31897+32333+32929) = (28382+31896+32332+35119) = (30241+31896) = (30241+31897) = (30241+35119) = (30241+32929) = (30241+32475) = (30241+31896+32332+32475) = (30241+31897+32333+32929) = (30241+31896+32332+35119) = (30631+3196) = (30631+31897) = (30631+35119) = (30631+32929) = (30631+32475) = (30631+31896+32332+32475) = (30631+31897+32333+32929) = (30631+31896+32332+35119) = (25205+26999+28495+31896) = (25205+26999+28495+31897) = (25205+26999+28495+35119) = (25205+26999+28495+32929) = (25205+26999+28495+32475) = (25205+26999+28495+31896+32332+32475) = (25205+26999+28495+31897+32333+32929) = (25205+26999+28495+31896+32332+35119) = (26999+28382+28495+31896) = (26999+28382+28495+31897) = (26999+28382+28495+35119) = (26999+28382+28495+32929) = (26999+28382+28495+32475) = (26999+28382+28495+31896+32332+32475) = (26999+28382+28495+31897+32333+32929) = (26999+28382+28495+31896+32332+35119)
	0205	Mod : 26876 = 26877 = 27698 = 27740 = 27753 = 28739 = 30163 = 28738 = 31001 = 31699
	0206	Mod : (22249+24105+26117+26728+31283+34041+36847) = (22249+30020+26117+26728+31283+34041+36847) = (22249+24105+26270+31283+34041+36847) = (22249+30020+26270+31283+34041+36847)
	0207	Mod : 36609 = 36772 = 36562 = (22013+30096+34313+36562) = (22013+30096+34809+36772) = (24105+30096+34313+36562) = (24105+30096+34809+36772)
	0208	Mod : 34313 = 34809 = (24105+30096+34313) = (24105+30096+34809) = (22013+30096+34313) = (22013+30096+34809)
	0209	Mod : 35871 = (35871+31105+35220) = (35871+31070+35220) = (35871+31105+34041+35220) = (35871+31070+34041+35220) = (30020+35871+31105+35220) = (35871+30020+31070+35220)
	0210	Mod : (23219+30206) = (23672+30206) = (24579+30206) = (24581+30206) = (23219+23672+30206) = (23219+23672+24579+30206)
R	0212	Mod : STD = 20063 = 20151 = (31495+35270) = (20063+20151) = (20063+31112) = (20063+23092) = (22562+25072) = (20063+22562+25072) = (20063+22562+25888) = (20151+22562+25072) = (20151+22562+25888) = (20063+20151+31495+35270) = (20063+20151+25888+31495+35270+35864)
	0213	Mod : 23219 = 23672 = 24579 = 24581 = (23219+23672) = (23219+23672+24579)
R	0215	Mod : 25205=26111=26485=26999=28382=30241=30631 = (25205+26999+28495) = (26999+28382+28495)
R	0216	Mod : (26999+36998) = (25205+36998) = (26111+36998) = (26485+36998) = (28382+36998) = (30241+36998) = (30631+36998) = (25205+26999+28495+36998) = (26999+28382+28495+36998)

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R 0217	Mod : 22562 = (22562+31495+35270) = (20063+22562+31495+35270) = (20063+22562) = (20151+22562) = (20063+20151+22562) = (20063+31495+35270+35864) = (20063+22562+25888+27609) = (20151+22562+25888+27609) = (20063+20151+31495+35270+35864) = (20063+22562+31495+35270+35864)
R 0218	Mod : 22013 = (22013+20063) = (22013+23092) = (22013+31495+35270) = (20063+20151+22013) = (20063+22013+23092) = (20063+22013+25888) = (20063+22013+22562+25072) = (20063+22013+22562+25888) = (20063+22013+22562+37987) = (20063+22013+25072+25888) = (20151+22013+22562+25072) = (20063+20151+22013+31495+35270)
R 0219	Mod : (25205+37665) = (26111+37665) = (26485+37665) = (26999+37665) = (28382+37665) = (30241+37665) = (30631+37665) = (25205+26999+28495+37665) = (26999+28382+28495+37665)
R 0220	Mod : (25205+36998+37665) = (26111+36998+37665) = (26485+36998+37665) = (26999+36998+37665) = (28382+36998+37665) = (30241+36998+37665) = (30631+36998+37665) = (25205+26999+28495+36998+37665) = (26999+28382+28495+36998+37665)
0221	Mod : (23672+26284) = (23672+26285) = (23219+23672+24579+26285)
0222	STD = Mod : 20067+20069+20071+28474+28478
R 0223	Mod : (22013+22562) = (20063+22013+22562) = (20151+22013+22562) = (22013+22562+31495+35270) = (20063+20151+22013+22562) = (20063+22013+22562+31495+35270) = (20063+22013+22562+25888+27609)
R 0224	Mod : (23222+25615) = (23222+25615+32207) = (23222+25615+32207) = (23222+25615+32207 / 56-5-b7) = (23222+25615+32207 / v2527m)
R 0227	Mod : 30660 = (28479+30660) = (30660+34862) = (28479+30660+34862) = (30660+35220+37999) = (28479+30660+35220+37999)
R 0229	Mod : 22562 = 25888 = 35864 = 37987 = (22562+35864) = (25888+27609+37987) = (22562+28160+28917) = (25888+28160+28917) = (22562+30660+34861) = (22562+30660+34864) = (25888+30660+34861) = (25888+30660+34864) = (22562+25072+25888)
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)
R 0231	Mod : 25888 = 37987 = (25888+30660+34861) = (25888+30660+34864) = (25888+27609+37987)
0232	STD = Mod : 25410 = 26017 = (25410+26017)
R 0233	Mod : 24498 = 24642 = 25568 = 25888 = 28651 = 37987
R 0234	Mod : 25888 = 37987 = (25888+28160+28917) = (25888+30660+34861) = (25888+30660+34864) = (22562+25072+25888) = (25888+27609+37987)
0235	Mod : (21678+21858) = (20117+21678+21858)
R 0236	Mod : 25888 = 37987 = (25888+30660+34861) = (25888+30660+34864) = (22562+25072+25888) = (25888+27609+37987)
R 0237	Mod : (20063+22562+31495) = (20063+31495+35864) = (20063+22562+31495+35864) = (20063+22562+31495+25888+27609) = (20063+31495+35864+25888+27609)
0238	STD = Mod : (28160+28413) = (28160+28917) = (28160+28413+28917)
R 0239	Mod : STD = (26497+28290) = (32929+37588) = (32401+37588) = (26497+28290+32929+37588) = (26497+28290+32401+37588)
R 0241	STD = Mod : (36297/B5) = (36311/B6) = (28160+28917/A1/A3/B4) = (25888+28160+28917/A1/A3/B4) = (28160+28917+37987/A1/A3/B4)
R 0242	STD = Mod : (36297/B5) = (36311/B6) = (28160+28917/A1/A3/B4) = (36311+30660/B6)

	CODE	DESIGNATION
	0243	Mod : (34041+36847) = (20268+34041+36847)
	0244	Mod : (22013+28479+28721+30439) = (22013+28479+28960+30439) = (22013+28479+30439+32011) = (22013+28479+30439+32456) = (22013+27846+28721+28916+30439) = (22013+27846+28479+28960+30439) = (22013+28479+28721+30439+32011) = (22013+27846+28479+28721+30439+32011)
	0247	Mod : (20059+20084) = (30020+30066) = (20057+20059+20084)
R	0249	Mod : (20151+22013+31495) = (22013+31112+31495) = (22013+23092+31495) = (20063+20151+22013+31495) = (20063+22013+31112+31495) = (20063+20151+22013+25888+31495+35864) = (20063+22013+25888+31112+31495+35864)
R	0250	Mod : 34637 = (26526+34637) = (26526+27046+31375+34637) = (26526+31375+34637+36720) = (20063+22013+22562+31495+25888+27609) = (20063+22013+31495+35864+25888+27609)
	0251	Mod : 24064 = 24065 = 24066 = 24067 = (24064+26346+US) = (24065+26346+US) = (24066+26346+US) = (24067+26346+US)
	0255	Mod : 36847 = (28160+28917+36847)
	0256	Mod : (20067+20069+35220) = (20067+20069+31283+35220)
R	0257	Mod : 28162 = (28162+30748)
	0258	STD = Mod : (22013+25199) = (22013+25200)
R	0259	Mod : 28160 = (28160+30660+34861) = (28160+30660+34864)
	0262	Mod : (20057+20067+35220+20069) = (20057+20067+20069+31283+35220)
	0264	Mod : 27698 = 27740 = 27753 = 28739 = 30163 = 28738 = 31001 = 26877 = 26876 = 31699 = (22536+27698) = (22536+27740) = (22536+30163) = (23227+27740) = (23227+28738) = (23227+28739) = (23529+26877) = (23529+27698) = (23529+27740) = (23529+27753) = (23529+31699) = (23227+27698+30163) = (23529+26877+31699)
	0269	Mod : 36847+(V2522 = V2524 = V2527M = 56-5-A1 = 56-5-A3 = 56-5-A4 = 56-5-A5 = 56-5-B4 = 56-5-B5 = 56-5-B6 = 56-5-B7)
	0270	Mod : ((20343+36847) = (31276+36847) = (20343+27498+36847) = (27498+31276+36847)) + (V2522 = V2524 = V2527M = 56-5-A1 = 56-5-A3 = 56-5-A4 = 56-5-A5 = 56-5-B4 = 56-5-B5 = 56-5-B6 = 56-5-B7)
	0271	Mod : (20343+36847) = (31276+36847) = (20343+27498+36847) = (27498+31276+36847)
	0272	Mod : (22013+36847) + (V2530 = V2533 = 56-5-B1 = 56-5-B2 = 56-5-B3)
	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	Mod : (27498+36847) + (V2522 = V2524 = V2527M = 56-5-A1 = 56-5-A3 = 56-5-A4 = 56-5-A5 = 56-5-B4 = 56-5-B5 = 56-5-B6 = 56-5-B7)
	0276	STD = Mod : 28479 = 28916 =27846 = (27846+28479) = (27846+28916)
	0277	Mod : (27498+36847) + (V2500 = V2527 = V2527E)
	0278	Mod : ((20343+22013+36847) = (22013+31276+36847) = (20343+22013+27498+36847) = (22013+27498+31276+36847)) + (V2530 = V2533 = 56-5-B1 = 56-5-B2 = 56-5-B3)
	0279	Mod : (22013+27498+36847) + (V2530 = V2533 = 56-5-B1 = 56-5-B2 = 56-5-B3)
	0284	Mod : (20057+20067+20069+20071+35220) = (20057+20067+20069+20816+27063+35220)
	0285	Mod : (22013+36847/56-5-B1/B2/B3/IAE) = (22013+26017+36847/56-5-B1/B2//B3/IAE)

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0286	Mod : (20057+20059+20067+20069+20071+35220) = (20057+20059+20067+20069+20071+32146+35220) = (20057+20059+20067+20069+20816+27063+35220) = (20057+20059+20067+20069+20071+31283+34864+35220) = (20057+20059+20067+20069+20071+31283+34862+35220)
0289	Mod : (20059+20067+20069+20071+30020+35220) = (20269+20067+20069+20071+30354+31283+35220) = (20059+20067+20069+20071+33100+31283+35220)
0290	Mod : (36847/56-5-A1/A3/A4/A5/IAE) = (36847+25072/56-5-A1/A3/A4/A5/IAE) = (36847+30660/56-5-A1/A3/A4/A5/IAE) = (36847+28160/56-5-A1/A3/A4/A5/IAE) = (36847+22562/56-5-A1/A3/A4/A5/IAE) = (36847+25888/56-5-A1/A3/A4/A5/IAE) = (36847+35864/56-5-A1/A3/A4/A5/IAE) = (36847+25888+30660/56-5-A1/A3/A4/A5/IAE) = (36847+22562+28160/56-5-A1/A3/A4/A5/IAE) = (36847+28160+30660/56-5-A1/A3/A4/A5/IAE) = (36847+25888+28160/56-5-A1/A3/A4/A5/IAE) = (36847+28160+28917/56-5-A1/A3/A4/A5/IAE) = (36847+30660+34862/56-5-A1/A3/A4/A5/IAE) = (36847+22562+30660/56-5-A1/A3/A4/A5/IAE) = (36847+30660+35864/56-5-A1/A3/A4/A5/IAE) = (36847+22562+25072/56-5-A1/A3/A4/A5/IAE) = (36847+22562+35864/56-5-A1/A3/A4/A5/IAE) = (36847+28160+28917+30660/56-5-A1/A3/A4/A5/IAE) = (36847+25888+28160+28917/56-5-A1/A3/A4/A5/IAE) = (36847+25888+30660+34862/56-5-A1/A3/A4/A5/IAE) = (36847+25888+30660+35864/56-5-A1/A3/A4/A5/IAE) = (36847+22562+25072+28160/56-5-A1/A3/A4/A5/IAE) = (36847+28160+30660+34861/56-5-A1/A3/A4/A5/IAE) = (36847+28160+30660+34864/56-5-A1/A3/A4/A5/IAE) = (36847+25888+28160+30660/56-5-A1/A3/A4/A5/IAE) = (36847+22562+30660+34862/56-5-A1/A3/A4/A5/IAE) = (36847+22562+30660+35864/56-5-A1/A3/A4/A5/IAE) = (36847+22562+30660+34861/56-5-A1/A3/A4/A5/IAE) = (36847+25888+30660+34861/56-5-A1/A3/A4/A5/IAE) = (36847+25888+30660+34864/56-5-A1/A3/A4/A5/IAE) = (36847+22562+30660+34864/56-5-A1/A3/A4/A5/IAE) = (36847+22562+25072+28160/56-5-A1/A3/A4/A5/IAE) = (36847+28160+30660+34862/56-5-A1/A3/A4/A5/IAE) = (36847+22562+28160+30660/56-5-A1/A3/A4/A5/IAE) = (36847+22562+28160+28917/56-5-A1/A3/A4/A5/IAE) = (36847+25888+28160+30660/56-5-A1/A3/A4/A5/IAE) = (36847+25072+28160+28917/56-5-A1/A3/A4/A5/IAE) = (36847+25888+28160+28917/56-5-A1/A3/A4/A5/IAE)= (36847+22562+25072+28160+30660/56-5-A1/A3/A4/A5/IAE) = (36847+22562+28160+30660+34861/56-5-A1/A3/A4/A5/IAE) = (36847+22562+28160+30660+34864/56-5-A1/A3/A4/A5/IAE) = (36847+22562+28160+28917+30660/56-5-A1/A3/A4/A5/IAE) = (36847+25888+28160+28917+30660/56-5-A1/A3/A4/A5/IAE) = (36847+28160+28917+30660+34862/56-5-A1/A3/A4/A5/IAE) = (36847+25888+28160+30660+35864/56-5-A1/A3/A4/A5/IAE) = (36847+25888+28160+30660+34861/56-5-A1/A3/A4/A5/IAE) = (36847+25888+28160+30660+34864/56-5-A1/A3/A4/A5/IAE) = (36847+22562+25072+28160+28917/56-5-A1/A3/A4/A5/IAE) = (36847+25888+28160+30660+34862/56-5-A1/A3/A4/A5/IAE) = (36847+22562+25072+28160+28917/56-5-A1/A3/A4/A5/IAE)
0291	Mod : 36847 = (V2522 = V2524 = V2527MA5 = 56-5-A4 = 56-5-A5 = 56-5-B5 = 56-5-B6 = 56-5-B7)
R 0292	Mod : (25888+30660) = (25888+34862+30660) = (25888+30660+35864)
0293	Mod : 30470 = 35436 = (27624+28258) = (27624+30470)
0294	STD = Mod : 23450 = 24588 = (20406+23450) = (23450+24588) = (20406+23450+24588) = (20406+23450+24588+28916)

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R	0295	Mod : 28378 = 33973 = 34456 = 37226 = (28238+32651) = (33973+32651) = (34456+32651) = (37226+32651) = (28378+32650+32651) = (33973+32650+32651) = (34456+32650+32651) = (32650+32651+37226)
R	0299	Mod : 30660 = (30660+31283+35220+37999)
R	0300	Mod : (28378+34035) = (33973+34035) = (34456+34035) = (28378+32650) = (33973+32650) = (34456+32650) = (32650+37226) = (34035+37226)
R	0301	Mod : (20067+20069) = (20067+20069+34862) = (20067+20069+31283+34862) = (20067+20069+31283+34864) = (20067+20069+31283+34861)
	0302	Mod : (22013+36847) = (V2530=V2533 = 56-5-B1 = 56-5-B2 = 56-5-B3)
	0303	Mod : (20047+20151) = (20047+23092) = (20063+20151) = (20047+20063+20151) = (20047+20063+23092) = (20047+20063+31112) = (20063+31112)
R	0304	Mod : (20059+20067) = (20059+20069) = (20059+20067+20069) = (35236+20067+20069) = (20059+20067+20069+34862) = (20059+20067+20069+31283+34861) = (20059+20067+20069+31283+34862) = (20059+20067+20069+31283+34864) = (20059+20067+20069+33100+34856+31283+34861) = (20059+20067+20069+33100+34856+31283+34862)
R	0305	Mod : (20067+20069+31283) = (20067+20069+31283+34862+37809)
	0306	Mod : 36847 = (36847+22562+25072)
	0307	Mod : (20343+22013+36847) = (31276+22013+36847)
	0308	Mod : 36847 = (20246+20510+36847) = (20246+20510+35220+36847)
R	0309	Mod : (28479+34456) = (28378+28479) = (28378+28916) = (33973+28479) = (28479+37226) = (28916+37226) = (22013+28479+30422) = (22013+28916+30422) = (22013+25453+28479+30422) = (22013+25453+28916+30422)
R	0310	Mod : (20059+20069+31283) = (20059+20067+20069+31283) = (20067+20069+31283+3523) = (20067+20069+31283+35236+34862+37809) = (20059+20067+20069+31283+34862+37809)
R	0311	Mod : (22013+27140) = (22013+27140+33100+34997)
	0312	Mod : (21678+36847) = (21678+28160+28917+36847)
	0313	Mod : 36847 = (28160+28917+36847)
	0314	Mod : 21678 = (21678+28160+28917)
	0315	Mod : 22013 = 24105 = 34041 = (23893+25225+34041) = AUA
	0316	Mod : (24105+30020) = (21678+24105+30020) = (24105+30020+36847)
	0317	Mod : 25241 = 25242 = (25241+25242)
	0318	Mod : 22013 = 24105 = 28160 = (21678+22013) = (21678+24105) = (21678+28160) = (21678+28160+36847)
R	0320	Mod : (24771+27140) = (24771+27140+33100+34856) = (24771+27140+33100+34898)
	0321	Mod : (26149+27777) = (26149+26608+27777)
	0322	Mod : 30660 = (26728+28479+30660) = (26728+28479+30660+31283)
R	0332	Mod : (34665/V2522A5/24A5/27A5/27EA5/27MA5/30A5/33A5)
	0333	STD = Mod : (20024+22013) = (20024+22013+US)
	0334	Mod : (31283+34861) = (31283+34862) = (31283+34864)
R	0335	Mod : (20057+20059+20067+20069) = (20057+20059+20067+20069+31283+34864) = (20057+20059+20067+20069+31283+34862) = (20057+20059+20067+20069+31283+34861)
R	0336	Mod : (24404+34665) = (24405+34665) = (25530+34665) = (27640+34665) = (24405+27640+34665)
	0340	Mod : 36847 = (31283+35220+36847)
R	0343	Mod : (30748+33323) = ((23871+30748+33323)/56-5-B4)

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R	0344	Mod : 30748/56-5-B4/V2527A5/V2527EA5 = (23108+30748)/56-5-B4 = (23871+30748)/56-5-B4
R	0345	Mod : 23408/V2500A1 = 23871/56-5-A1/A3 = (23109+23408)/V2500A1 = (23108+23109+23408)/V2500A1
R	0346	Mod : (25615+30748) = (23108+25615+30748)
R	0347	Mod : (30748+33323+34540)
	0348	Mod : (20268+22461) = (20268+23408) = (20268+22461+23408)
	0350	Mod : (21678+25410) = (21678+26017) = (21678+25410+26017)
R	0351	Mod : (28162+34540) = (28162+30748+34540)
R	0352	Mod : (25615+28162) = (25615+28162+30748)
R	0353	Mod : (25615+28162) = (25615+28162+30748) = (23108+25615+28162+30748)
R	0354	Mod : (25615+28162+33323) = (25615+28162+30748+33323)
R	0355	Mod : 30748 = (30748+33323)
R	0356	Mod : (25615+30748+33323)
R	0357	MSN : 0002 = 0003 = 0004 = 0005 = 0006 = 0007 = 0008 = 0010 = 0012 = 0013 = 0014 = 0016 = 0017 = 0018 = 0019 = 0020 = 0021
R	0358	(56-5-B1 = 56-5-B2 = 56-5-B3 = V2530 = V2533)/321-200 = (56-5-A4 = 56-5-A5 = 56-5-B5 = 56-5-B6 = 56-5-B7 = V2522 = V2524 = V2527M)/319-100
R	0359	Mod : (30748+33323) + ((56-5-B1 = 56-5-B2 = 56-5-B3)/321-200 = (56-5-B5 = 56-5-B6 = 56-5-B7)/319-100))
	0360	Mod : (22013+23698) = (22013+23698+23699)
R	0361	Mod : 30748+(56-5-B1 = 56-5-B2 = 56-5-B3 = V2530 = V2533)/321-200 = 30748+(56-5-A4 = 56-5-A5 = 56-5-B5 = 56-5-B6 = 56-5-B7 = V2522 = V2524 = V2527M)/319-100
R	0363	Mod : (32401+28378) = (28378+32402) = (28378+32929) = (28378+32475) = (31896+32402+28378) = (31897+32401+28378) = (31896+32332+32475+28378) = (31897+32333+32929+28378)
	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)
R	0367	Mod : 34313 = 34809 = (32401+34809) = (32402+34313) = (32929+34809) = (32475+34313) = (31896+32402+34313) = (31897+32401+34809) = (31896+32332+32475+34313) = (31897+32333+32929+34809)
R	0369	Mod : (25108+27620) = (35793+27620) = (22013+23672+27620) = (23672+24105+27620) = (24581+36529+27620) = (24785+36529+27620) = (25108+30020+27620) = (25108+27620+37285) = (35793+27620+37285) = (22013+23219+36529+27620) = (24105+25294+36529+27620) = (24105+25108+30020+27620) = (24581+30020+36529+27620) = (24785+30020+36529+27620) = (23672+24105+27620+37285) = (24581+36529+27620+37285) = (24785+36529+27620+37285) = (25108+30020+27620+37285) = (22013+23219+23672+35793+27620) = (22013+23219+23672+36529+27620) = (23672+24105+25294+35793+27620) = (23672+24105+25294+36529+27620) = (24105+25108+30020+27620+37285)
	0370	Mod : 20268 = (20268+25800) = (20268+24405+25501) = (20268+24405+25501+25800)
R	0371	Mod : (27620+34637) = (27620+34637+37285) = (22013+23219+23672+27620+34367) = (23672+24105+25294+27620+34637) = (23672+24105+25294+27620+34637+37285)

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R	0373	Mod : (25108+34637+27620) = (35793+34637+27620) = (22013+23672+34637+27620) = (23672+24105+34637+27620) = (24581+36529+34637+27620) = (24785+36529+34637+27620) = (25108+30020+34637+27620) = (25108+34637+27620+37285) = (35793+34637+27620+37285) = (22013+23219+36529+34637+27620) = (24105+25294+36529+34637+27620) = (24105+25108+30020+34637+27620) = (24581+30020+36529+34637+27620) = (24785+30020+36529+34637+27620) = (22013+23672+34637+27620+37285) = (23672+24105+34637+27620+37285) = (24581+36529+34637+27620+37285) = (24785+36529+34637+27620+37285) = (25108+30020+34637+27620+37285) = (22013+23219+23672+35793+34637+27620) = (22013+23219+23672+36529+34637+27620) = (23672+24105+25294+35793+34637+27620) = (23672+24105+25294+36529+34637+27620) = (24105+25108+30020+34637+27620+37285)
R	0376	Mod : (34313+28378) = (34809+28378) = (32401+34809+28378) = (32402+34313+28378) = (32929+34809+28378) = (32475+34313+28378) = (31896+32402+34313+28378) = (31897+32401+34809+28378) = (31896+32332+32475+34313+28378) = (31897+32333+32929+34809+28378)
R	0377	Mod : (33909+32401) = (33909+32402) = (33909+32929) = (33909+32475) = (31896+32402+33909) = (31897+32401+33909) = (31896+32332+32475+33909) = (31897+32333+32929+33909)
R	0378	MSN : 1071 = 1078 = 1090 = 1091 = 1126 = 1129 = 1131 = 1149 = 1164 = 1167
	0379	Mod : (20268+24405) = (20268+24405+25800) = (20268+25800+27727) = (20268+24405+25800+27727)
R	0380	Mod : 31579 = 31580 = 31896 = 31897 = 35119 = 32475 = 32929 = (31579+31896+32332) = (31580+31897+32333) = (31896+32332+35119) = (31579+38367+31896) = (31579+35119+38367) = (31579+32475+38367) = (31896+32332+32475) = (31897+32333+32929) = (31896+32332+35119+31579) = (31579+31896+32332+35119+38367) = (31579+31896+32332+32475+38367)
	0382	Mod : 30660 = (28160+28917+30660) = (28160+28917+30660+34862) = (25888+28160+28917+30660) = (22562+28160+28917+30660)
	0384	Mod : (28160+30660) = (28160+30660+34862) = (22562+25072+28160+30660)
	0385	Mod : (22562+30660) = (30660+35864) = (22562+34862+30660) = (22562+30660+35864)
	0386	Mod : 36847 = (V2522 = V2524 = V2527 = V2527E = V2527MA5 = V2500 = 56-5-A1 = 56-5-A3
	0388	Mod : 24404 = 24405 = 25416 = 25530 = (24404+25416) + (24405+25416)
	0390	Mod : (36847+56-5-A1/A3/B4) = (36311+36847+56-5-B6) = (28160+28917+36847+56-5-A1/A3/B4) = (36311+28160+28917+36847+56-5-B6) = (22562+36847+V2500A1) = (22562+28160+28917+36847+V2500A1)
	0391	Mod : (25240+28238) = (25274+28238) = (28238+28711)
	0393	Mod : (21678+22013) = (21678+24105) = (21678+28160) =(21678+30020)
	0394	Mod : (21678+22013) = (21678+24105) = (21678+28160)
R	0395	Mod : 26925 = (26925+30660) = (26925+30660+31283+35220+37999)
	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+25238)
	0399	Mod : (27957+V2500A1) = (32656+V2522A5/V2524A5/V2527A5/V2530A5/V2533A5/2527EA5/2527MA5)
	0401	STD = Mod : 25072 = (22562+25072) = (28160+28917) = (25072+28160+28917) = (22562+25072+28160+28917)
R	0402	Mod : (20059+20067+20069+35220) = (20059+20067+20069+31283+35220) = (20059+20067+20069+31283+34862+35220+37809)
	0403	Mod : 27650 = (24588+27650) = (24215+24588+27650)

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	0406	Mod : (20067+20069+20071) = (20067+20069+20071+33100+34997) = (20067+20069+20071+31283+34861) = (20067+20069+20071+31283+34862) = (20067+20069+20071+31283+33100+34856) = (20067+20069+20071+31283+33100+34898) = (20067+20069+20071+31283+33100+34997)
	0407	Mod : (20059+20067+20069+20071) = (20067+20069+20071+35236) = (20059+20067+20069+20816+27063) = (20059+20067+20069+20071+32146) = (20059+20067+20069+20071+33100+34856) = (20059+20067+20069+20071+33100+34898) = (20059+20067+20069+20071+31283+34862) = (20059+20067+20069+20071+31283+33100+34862) = (20059+20067+20069+20071+31283+33100+34898)
R	0408	Mod : (20057+20059) = (20057+20059+31276+32013)
	0409	Mod : (20067+20069+20071+30020+35220) = (20067+20069+20071+33100+31283+35220) = (20067+20069+20071+300020+30354+35220)
	0411	Mod : (36847+56-5-A4/A5/B1/B2/B3/B5/B6/B7/B8/B9) = (28160+36847+56-5-A3/B4) = (36311+28160+36847+56-5-B6) = (22562+28160+36847+V2500A1)
	0412	Mod : STD = (28160+28917+36847) = (22562+25072+36847) = (25888+27609+36847) = (22562+25072+28160+28917+36847) = (25888+27609+28160+28917+36847)
	0413	Mod : (26999+28244+33253) = (26999+28244+33505) = (26999+28244+34660) = (25205+26999+28244+28382+33253) = (26999+28244+28382+28495+33253) = (26999+28244+28382+28495+34660)
R	0415	Mod : (20059+20343) = (20059+31276) = (31276+35236)
	0416	Mod : 20406 = (20406+24588) = (20406+24588+28916)
	0417	Mod : 28244 = (23885+28244) = (26999+28244+28495) = (26999+27917+28244)
R	0418	Mod : (20057+20059+20343) = (20057+20059+31276)
	0419	Mod : (28244+28382) = (26999+28244) = (25205+28244) = (28244+30631) = (28244+30241) = (26485+28244) = (26111+26999+28244) = (26111+28244+28382) = (26999+28244+30241) = (23885+26111+28244) = (26999+28244+28495+28382) = (23885+26111+26999+28244) = (25205+26999+28244+28495)
	0422	Mod : 28479 = 28702 = 28916 = (28479+31283+34861) = (26728+28479)
	0423	Mod : (36847+V2522/2524/2527M/2530/2533) = (22562+25072+36847+V2522/2524/2527M/2530/2533) = (25888+27609+36847+V2522/2524/2527M/2530/2533) = (28160+36847+V2527/2527E) = (22562+25072+28160+36847+V2527/2527E) = (25888+27609+28160+36847+V2527/2527E)
	0425	Mod : (26999+34637+34660) = (26999+34637+33505) = (26999+34637+33253) = (26999+28244+28382+28495+34660+34637) = (26999+28244+28382+25495+34660+34637+34825)
	0428	Mod : (22013+24588) = (22013+23450+24588) = (20406+22013+23450+24588) = (20406+22013+23450+24588+28916)
R	0429	Mod: (26377+26999+35220+37999) = (26377+26999+31283+35220+37999)
	0430	Mod : (28160+36847) = (22562+25072+28160+36847) = (25888+27609+28160+36847)
	0431	Mod : (23779+24349+34637+35220) = (23779+24852+26526+34637+35220) = (23779+24349+24785+26526+34637+35220) = (23779+24852+34637+35220)
	0432	Mod : (21678+22013+26377) = (21678+22013+26999) = (21678+22013+26379+26999)

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R	0434	Mod : (25888+36847+V2522/2524/2527M/2530/2533) = (37987+36847+V2522/2524/2527M/2530/2533) = (22562+25072+25888+36847+V2522/2524/2527M/2530/2533) = (25888+28160+36847+V2527/2527E) = (28160+36847+37987+V2527/2527E) =(22562+25072+25888+28160+36847+V2527/2527E)
	0435	Mod : (21946+26169+30308) = (21946+26169+30299+30308)
	0437	Mod : (34637+35220) = (26526+34637+35220)
	0438	Mod : (22562+36847) = (22562+25088+27609+36847) = (22562+28160+28917+36847) = (22562+27609+25888+28160+28917+36847)
	0439	Mod : 22562+36847+V2522/2524/2527M/2530/2533) = (22562+27609+25888+36847+V2522/2524/2527M/2530/2533) = (22562+28160+36847+V2527/2527E) = (22562+27609+25888+28160+36847+V2527/2527E)
	0440	Mod : (26526+30660+34637) = (30660+34637)
R	0441	Mod : 37871 = (35220+37871) = (31283+35220+37871)
R	0442	Mod: (21678+26925+26999+27620+33503) = (21678+26925+26999+27620+33503+27646)
R	0443	Mod : (21678+26485+27620) = (21678+26999+27620) = (21678+27620+27646) = (21678+27620+30631) = (21678+27620+30635) = (21678+26999+27620+33503+37589)
R	0444	Mod : (35542+37871) = (35220+35542+37871)
	0447	Mod : (25205+26526+28916) = (26111+26526+28916) = (26526+26999+28479) = (26526+26999+28702) = (26526+26999+28916) = (26526+28382+28916) = (26526+28916+30631) = (23885+26111+26526+28916) = (24075+25205+26526+28916) = (25205+26526+26999+28495+28916) = (26526+26999+28382+28479+28495) = (26526+26999+28382+28495+28702) = (26526+26999+28382+28495+28916) = (24075+25205+26526+26999+28382+28479) = (24075+25205+26526+26999+28495+28916) = (26526+26999+28916+30241) = (23885+26526+26999+28916)
	0448	Mod : 34637 = (26526+34637) = (26526+28244+34637) = (26526+28244+34637+34825)
	0449	Mod : (34637+35350) = (26526+34637+35350) = (26526+28244+34637+35350)
	0450	Mod : STD = 25404 = (30660+34861) = (30660+34864)
	0451	Mod : 30660 = (25404+30660)
	0452	Mod : STD = 32619 = 33239 = 36462 = (32619+33239) = (32619+36462) = (33239+36462) = (32619+33239+36462)
	0453	Mod : (36462+36481) = (36462+36750) = (36462+32619+36481) = (36462+32619+36750) = (36462+33239+36481) = (36462+33239+36750) = (36462+32619+33239+36481) = (36462+33239+32619+36750)
R	0454	Mod : 26526 = 34637 = (26526+34637) = (26526+33503+37589) = (34637+33503+37589) = (26526+33503+34637+37589)
	0456	Mod : (21678+25404) = (21678+25404+31283+34862) = (21678+25404+30626+31283+34862+35110)
	0457	Mod : (21678+21858+25404) = (21678+21858+25404+30626+35110) = (21678+21858+25404+31283+34864) = (21678+21858+25404+31283+34861) = (21678+21858+25404+31283+34862) = (21678+21858+25404+31283+34864+30626+35110) = (21678+21858+25404+31283+34862+30626+35110)
R	0458	Mod : 31579 = 31580 = 31896 = 31897 = 35119 = 32475 = 32929 = (31579+31896+32332) = (31580+31897+32333) = (31896+32332+35119) = (31579+38367+31896) = (31579+35119+38367) = (31579+32475+38367) = (31896+32332+32475) = (31897+32333+32929) = (31580+31897+38441) = (31580+32929+38441) = (31896+32332+35119+31579) = (31579+31896+32332+35119+38367) = (31579+31896+32332+32475+38367) = (31580+31897+32333+32929+38441)

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	0459	Mod : 26377 = 26999 = (26377+26999) = (26377+26999+31283+34861) = (26377+26999+30626+31283+34862+35110)
	0460	Mod : (21678+25404+26377) = (21678+25404+26999) = (21678+25404+26377+26999) = (21678+25404+26377+31283+34861) = (21678+25404+26377+31283+34862) = (21678+25404+26377+31283+34864) = (21678+25404+26377+26999+31283+34862) = (21678+25404+26377+30626+31283+34862+35110) = (21678+25404+26377+26999+30626+31283+34862+35110)
	0461	STD = Mod : (28238+31897) = (28238+31896)
R	0462	STD = Mod : (31579+38367) = (31896+32332) = (31897+32333) = (31580+38441) = (31579+38367+31896+32332) = (31580+31897+32333+38441)
	0463	Mod : (26999+27646+33100) = (26999+30626+31283+33100+34862+35110) = (26999+27646+30626+31283+33100+34862+35110)
	0464	Mod : (21678+27522+35227) = (21678+27522+35865)
	0465	Mod : 30784 = (22562+25072+28897+30784)
R	0466	Mod : STD = 32651 = (32650+32651) = (34809+37588) = (34809+37588+36609) = (34809+37588+36772) = (32651+34809+37588) = (32650+32651+34809+37588) = (32651+34809+37588+36609) = (32651+34809+37588+36772) = (32650+32651+34809+37588+36609) = (32650+32651+34809+37588+36772)
R	0467	Mod : 20024 = (20024+32651) = (20024+32650+32651) = (20024+34809+37588) = (20024+32650+32651+34035) = (20024+32651+34809+37588) = (20024+34809+37588+36609) = (20024+34809+37588+36772) = (20024+32650+32651+34809+37588) = (20024+32651+34809+37588+36609) = (20024+32651+34809+37588+36772) = (20024+32650+32651+34035+34809+37588) = (20024+32650+32651+34809+37588+36609) = (20024+32650+32651+34809+37588+36772) = (20024+32650+32651+34809+34035+37588+36609) = (20024+32650+32651+34809+34035+37588+36772)
R	0469	Mod : (20024+32650) = (20024+34035) = (20024+32650+34035) = (20024+32650+34809+37588) = (20024+34035+34809+37588) = (20024+32650+34035+34809+37588) = (20024+32650+34809+37588+36609) = (20024+32650+34809+37588+36772) = (20024+34035+34809+37588+36609) = (20024+34035+34809+37588+36772) = (20024+32650+34035+34809+37588+36609) = (20024+32650+34035+34809+37588+36772)
R	0470	Mod : 36562 = 36609 = 36772 = (34809+36609) = (34809+36772) = (34313+36562) = (32651+36562) = (32651+36609) = (32651+36772) = (32651+34809+36609) = (32651+34809+36772) = (32651+34313+36562) = (32650+32651+36562) = (32650+32651+36609) = (32650+32651+36772) = (32650+32651+34809+36609) = (32650+32651+34809+36772) = (32650+32651+34313+36562)
	0471	Mod : (30020+27140) = (33300+27140) = (27140+32650+32651+33100) = (27140+32650+32651+33300)
	0472	Mod : (25404+28479) = (25404+28916) = (25404+28160+28479+28917) = (25404+28160+28916+28917)
R	0474	Mod: (34637+33503) = (26526+33503) = (26526+33503+34637)
R	0475	Mod : (21678+26999) = (21678+21858+26377) = (21678+21858+26999) = (21678+26377+26999) = (21678+26377+26999+33503+37589) = (21678+21858+26377+26999+33503+37589)
R	0476	Mod : (21678+26999+33503) = (21678+26377+26999+33503) = (21678+21858+26377+26999+33503)

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R	0477	Mod : (20024+36562) = (20024+36609) = (20024+36772) = (20024+34809+36609) = (20024+34809+36772) = (20024+34313+36562) = (20024+32651+36562) = (20024+32651+36609) = (20024+32651+36772) = (20024+32651+34809+36609) = (20024+32651+34809+36772) = (20024+32651+34313+36562) = (20024+32650+32651+36562) = (20024+32650+32651+36609) = (20024+32650+32651+36772) = (20024+32650+32651+34809+36609) = (20024+32650+32651+34809+36772) = (20024+32650+32651+34313+36562)
	0479	Mod : 32619 = 33239 = 36462 = (32619+33239) = (32619+36462) = (33239+36462) = (32619+33239+36462)
	0481	Mod : 36462 = (32619+36462) = (33239+36462) = (32619+33239+36462)
R	0482	Mod : (20067+20069+20071+21708) = (20067+20069+20816+21708+27063) = (20067+20069+20071+37277) = (20067+20069+20071+37277+31283) = (20067+20069+20071+21708+33100+34856) = (20067+20069+20071+21708+31283+34861) = (20067+20069+20071+21708+31283+34862) = (20067+20069+20071+37277+33100+34856) = (20067+20069+20071+21708+31283+33100+34856) = (20067+20069+20071+37277+31283+33100+34856)
R	0483	Mod :(20067+20069+20071+21708+30020) = (20067+20069+20071+21708+31283+33100) = (20067+20069+20071+37277+31283+33100)
	0485	Mod : (25888+28160) = (22562+25888+28160) = (25888+28160+30660+34861) = (25888+28160+30660+34864) = (22562+25072+25888+28160)
	0486	Mod : (22562+28160+30660) = (28160+30660+35864)
	0487	Mod : STD = (25888+27609) = (22562+25072)
	0488	Mod : 22562 = 35864 = (22562+25888+27609)
	0489	Mod : 25871 = 25887 = 25893 = 26149 = 26338 = 27725 = 28307 = (25871+30660+34861) = (25871+30660+34864) = (25887+30660+34861) = (25887+30660+34864) = (26149+30660+34861) = (26149+30660+34864)
	0490	Mod : 34156 = 32619 = 32656 =33239 = (26338+34156) = (25893+32619) = (25871+33239) = (25893+33239) = (26149+32656) = (25887+34156) = (26338+34156) = (34156+30660+34861) = (34156+30660+34864) = (32656+30660+34861) = (32656+30660+34864) = (33239+30660+34861) = (33239+30660+34864)
R	0491	Mod : (31896+37670+37147) = (32475+37670+37147) = (31896+32332+32475+37670+37147)
	0492	Mod : 20024 = (20024+32651) = (20024+32650+32651) = (20024+32650+32651+34035)
	0493	Mod : (34156+30660) = (32619+30660) = (33239+30660) = (32656+30660) = (25871+30660+33239) = (25893+30660+32619) = (26149+30660+32656) = (25887+30660+34156) = (26338+30660+34156) = (25893+30660+33239) = (28307+30660+33239)
	0494	Mod :(20024+32650+34313) = (20024+32650+34809) = (20024+34035+34809)
	0495	Mod : 34156 = 32619 = 33239 = (26338+34156) = (25893+32619) = (25871+33239) = (25893+33239) = (25887+34156) = (26338+34156) = (28307+33239)
	0497	Mod : 32656 = (26149+32656)
R	0498	Mod : (30660+32494+32496) = (20057+20067+20069+20071+37277) = (20057+20067+20069+20071+37277+31283) = (26728+27522+28479+30660+31371+32494+32496) = (26728+27522+28479+30660+31283+31371+32494+32496) = (20057+20067+20069+20071+37277+31283+33100+34856)
R	0499	STD = Mod : 20057 = 20059 = 30020 = 35236 = (20057+20059) = (20059+20084+38025)
	0500	Mod : (25241+28138) = (25242+28138) = (25241+25242+28138)

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	0501	Mod : (25241+26963) = (25242+26963) = (25241+25242+26963)
R	0503	Mod : (20067+20069+20071+21708+35220) = (20067+20069+20071+37277+35220) = (20067+20069+20816+21708+27063+35220) = (20067+20069+20071+37277+31283+35220) = (20067+20069+20071+21708+33100+34856+35220) = (20067+20069+20071+21708+31283+34861+35220) = (20067+20069+20071+21708+31283+34862+35220) = (20067+20069+20071+37277+31283+35220)
	0504	STD = Mod : (22013+24044) = (25951+32239)
R	0505	Mod : 20059 = 30067 = 35236 = (20059+20084+38025)
R	0506	Mod : (20059+20067+20069+20071+21708) = (20059+20067+20069+20071+37277) = (20059+20067+20069+20816+21708+27063) = (20059+20067+20069+20071+37277+31283) = (20059+20067+20069+20071+21708+33100+34856) = (20059+20067+20069+20071+37277+31283+33100+34856) = (20059+20067+20069+20071+21708+31283+33100+34856+34862)
R	0507	Mod : (30660+32494+32496+35865) = (20057+20059+20067+20069+20071+37277) = (20057+20059+20067+20069+20071+37277+31283) = (26728+27522+28479+30660+31283+31371+32494+32496+35865) = (20057+20059+20067+20069+20071+37277+31283+33100+34856)
	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) = (20268+25951+26965) = (20268+25951+27773) = (20268+26965+35040) = (20268+27773+35040)
	0509	Mod : STD = (34864+28916) = (34864+28479)
	0510	Mod : 22013 = (22013+34864+28916) = (22013+28479+34864)
R	0511	Mod :(20067+20069+20071+21708+30020+35220) = (20067+20069+20071+37277+33100+35220) = (20067+20069+20071+21708+31283+33100+35220) = (20067+20069+20071+37277+31283+33100+35220)
R	0512	Mod : (20057+20067+20069+20071+21708+35220) = (20057+20067+20069+20071+37277+35220) = (20057+20067+20069+20071+37277+31283+35220) = (20057+20067+20069+20071+37277+31283+35220+33100+34856)
	0513	STD = Mod : 31896+32332
R	0514	Mod : (20059+20067+20069+20071+21708+35220) = (20059+20067+20069+20071+37277+35220) = (20059+20067+20069+20816+21708+27063+35220) = (20059+20067+20069+20071+21708+33100+34856+35220) = (20059+20067+20069+20071+37277+31283+35220) = (20059+20067+20069+20071+37277+31283+35220+33100+34856) = (20059+20067+20069+20071+21708+31283+34856+34862) = (20059+20067+20069+20071+21708+31283+33100+34856+34862+35220)
R	0515	Mod :(20057+20059+20067+20069+20071+21708+30020) = (20057+20059+20067+20069+20071+21708+31283+33100) = (20057+20059+20067+20069+20071+37277+31283+33100)
R	0516	Mod : (20059+20067+20069+20071+21708+30020+35220) = (20059+20067+20069+20071+37277+33100+35220) = (20059+20067+20069+20071+21708+31283+33100+35220) = (20059+20067+20069+20071+21708+30354+31283+35220) = (20059+20067+20069+20071+37277+31283+33100+35220)

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R	0517	Mod : (20057+20059+20067+20069+20071+21708+35220) = (20057+20059+20067+20069+20071+37277+35220) = (20057+20059+20067+20069+20071+37277+31283+35220) = (20057+20059+20067+20069+20071+37277+31283+35220+33100+34856)
	0518	Mod : (25205+26526) = (26111+26526) = (26526+26999) = (26526+28382) = (26526+30241) = (26526+30631) = (26526+30635) = (26485+26526) = (26526+26999+28495) = (26526+26999+30241) = (23885+26111+26526) = (23885+26526+26999) = (24075+25205+26526) = (24075+26526+28382) = (26111+26526+26999) = (26526+26999+28382+28495) = (26526+26999+28495+28916) = (23885+26111+26526+26999) = (26111+26526+28382+30635) = (26526+26999+34864) = (24075+25205+26526+26999+28495)
R	0519	Mod :(20057+20067+20069+20071+30020) = (20057+20067+20069+20071+31283+33100)
R	0520	Mod : (20059+20067+20069+20071+21708+30020) = (20059+20067+20069+20071+21708+31283+33100) = (20059+20067+20069+20071+31283+33100+37277)
	0521	Mod : 31896 = 32475 = (31896+32332+32475)
R	0522	Mod : (20059+20067+20069+20071+30020) = (20059+20067+20069+20071+31283+33100) = (20059+20067+20069+20071+30020+30354+31283)
R	0523	Mod : (20059+20067+20069+20071+35220) = (20067+20069+20071+35236+35220) = (20059+20067+20069+20816+27063+35220) = (20059+20067+20069+20071+32146+35220) = (20059+20067+20069+20071+33100+34856+35220) = (20059+20067+20069+20071+33100+34898+35220) = (20059+20067+20069+20071+31283+34862+35220) = (20059+20067+20069+20071+31283+33100+34898+35220)
	0524	Mod : (20057+20067+20069+20071) = (20057+20067+20062+20816+27063)
	0529	Mod : (20057+20067) = (20057+20069) = (20057+20067+20069)
	0531	Mod : (25205+34637) = (26111+34637) = (26485+34637) = (26999+34637) = (28382+34637) = (30241+34637) = (30631+34637) = (23885+26111+34637) = (26999+28244+34637) + (26999+28244+28382+28495+34637)
R	0532	Mod : (20059+20067+20069+20071+31283+33100+35220+36847) = (20059+20067+20069+20071+30020+30354+31283+35220+36847)
	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)
R	0538	Mod : (20067+20069+20071+30020+36847) = (20067+20069+20071+31283+33100+35220+36847) = (20067+20069+20071+30020+30354+31283+35220+36847)
	0539	Mod : (32619+35220) = (33239+35220) = (34156+35220) = (35220+35944) = (25893+32619+35220) = (26149+30660+32656+35220+35944) = (25893+28307+30660+32619+32239+35220)
R	0540	Mod : 24035 = 24160 = 24211 = (24035+31897+32333) = (24160+31897+32333) = (24211+31897+32333)
	0541	Mod : (25205+28244) = (26999+28244) = (28244+28382) = (28244+30631) = (26485+28244) = (25205+34637) = (26111+34637) = (26485+34637) = (26999+34637) = (28382+34637) = (30241+34637) = (30631+34637) = (23885+26111+28244) = (26111+26999+28244) = (26111+28244+28382) = (26999+28244+30241) = (26999+28244+28382+28495) = (25205+26999+28244+28495)

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0543	Mod : (26999+27650+28244) = (27650+28244+28382) = (27650+28244+28382) = (26999+27650+28244+28382+28495)
0544	STD = Mod : (31896+32332) = (31897+32333)
0545	Mod : (26999+28244+33253) = (26999+28244+34660) = (26999+28244+33505) = (25205+26999+28244+28382+33253) = (26999+28244+28382+28495+33253) = (26999+28244+28382+28495+34660) = (26999+28244+28382+28495+34660+34637) = (26999+28244+28382+28495+34660+34637+34825)
0546	(56-5-A3 = V2527) = (23408+V2500) = (21615+56-5-A3) = (23264+26058+26059+56-5-A3)
0547	(56-5-B1 = 56-5-B2 = V2530) = (31810+56-5-B2)
0548	Mod : (25404+28160+28479+34041) = (25404+28160+28916+31283+34041)
0549	Mod : (20067+20069+20071+35220) = (20067+20069+20071+33100+34997+35220) = (20067+20069+20071+31283+34861+35220) = (20067+20069+20071+31283+34862+35220) = (20067+20069+20071+31283+33100+34898+35220)
0550	Mod : (25241+30162) = (25242+30162) = (25241+25242+30162)
0551	Mod : (25241+26963+30162) = (25242+26963+30162) = (25241+25242+26963+30162)
0552	Mod : (25241+30162+32088) = (25241+30162+32090) = (25242+30162+32088) = (25242+30162+32090) = (25241+25242+30162+32088) = (25241+25242+30162+32090)
0553	Mod : (25241+26963+32088) = (25241+26963+32090) = (25242+26963+32088) = (25242+26963+32090) = (25241+25242+26963+32088) = (25241+25242+26963+32090) = (25241+25242+26963+30162+32088+32090+36466)
0554	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) = (25241+25242+26963+30162+32088+32090)
0555	Mod : 37871 = (23779+37871) = (35220+37871) = (23779+35220+37871)
0556	Mod : (26526+37871) = (23779+26526+37871) = (26526+35220+37871) = (23779+26526+35220+37871)
0557	Mod : (24349+37871) = (24785+37871) = (24852+37871) = (23779+24349+37871) = (23779+24785+37871) = (23779+24852+37871) = (24349+35220+37871) = (24785+35220+37871) = (24852+35220+37871) = (23779+24349+24785+37871) = (23779+24785+24852+37871) = (23779+24349+35220+37871) = (23779+24785+35220+37871) = (23779+24852+35220+37871) = (23779+24349+24785+35220+37871) = (23779+24785+24852+35220+37871)
0558	Mod : (24349+26526+37871) = (23779+24349+26526+37871) = (23779+24785+26526+37871) = (23779+24852+26526+37871) = (24349+26526+35220+37871) = (23779+24349+24785+26526+37871) = (23779+24785+24852+26526+37871) = (23779+24852+26526+37871+37999) = (23779+24349+26526+35220+37871) = (23779+24785+26526+35220+37871) = (23779+24852+26526+35220+37871) = (23779+24785+24852+26526+35220+37871) = (23779+24852+26526+35220+37871+37999) = (23779+24349+24785+26526+35220+37871+37999)

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R	0559	Mod : (23779+24349+34637+37871) = (23779+24852+34637+37871) = (23779+24852+26526+34637+37871) = (23779+24349+34637+35220+37871) = (23779+24852+34637+35220+37871) = (23779+24349+24785+26526+34637+37871) = (23779+24852+26526+34637+35220+37871) = (23779+24349+24785+26526+34637+35220+37871)
R	0560	Mod : (26526+37871) = (26526+34637+37871) = (34637+35220+37871) = (26526+34637+35220+37871)
	0561	Mod : (22013+26999+30626+31283+33100+35110+35220) = (22013+26999+31283+33100+35220) = (22013+26999+27646+30626+31283+33100+35110+35220)
R	0562	Mod : (26526+37871) = (26526+35220+37871)
	0563	Mod : 33713 = (25328+33713)
	0564	Mod : 36331 = (23900+30479+36331)
	0565	STD = Mod : (26526+28956) = (26526+27046+28956)
	0566	Mod : 28547 = (23264+23900+28547)
	0567	Mod : 35311 = (23900+30479+35311)
	0568	Mod : (23900/56-5-B4/B5/B6/V2527E) = (23264+23900+26058+26059/56-5-B4)
	0569	Mod : 28547 = (23264+23900+28547)
	0570	Mod : (30479+56-5-A3/V2527) = (23900+30479+56-5-A3/V2527) = (23264+23900+30479/V2527) = (20802+23264+23900+26059+30479/V2527)
	0571	Mod : 35735 = (23900+30307+35753)
	0572	Mod : (22013+24385+CFM) = (22013+24385+IAE) = (22013+24385+AUA)
	0573	Mod : (23264/V2500A1) = (21615+23264/56-5-A1) = (21615+22269+23264+26059/56-5-A1)
R	0574	Mod : (30020+37871) = (26526+30020+37871) =(30020+35220+37871) = (26526+30020+35220+37871)
	0575	Mod : (23900/V2500A1) = (23900+21615/56-5-A1)
	0576	Mod : (31132/56-5-A3) = (31132/V2527-A5) = (23408+31132/V2500A1) = (23900+31132/56-5-A3) = (23900+31132/V2527A5)
	0578	Mod : (21601/V2500) = (20802+21601/V2500) = (21601+21615/56-5-A1) = (20141+20802+21601+21615/56-5-A1)
	0579	Mod : (26999+27650 28244) = (27650+28244+28382) = (26999+27650+28244+28382+28495)
	0581	Mod : (23264+23900/V2500) = (22269+23264+23900/V2500) = (21615+23264+23900/56-5-A1) = (21615+22269+23264+23900/56-5-A1) = (21615+22269+23264+23900+26059/56-5-A1)
	0582	Mod : (21601/56-5-B4=V2527E) = (21601+23900+25733/56-5-B4)
	0583	Mod : 34047 = (23900+34047) = (23264+23900+26058+26059+34047)
R	0584	Mod : (30020+34637+37871) =(26526+30020+34637+37871) = (30020+34637+35220+37871) = (26526+30020+34637+35220+37871)
R	0585	Mod : 37871 = (31283+37871) = (34862+37809+37871) = (31283+34862+37809+37871)
	0586	Mod : 27942 = (23264+23900+27942)
	0587	Mod : 31133 = (22269+23900+31133) =(23264+23900+31133) = (23900+26058+31133)

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	0588	Mod : (35198/56-5-A4/A5/B5/B6/V2522/V2524) = (35197+35198/56-5-A4/A5/B5/B6/V2522/V2524)
	0589	Mod : (35198) = (35197+35198)
	0591	Mod : (35197/56-5-A4/A5/B5/B6/V2522/V2524) = (27112+35197/56-5-B5)
	0592	Mod : (30479/56-5-B4/V2527E) = (23900+30479/56-5-B4/V2527E) = (23264+23900+30479/56-5-B4/V2527E) = (23900+26058+26059+30479/56-5-B4) = (23264+23900+26058+26059+30479/56-5-B4)
	0593	Mod : (25241+32088) = (25241+32090) = (25242+32088) = (25242+32090) = (25241+25242+32088) = (25241+25242+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)
	0600	Mod : 28238 = (27846+28238) = (28238+28479) = (27846+28238+28479) = (27846+28238+26916) = (27846+28238+28702)
	0601	Mod : 35325 = (23264+23900+35235)
	0602	Mod :(23264+23900/56-5-A3/V2527) = (22269+23264+23900/56-5-A3/V2527) = (23264+23408+23900/V2500) = (21615+23264+23900/56-5-A3) = (22269+23264+23408+23900/V2500) = (22269+23264+23900+26059/V2527) = (22269+23264+23900+26059/56-5-A3) = (21615+22269+23264+23900/56-5-A3) = (22269+23264+23408+23900+26059/V2500A1) = (21615+22269+23264+23900+26059/56-5-A3)
	0603	Mod : (22269+23408+23900) = (22269+23264+23408+23900+26058) = (22269+23264+23408+23900+26058+26059)
	0604	Mod : 35325 = (27112+35426)
	0605	Mod : (27112+27770/56-5-A4/A5/B5/B6/V2522/V2524)
	0606	Mod : (22269+23900) = (23264+23900+26058) = (22269+23264+23900+26058+26059)
	0607	Mod : (22269+23900) = (22269+23264+23900+26058+26059)
	0609	Mod : (20268+24917+V2533) = (20268+24917+31607+V2530)
R	0610	Mod : (30020+37871) = (30020+31283+37871)
	0612	Mod : 34251 = (26457+34251)
	0613	Mod : (22269+23900/56-5-B4/V2527E) = (22269+23900+26058/56-5-B4) = (23264+23900+26058/56-5-B4)
	0614	Mod : 25205 = 26111 = 26485 = 26999 = 28382 = 30241 = 30631 = 30635 = (23885+26111) = (26999+28382+28495) = (24075+25205+26999+28495)
	0615	Mod : (23264+23900/56-5-B4/V2527E) = (22269+23264+23900/56-5-B4/V2527E) = (23264+23900+26059/56-5-B4)
	0616	Mod : (21615+27942) = (21615+22269+23264+23900+27942)
	0618	Mod : (27112+28238+28951/56-5-B7/V2524/27M) = (27112+28238+28951+32635/56-5-B7/V2524/27M)
R	0619	Mod : (34041+37871) = (31283+34041+37871)
	0620	Mod : (28479+P6146) = (28916+P6146) = (28479+31283+P6146) = (28916+31283+P6146) = (28479+34862+P6146) = (28479+31283+34862+P6146)
	0621	Mod : (28479+P6146) = (28479+31283+P6146)
	0622	Mod : (30020+31283+P6146) = (28479+30020+31283+P6146)

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	0623	Mod : (30020+31283) = (28479+30020+31283)
	0625	Mod : 21678 = (21678+22013) = (21678+24105) = (21678+28160) = (21678+30020) = (21678+28160+36847) = (21678+24105+30020+36847)
	0626	Mod : (20067+20069) = (20067+20069+20071+28478) = (20067+20069+20071+21708+28478)
	0628	Mod : (21615+22269+23900) = (21615+22269+23264+23900+26058+26059)
R	0629	Mod : (30020+35542+37871) = (30020+35542+31283+37871)
	0630	Mod : (21711/V2500) = (21615+21711/56-5-A1) = (21615+21711+25733/56-5-A1) = (21615+21711+23900+25733/56-5-A1)
R R	0631	Mod : 28479 = 28702 = 28916 = (31283+34861) = (31283+34862) = (28479+31283) = (28702+28916) = (28916+31283) = (28479+31283+34862)
	0633	Mod : (34094+(56-5-B4/B5/B6 = V2527e)) = ((23900+34094)+(56-5-B4/B5/B6 = V2527e)) = (23900+26058+26059+27942+34094+56-5-B4)
	0634	Mod : 23264+(56-5-A3 = V2527) = ((21615+23264) = (22269+23264))+(56-5-A3 = V2527) = (23264+23408)+V2500 = ((22269+23264+26059)+(56-5-A3 = V2527)) = (21615+22269+23264+26059+56-5-A3)
	0635	Mod : 22269+(56-5-A3 = V2527) = (22269+23408)+V2500 = ((22269+26058) = (23264+26058) = (21615+22269))+56-5-A3
	0636	Mod : 23900+(56-5-A3 = V2527) = (23408+23900)+V2500
	0638	Mod : 25328 = 35306 = (25328+26457)
	0639	Mod : (26526+30020+30660) = (26526+26925+30020+30660+31283)
R R R	0642	Mod : 37871 = (31283+37871) = (35220+37871+37999) = (31283+34862+37871+37809) = (31283+35220+37871+37999) = (31283+35220+36847+37871)
R R R	0643	Mod : (24105+37871) = (30020+37871) = (24105+31283+36847+37871) = (30020+31283+36847+37871) = (24105+31283+35220+36847+37871) = (30020+31283+35220+36847+37871)
R	0644	Mod : (26398+56-5-B4/B5/B6/B7) = (26398+30020)
	0645	Mod : (20057+20067+20069+20071+30020+35220) = (20057+20067+20069+20071+30354+31283+35220) = (20057+20067+20069+20071+33100+35220+31283)
	0646	Mod : (22013+22562+23092+31495) = (22013+22562+31112+31495) = (20151+22013+22562+31495) = (20063+20151+22013+22562+31495) = (20063+20151+22013+31495+35864) = (20063+22013+31112+31495+35864) = (20063+20151+22013+22562+31495+35864) = (20063+20151+22013+31112+31495+35864)
	0648	Mod : 25590 = (25590+31283+34861) = (25590+31283+34862)
	0649	Mod : 28916 = 28479 = 28702 = (28479+31283+34862) = (28479+31283+34861)
R	0650	Mod : 35311 = 36331 = 36854 = 36849 = 36932 = 37259 = 38519
	0651	Mod : P0164 = 28360 = 31371 = (P0164+28360) = (P0164+31371) = (28360+31371) = (31371+31728) = (31283+34864) = (31283+34861) = (P0164+30660+31371) = (P0164+28360+31371) = (P0164+31371+31728) = (28360+30660+31371) = (30660+31371+31728) = (P0164+30660+31371+31728) =
R	0652	Mod : (36427+36743) = (24588+28479+36427+36743)
R R	0653	Mod : (20406+36427+36743) = (20406+24588+36427+36743) = (20406+24588+28479+36427+36743)
R	0654	Mod : (22013+24588+36427+36743) = (22013+24588+28479+36427+36743)
R R R R	0655	Mod : (22013+28479+28960+36427+36743) = (22013+28479+32456+36427+36743) = (22013+24588+28479+28960+36427+36743) = (22013+24588+28479+28721+36427+36743) = (20406+22013+24588+28479+28721+36427+36743)

	CODE	DESIGNATION
	0656	Mod : (CFM+33323) = (CFM+25225+28399+33323) = (IAE+33323)
R	0657	Mod : (20406+22013+24588+36427+36743)
R	0658	Mod : (20406+22013+28479+28960+36427+36743) = (20406+22013+24588+28479+28960+36427+36743)
R	0659	Mod : (23510+36427+36743) = (23672+36427+36743) = (23510+23672+36427+36743)
R	0660	Mod : 26398 = (26398+31897+32333) = (26398+31896+32332)
R	0662	Mod : (26999+31283) = (27646+31283) = (30631+31283) = (2699+27646+31283) = (26999+31283+33100+34856) = (26999+31283+33100+34898) = (26999+31283+34862+37809) = (27646+31283+34862+37809) = (30631+31283+34862+37809) = (26999+27646+31283+34862+37809) = (26999+30626+31283+33100+34856+35110) = (26999+30626+31283+33100+34898+35110) = (26999+31283+33100+34856+34862+37809) = (26999+31283+33100+34898+34862+37809) = (26999+27646+30626+31283+33100+34898+35110) = (26999+30626+31283+33100+34856+35110+34862+37809) = (26999+30626+31283+33100+34898+35110+34862+37809) = (26999+27646+30626+31283+33100+34898+35110+34862+37809)
R	0664	Mod : (26999+31283) = (27646+31283) = (30631+31283) = (2699+27646+31283) = (26999+30626+31283) = (26999+30626+31283+33100+34898) = (26999+27646+30626+31283+33100+34856) = (26999+30626+31283+33100+34856) = (26999+30626+31283+34862+37809) = (26999+30626+31283+33100+34856+34862+37809) = (26999+30626+31283+33100+34898+34862+37809) = (26999+27646+30626+31283+33100+34856+34862+37809)
	0665	Mod : 26925 = (26925+27979) = (24266+26925+32310)
	0667	Mod :20268 = (20268+25800) = (20268+25530+26505) = (20268+25800+25530+26505)
R	0669	Mod : (24035 = 24160 = 24211 + CFM) = (24035+PW) = (24035+24211 + CFM) + (24035+31896+32332 + CFM) = (24160+31896+32332 + CFM) = (24211+31896+32332 + CFM)
	0670	Mod : (21678+26485) = (21678+26999) = (21678+27646) = (21678+30631) = (21678+30635) = (21678+26999+33497) = (21678+26999+27620+33497) = (21678+26999+27646+33497)
	0671	Mod : (26398+32401) = (26398+32402) = (26398+32929) = (26398+32475) =(26398+31896+32402) = (26398+31897+32401) = (26398+31896+32332+32475) = (26398+31897+32333+32929)
	0672	Mod : (24105=28439=30020=30203=30920)
R	0675	Mod : STD = (31283+34862) = (31283+34864) = (31283+34861)
R	0676	Mod : (24035+35404) = (24035+25404+34862) = (24035+25404+31283+34862)
R	0677	Mod : 24035 = 24160 = 24189 = (24035+31283+34862) = (24189+31283+34862)
	0678	Mod : (20966+CFM 56-5-A3) = (20966+23408+IAE V2500)
R	0679	Mod : (24035+36847+25404) = (24035+31283+35220+36847+25404)
R	0680	Mod : (24035+35220+25404) = (24035+31283+35220+25404)
R	0681	Mod : (24035+35220) = (24160+35220) = (24189+35220) = (24035+31283+35220)
R	0684	MSN : 0069 =0070 = 0071 = 0072 = 0078 = 0083 = 0086 = 0093 = 0094 = 0104 = 0110 = 0116 = 0017 = 0135 = 0137 = 0147 = 0161 = 0162 = 0172 = 0200 = 0201 = 0202 = 0209 = 0216 = 0217 = 0218 = 0267 = 0268 = 0269 = 0346 = 0382 = 0401 = 0412 = 0458 = 0468 = 0473 = 0474 = 0484 = 0493 = 0502 = 0505 = 0518 = 0560 = 0563 = 0564 = 0567 = 0595

	CODE	DESIGNATION
	0685	Mod : K0860 = K4355 = (26169+30308+K0860) = (26169+30308+K4355)
	0686	Mod : (21946+K0860) = (21946+K4355) = (21946+26169+30308+K0860) = (21946+26169+30308+K4355) = (21946+26169+30299+30308+31285+K0860) = (21946+26169+30299+30308+31285+K4355)
R	0687	Mod : STD = 321-100 = 321-200 = (32207+V2527M) = (32207+V2527M) = (32207+56-5-B7) = (23871+56-5-A1) = (23871+56-5-A3) = (20139+V2500) = (23108+V2500) = (23408+V2500)
	0688	Mod : (26169+30299+K0860) = (26169+30299+K4355)
R	0689	Mod : 25615 = (25615+32207+56-5-B7) = (25615+32207+V2527M)
	0690	Mod : (21532+CFM 56-5-A3) = (21532+23408+IAE V2500)
R	0691	Mod : (21678+22013+25404+26377+30626+31283) = (21678+22013+25404+26999+30626+31283) = (21678+22013+25404+26377+30626+31283+34862+37809) = (21678+22013+25404+26999+30626+31283+34882+37809)
R	0693	Mod : (26999+31283+33100) = (27646+31283+33100) = (26999+31283+33100) = (27646+31283+33100) = (26999+27646+31283+33100) = (26999+30626+31283+33100+35110) = (26999+27646+30626+31283+33100+35110) = (26999+27646+31283+33100+34862+37809) = (26999+30626+31283+33100+35110+34862+37809) = (26999+27646+30626+31283+33100+35110+34862+37809)
	0694	Mod : (26600+31810)=(30310+31810)
R	0695	Mod : 23222 = 26057 + (56-5-A1+23222+23871) = (56-5-A3+23222+23871) = (23222+32207+V2527M) = (23222+32207+56-5-B7)
R	0696	Mod : (26999+30626+31283+33300) = (26999+30626+31283+33100) = (26999+27646+30626+31283+3310) = (26999+27646+30626+31283+33300) = (26999+30626+31283+33100+34862+37809) = (26999+30626+31283+33300+34862+37809) = (26999+27646+30626+31283+33100+34862+37809) = (26999+27646+30626+31283+33300+34862+37809)
R	0697	Mod : (22013+26999+31283) = (22013+27646+31283) = (22013+26999+27646+31283) = (22013+26999+31283+33100) = (22013+26999+30626+31283+33100+35110) = (22013+26999+27646+30626+31283+33100+35110) = (22013+26999+27646+31283+33100+35110) = (22013+26999+31283+33100+34862+37809) = (22013+26999+27646+31283+33100+35110+34862+37809) = (22013+26999+30626+31283+33100+35110+34862+37809) = (22013+26999+27646+30262+31283+33100+35110+34862+37809)
R	0698	Mod : (26398+23222) = (26057+26398) = (23222+26398+32207+V2527M) = (23222+26398+32207+56-5-B7)

	CODE	DESIGNATION
R	0699	Mod : (23222+26398+321-100) = (26057+26398+321-100) = (23222+26398+V2530) = (26057+26398+V2530)
R	0700	Mod : (22013+26999+30626+31283+33100) = (22013+26999+27646+30626+31283+33100) = (22013+26999+30626+31283+33100+34862+37809) = (22013+26999+27646+30626+31283+33100+34862+37809)
R	0701	STD = Mod : 26377 = (26377+34861) = (26377+34862) = (26377+34864) = (26377+31283+34861) = (26377+31283+34862) = (26377+31283+34864)
R	0702	Mod : (23222+25615+26398) = (25615+26057+26398) = (23222+25615+26398+32207+V2527M) = (23222+25615+26398+32207+56-5-B7)
	0704	Mod : (21601+CFM 56-5-A3 = IAE V2527) = (21601+23408+IAE V2500)
R	0705	Mod : (32650+33100+33877) = (32650+33300+33877) = (21678+32650+33100+33877) = (21678+32650+33300+33877)
R	0706	Mod : (25590+31283) = (25590+31283+34862+37809)
R	0707	Mod : (22875+31283) = (22875+31283+34862+37809)
R	0708	Mod : (22875+25590+31283) = (22875+25590+31283+34862+37809)
R	0709	Mod : (26925+31283) = (26925+31283+34862+37809)
R	0710	Mod : (21899+30363+31283) = (21899+30363+31283+34862+37809)
	0715	Mod : (21711+CFM 56-5-A3) = (21711+23408+IAE V2500)
R	0716	Mod : (22249+25529+31283) = (22249+26270+31283) = (22249+26117+31283) = (22249+25529+31283) = (22249+25529+26117+31283) = (22249+26117+26270+31283) = (22249+25529+31283) = (22249+25529+31283+34862+37809) = (22249+26117+31283+34862+37809) = (22249+26270+31283+34862+37809) = (22249+26117+31283+34862+25529+37809) = (22249+26117+26270+31283+34862+37809)
R	0717	Mod : (22249+30020+31283) = (22249+30020+31283+34862+37809)
R	0719	Mod : (21678+25404+31283) = (21678+25404+31283+30626+35110) = (21678+25404+31283+35220+37999) = (21678+25404+31283+34862+37809) = (21678+25404+31283+35110+35220+37999) = (21678+25404+30626+31283+35110+34862+37809)
R	0720	Mod : (21678+21858+25404+31283) = (21678+21858+25404+31283+30626+35110) = (21678+21858+25404+31283+34862+37809) = (21678+21858+25404+30626+31283+35110+34862+37809)
R	0721	Mod : (21678+25404+30626+31283) = (21678+25404+30626+31283+34862+37809) = (21678+25404+30626+31283+35220+37999)
	0722	Mod : (21678+21858+25404+30626+31283) = (21678+21858+25404+30626+31283+34862+37809)
R	0723	Mod : (26377+26999+31283) = (26377+26999+30626+31283+35110) = (26377+26999+31283+34862+37809) = (26377+26999+30626+31283+35110+34862+37809)
R	0724	Mod : (26377+26999+30626+31283) = (26377+26999+30626+31283+34862+37809)
	0725	Mod : (28721=28960=32011=32456)
	0726	Mod : (21678+25404+26377+26999+31283) = (21678+25404+26377+26999+30626+31283+35110) = (21678+25404+26377+26999+31283+34862+37809) = (21678+25404+26377+26999+30626+31283+34862+35110+37809)

	CODE	DESIGNATION
R	0727	Mod : (21678+22013+25404+26377+31283) = (21678+22013+25404+26999+31283) = (21678+22013+25404+26377+26999+31283) = (21678+22013+25404+26999+30626+31283+35110) = (21678+22013+25404+26377+31283+34862+37809) = (21678+22013+25404+26999+31283+34862+37809) = (21678+22013+25404+26377+26999+30626+31283+35110) = (21678+22013+25404+26377+26999+31283+34862+37809) = (21678+22013+25404+26999+30626+31283+35110+34862+37809) = (21678+22013+25404+26377+26999+30626+31283+35110+34862+37809)
R	0728	Mod : (21678+25404+26377+26999+30626+31283) = (21678+25404+26377+26999+30626+31283+34862+37809)
	0729	Mod : (22013+26401+28479)=(22013+26401+28916)
	0730	Mod : (20268+V2533) = (20268+31607+V2530)
	0731	Mod : 22013 = (22013+34861) = (22013+34862) = (22013+34864) = (22013+31283+34861) = (22013+31283+34862) = (22013+31283+34864)
	0732	Mod : 32475 = 32929 = (31896+32402) = (31897+32401) = (26999+28495+32475) = (26999+28495+32929) = (31896+32332+32475) = (26999+28495+31896+32402)
	0733	Mod : 21678 = (21678+34861) = (21678+34862) = (21678+34864) = (21678+31283+34861) = (21678+31283+34862) = (21678+31283+34864)
	0734	Mod : STD = (32998+35526) = (34076+37588)
	0735	Mod : (22013+27276) = (22013+31395) = (22013+27276+31395)
	0738	Mod : (21678+26377) = (21678+26999) = (21678+26377+26999) = (21678+26999+34861) = (21678+26999+34862) = (21678+26999+34864) = (21678+26377+34861) = (21678+26377+34862) = (21678+26377+34864) = (21678+26999+31283+34861) = (21678+26999+31283+34862) = (21678+26999+31283+34864) = (21678+26377+31283+34861) = (21678+26377+31283+34862) = (21678+26377+31283+34864) = (21678+26377+26999+34861) = (21678+26377+26999+34862) = (21678+26377+26999+34864) = (21678+26377+26999+31283+34861) = (21678+26377+26999+31283+34862) = (21678+26377+26999+31283+34864)
	0739	Mod : 32997 = 34573 = (32992+32997+34573)
	0740	Mod : 34076 = 35526 = (34076+37588+35526) = (32998+34076+35526)
	0741	Mod : (21678+22013) = (21678+22013+34861) = (21678+22013+34862) = (21678+22013+34864) = (21678+22013+31283+34861) = (21678+22013+31283+34862) = (21678+22013+31283+34864)
	0742	Mod : (21678+25404) = (21678+25404+34861) = (21678+25404+34862) = (21678+25404+34864) = (21678+25404+31283+34861) = (21678+25404+31283+34862) = (21678+25404+31283+34864)

	CODE	DESIGNATION
R	0743	Mod : (26346+56-5-A1/A3+US) = (31106+32311+56-5-A1+US) = (24946+31106+56-5-A3+US) = (31106+32311+56-5-A3+US)
R	0745	Mod : (21678+22013+26377) = (21678+22013+26999) = (21678+22013+26377+26999) = (21678+22013+26377+34861) = (21678+22013+26377+34862) = (21678+22013+26377+34864) = (21678+22013+26999+34861) = (21678+22013+26999+34862) = (21678+22013+26999+34864) = (21678+22013+26377+31283+34861) = (21678+22013+26377+31283+34862) = (21678+22013+26377+31283+34864) = (21678+22013+26999+31283+34861) = (21678+22013+26999+31283+34862) = (21678+22013+26999+31283+34864) = (21678+22013+26377+26999+34861) = (21678+22013+26377+26999+34862) = (21678+22013+26377+26999+34864) = (21678+22013+26377+26999+31283+34861) = (21678+22013+26377+26999+31283+34862) = (21678+22013+26377+26999+31283+34864)
R	0746	Mod : (21678+22013+25404) = (21678+22013+25404+34861) = (21678+22013+25404+34862) = (21678+22013+25404+34864) = (21678+22013+25404+31283+34861) = (21678+22013+25404+31283+34862) = (21678+22013+25404+31283+34864)
R	0750	Mod : (21678+25404+26999+33100) = (21678+25404+26377+26999+33100) = (21678+25404+23677+26999+33100+34862+35110) = (21678+25404+26999+30626+33100+35110+31283+34862)
	0751	Mod :(21678+22013)=(21678+24105)=(21678+28160)
	0754	STD = Mod : (22013+24044) = (25951+32239)
R	0759	Mod : (21678+22013+25404+26999+33100)
R	0762	Mod : 21678 = (21678+32650+32651) = (21678+33100+34856) = (21678+33100+34898) = (21678+32650+32651+33100+34856) = (21678+32650+32651+33100+34898)
R	0763	Mod : 21678+32650+32651+33100+33877+34856) = (21678+32650+32651+33100+33877+34898) = (21678+32650+32651+33877) = (21678+33100+33877+34856) = (21678+33100+33877+31678+33877)
R	0764	Mod : 31283 = (28160+28917+31283) = (31283+34862+37809) = (28160+28917+31283+34862+37809)
R	0765	Mod : (24105+30020) = (24105+30626+31283) = (22013+30626+31283) = (28160+30626+31283) = (24105+30020+30626+31283) = (22013+30626+31283+34862+37809) = (24105+30626+31283+34862+37809) = (28160+30626+31283+34862+37809) = (22013+30626+31283+35220+37999) = (28160+30626+31283+35220+37999) = (24105+30020+30626+31283+34862+37809)
	0766	Mod : 30020 = (24105+26925+30020) = (24105+26925+28479+30020)
R	0767	Mod : (22013+31283) = (24105+31283) = (28160+31283) = (22013+30626+31283+35110) = (24105+30626+31283+35110) = (28160+30626+31283+35110) = (22013+31283+34862+37809) = (24105+31283+34862+37809) = (28160+31283+34862+37809) = (22013+31283+35220+37999) = (22013+31283+35110+35220+37999) = (22013+30626+31283+35110+34862+37809) = (24105+30626+31283+35110+34862+37809) = (28160+30626+31283+35110+34862+37809)
	0771	Mod : 26485=26999=27646=30631=30635
	0772	Mod : (21678+21706+21766+21768+28479)=(21678+21706+21766+21768+28916)
	0774	Mod : (21678+21706+21768) = (21678+21706+21768+21858+26347)

	CODE	DESIGNATION
R	0775	Mod : (21678+32650) = (21678+32650+33100+34856) = (21678+32650+33100+34898)
R	0777	Mod : (20057+20067+20069+31283) = (20057+20067+20069+31283+34862+37809)
R	0778	Mod : 33100 = 33300 = (21678+33100) = (21678+33300) = (33100+32650+32651) = (33300+32650+32651) = (21678+32650+32651+33100) = (21678+32650+32651+33300)
	0780	Mod: 32619 = 33239 = (32619+33239)
	0781	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) = (22013+28479+28721+30439) = (22013+28479+28960+30439)
	0783	Mod: 32619 = 33239 = (32619+33239) = (26577+33239)
R	0784	Mod : (21678+22013) = (21678+22013+33100+34997) = (21678+22013+32650+32651) = (21678+22013+32650+32651+33100+34997)
R	0787	Mod : (20057+20059+20067+20069+31283) = (20057+20059+20067+20069+31283+34862+37809)
R	0791	Mod : (31896+35991) = (31897+35991) = (35119+35991) = (31896+32332+35119+35991) = (31897+32401+35651+35991) = (31897+36772+37588+35991) = (31897+34809+37588+35991)
R	0793	Mod : STD = (33100+34856) = (33100+34898) = (32650+32651) = (33100+34856+32650+32651) = (33100+34898+32650+32651)
	0801	Mod: 32619 = 33239 = (32619+33239) = (22013+24044+33239) = (22013+24044+32619) = (25951+32239+32619) = (22013+24044+32619+33239)
	0802	Mod : (28378+28479) = (28378+28916) = (33973+28479) = (22013+28479+30422) = (22013+28916+30422) = (22013+25453+28479+30422) = (22013+25453+28916+30422)
R	0803	Mod : (33100+33877) = (33300+33877) = (32650+32651+33100+33877) = (32650+32651+33300+33877) = (21678+33100+33877) = (21678+33300+33877) = (21678+32650+32651+33100+33877) = (21678+32650+32651+33300+33877)
	0806	Mod : (21678+21766+28479)=(21678+21766+28916)
	0808	Mod : (21678+21766+21767+28479)=(21678+21766+21767+28916)
	0810	Mod : (21678+21706+21766+21767+21768+28479) = (21678+21706+21766+21767+21768+28916)
R	0813	Mod : STD = 37588 = (32401+35651) = (32401+37558) = (32929+37588)
R	0816	Mod : (21678+32650+33877) = (21678+32650+33100+33877+34898) = (21678+32650+33877+33100+34856)
R	0819	Mod : 31896 = 31897 = (32929+37588) = (31897+32401+35651) = (31897+37588+32401) = (31897+32929+37588)
R	0821	Mod : 28378 = (32401+35651+28378) = (28378+32401+36609+37588) = (28378+32929+36772+37588) = (28378+32929+36609+37588) = (28378+32401+36772+37588)

	CODE	DESIGNATION
R	0822	Mod : (22013+33100) = (21678+22013+33100) = (22013+32650+32651+33100) = (21678+22013+32650+32651+33100
R	0823	Mod : 33909 = 33910 = (33909+32401+35651) = (33909+32401+36609+37588) = (33909+32929+36609+37588) = (33909+32401+36772+37588) = (33909+32929+36772+37588)
	0827	Mod : (20268+24917+V2533) = (20268+24917+31607+V2530)
	0829	STD or Mod : (31395+32207) = (27276+31395+32207)
R	0830	Mod : 31897 = 31896 = (32929+37588) = (31897+32401+37588) = (26999+28495+31896) = (26999+28495+31897) = (31897+32401+35651) = (26999+28495+32929+37588) = (26999+28495+31897+32401+35651) = (26999+28495+31897+32401+37588)
R	0831	STD = Mod (32401+37588) = (32929+37588) = (32401+35651)
R	0833	Mod : 26497 = (26497+32401+35651) = (26497+32401+37588) = (26497+32929+37588)
R	0834	Mod : (26497+32929) = (26497+32475) = (26497+32402) = (26497+32401)
R	0835	Mod : (26497+32475+32997) = (26497+32402+32997)
R	0836	Mod : (20047+20063+20151+26723) = (20047+20063+20151+30277) = (20047+20063+20151+27763) = (20047+20063+26723+31112) (20047+20063+20151+37985) = (20047+20063+20151+26723+27763)
R	0837	Mod : (26999+31896) = (26999+31897) = (28382+31897) = (28382+31896) = (30241+31896) = (30631+31896) = (26999+32929+37588) = (28382+32929+37588) = (30241+32929+37588) = (30631+32929+37588) = (25205+32929+37588) = (26111+32929+37588) = (26485+32929+37588) = (26999+31897+32401+37588) = (28382+31897+32401+37588) = (30241+31897+32401+37588) = (30631+31897+32401+37588) = (25205+31897+32401+37588) = (26111+31897+32401+37588) = (26485+31897+32401+37588) = (23885+26111+32929+37588) = (26999+28382+28495+31896) = (26999+28382+28495+31897) = (26999+31897+32401+35651) = (28382+31897+32401+35651) = (30241+31897+32401+35651) = (26999+28382+28495+32929+37588) = (25205+26999+28495+32929+37588) = (23885+26111+31897+32401+37588) = (26999+31897+32333+32929+37588) = (26999+28382+28495+31897+32401+35651) = (26999+28382+28495+31897+32401+37588) = (25205+26999+28495+31897+32401+37588) = (26999+28382+28495+31897+32929+37588) = (26999+28382+28495+31897+32333+32929+37588)
R	0838	Mod : (22013+28479) = (22013+28916) = (24105+28479) = (24105+28702) = (24105+28916) = (22013+28702)
R	0840	Mod : (30020+35220) = (30020+24105+35220) = (30020+35220+37999) = (24105+26925+28479+30020+35220)
R	0841	Mod : (24105+26925+28479) = (24105+26925+28916) = (22013+26925+28479)
R	0843	Mod : (26925+35220) = (24105+26925+35220) = (22013+26925+35220) = (26925+28479+35220) = (24105+26925+28479+35220) = (22013+26925+28479+35220)
	0845	Mod : (28136+28951)=(28136+32635)
	0846	Mod : (21678+26335) = (21678+26334) = (21678+26335+28160+28917)

	CODE	DESIGNATION
R	0848	Mod : (30368+32205+33125+37871) = (32205+33125+37871+35485)
R	0850	Mod : (27276+30020+31395+35220) = (24105+27276+30020+30977+31395+32207+35220)
R	0852	Mod : (26526+35220) = (26526+35220+37999) = (26526+30660+31283+35220) = (26526+30660+31283+35220+37999)
R	0853	Mod : (22013+38634) = (20024+22013+36634) = (22013+34809+37588+38634) = (20024+22013+34809+37588+38634) = (22013+34809+36609+37588+37588+38634) = (22013+34809+36772+37588+38634) = (20024+22013+34809+36609+37588+38634) = (20024+22013+34809+36772+37588+38634)
R	0855	Code : (22013+36562+38634) = (22013+36609+38634) = (22013+36772+38634) = (22013+34313+36562+38634) = (22013+34809+36609+38634) = (22013+34809+36772+38634) = (20024+22013+36562+38634) = (20024+22013+36609+38634) = (20024+22013+36772+38634) = (20024+22013+34313+36562+38634) = (20024+22013+34809+36609+38634) = (20024+22013+34809+36772+38634)
R	0857	Mod : (22013+34313+38634) = (22013+34809+38634) = (20024+22013+34313+38634) = (20024+22013+34809+38634)
R	0858	Mod : 37871 = (31283+35220+37871) = (200267+20069+28474+28478+31283+35220+37871)
R	0861	Mod : (26526+35220) = (34637+35220) = (26526+34637+35220) = (26526+35220+37999) = (34637+35220+37999)
R	0862	Mod : (20067+20069+37871) = (20067+20069+31283+35220+37871)
R	0863	Mod : (26526+35220+35485) = (34637+35220+35485) = (26526+34637+35220+35485) = (34637+35220+35485+37999) = (26526+35220+35485+37999)
R	0864	Mod : (20059+20067+20069+37871) = (20059+20067+20069+31283+35220+37871)
R	0865	Mod : (26526+30020+35220+35485) = (30020+34637+35220+35485) = (26526+30020+34637+35220+35485)
R	0866	Mod : (26526+30020+35220) = (30020+34637+35220) = (26526+30020+34637+35220)
R	0868	Mod : (20057+20067+20069+37871) = (20057+20067+20069+31283+35220+37871)
R	0870	Mod : (20057+20059+20067+20069+37871) = (20057+20059+20067+20069+31283+35220+37871)
R	0874	Mod : (20059+20067+20069+20071+21708+33100+37871) = (20059+20067+20069+20071+21708+33100+31283+35220+36847+37871)
R	0875	Mod : (20059+20067+20069+20071+33100+37871) = (20059+20067+20069+20071+30020+30354+37871) = (20059+20067+20069+20071+33100+31283+35220+36847+37871) = (20059+20067+20069+20071+30020+30354+31283+35220+36847+37871)
R	0877	Mod : (20067+20069+20071+33100+37871) = (20067+20069+20071+30020+37871) = (20067+20069+20071+30020+30354+37871) = (20067+20069+20071+33100+31283+35220+36847+37871) = (20067+20069+20071+30020+31283+35220+36847+37871) = (20067+20069+20071+30020+30354+31283+35220+36847+37871)

	CODE	DESIGNATION
R	0879	Mod : (26526+30660+36427+26925+31896) = (25526+30660+36427+26925+31897) = (26526+26925+30660+31283+36427+31896) = (26526+26925+30660+31283+31897+36427) = (26526+26925+30660+31897+32401+36427+37588) = (26526+26925+30660+31283+31897+32401+36427+37588)
R	0881	Mod : (22249+25529+30020+31283) = (22249+26270+30020+31283) = (22249+26117+30020+31283) = (22249+26117+30020+31283+34862+37809) = (22249+25529+30020+31283+34862+37809) = (22249+26270+30020+31283+34862+37809)
R	0882	Mod : (26526+30660) = (26526+26925+30660+31283) = (26526+30660+31283+34862) = (26526+26925+30660+31896+32402+36427) = (26526+26925+30660+31897+32401+36427) = (26526+26925+30660+31283+31897+32401+36427) = (26526+26925+30660+31283+31896+32402+36427)
R	0885	Mod : (26526+26925+35220+36427+31896) = (26526+26925+35220+36427+31897) = (26526+26925+30660+31283+35220+36427+31896) = (26526+26925+30660+31283+35220+36427+31897) = (26526+26925+35220+36427+31897+32401+37588)
R	0887	Mod : (26526+33503+35220) = (34637+33503+35220) = (26526+33503+34637+35220)
R	0888	Mod : (26526+35220) = (34637+35220) = (26526+34637+35220) = (26526+33503+35220+37589) = (26526+33503+34637+35220+37589)
R	0889	Mod : 35871 = (31283+35871) = (35871+36427) = (31283+35871+36427)
R	0890	Mod : (26526+35871) = (26526+31283+35871) = (26526+35871+36427) = (26526+30660+31283+35871) = (26526+31283+35871+36427) = (26526+30660+31283+35871+36427)
R	0891	Mod : 37871 = (28160+28917+37871)
R	0892	Mod : (22013+37871) = (24105+37871) = (28160+37871) = (21678+22013+37871) = (21678+24105+37871) = (21678+28160+37871) = (21678+28160+36847+37871)
R	0895	Mod : (21678+37871) = (21678+28160+28917+37871)
R	0896	Mod : (26377+26999+30626+35220) = (26377+26999+30626+31283+35220)
R	0897	Mod : (21678+26999+35220) = (21678+26377+26999+35220) = (21678+21858+26377+26999+35220) = (21678+26377+26999+33503+35220+37589) = (21678+21858+26377+26999+33503+35220+37589)
R	0898	Mod : (21678+26999+33503+35220) = (21678+26377+26999+33503+35220) = (21678+21858+26377+26999+33503+35220)
R	0900	Mod : (24105+30020+37871) = (21678+24105+30020+37871) = (24105+30020+36847+37871)
R	0901	Mod : (21678+22013+25404+26377) = (21678+22013+25404+26999) = (21678+22013+25404+26377+26999) = (21678+22013+25404+26377+34861) = (21678+22013+25404+26377+34862) = (21678+22013+25404+26377+34864) = (21678+22013+25404+26999+34861) = (21678+22013+25404+26999+34862) = (21678+22013+25404+26999+34864) = (21678+22013+25404+26999+33100+34997) = (21678+22013+25404+26377+26999+34862) = (21678+22013+25404+26377+26999+31283+34861) = (21678+22013+25404+26377+26999+31283+34864) = (21678+22013+25404+26999+33100+34997+34861) = (21678+22013+25404+26999+33100+34997+34862) = (21678+22013+25404+26999+33100+34997+34864)

	CODE	DESIGNATION
R	0903	Mod : (22013+37871) = (22013+37871+37999)
R	0904	Mod : (30020+37871) = (30020+37871+37999)
R	0905	Mod : (56-5-B1/B2/B3/V2530/V2533) = (25951/56-5-A1/A3/A4/A5/B4/B5/B6/B7/B8/B9/V2500/V2522/V2527/V2527E/V2524/V2527M)
R	0907	Mod : (21678+25404+30626+31283+37986)
R	0909	Mod : (21678+21859+25404+30626+31283+37986)
R	0910	Mod : 27522 = (27522+31371+31728) = (27522+28360+38347) = (27522+30660+P0164+31371+31728)
R	0911	Mod : (V2500/V2522/V2524/V2527/V2527E/V2527M/56-5-A1/A3/A4/A5/B4/B5/B6/B7/B8/B9/PW) = (25951+32239/V2500/V2522/V2524/V2527/V2527E/V2527M/ 56-5-A1/A3/A4/A5/B4/B5/B6/B7/B8/B9/PW) = (24044/56-5-B1/B2/B3/V2530/V2533)
R	0912	Mod : (21678+25404+26999+31283+33100) = (21678+25404+26377+26999+31283+33100) = (21678+25404+26999+30626+31283+33100+35110) = (21678+25404+26377+26999+31283+33100+35110) = (21678+25404+26999+31283+33100+34862+37809) = (21678+25404+26377+26999+31283+33100+34862+37809) = (21678+25404+26999+30626+31283+33100+35110+34862+37809) = (21678+25404+26377+26999+31283+33100+35110+34862+37809)
R	0913	Mod : (30660+31371) = (30660+31371+28360+38347)
R	0914	Mod : (21678+25404+26999+30626+31283) = (21678+25404+26999+30626+31283+33100+34898) = (21678+25404+26377+26999+30626+31283+34898) = (21678+25404+26999+30626+31283+34862+37809) = (21678+25404+26377+26999+30626+31283+33100+34856) = (21678+25404+26999+30626+31283+33100+34898+34862+37809) = (21678+25404+26377+26999+30626+31283+34898+34862+37809) = (21678+25404+26377+26999+30626+31283+33100+34856+34862+37809)
R	0917	Mod : (21678+22013+25404+26377+26999+30626+31283+33100) = (21678+22013+25404+26377+26999+30626+31283+33100+34862+37809) = (21678+22013+25404+26377+26999+30626+31283+33100+35220+37999)
R	0918	Mod : (26999+31283+33100) = (27646+31283+33100) = (26999+31283+33100) = (27646+31283+33100) = (26999+27646+31283+33100) = (26999+30626+31283+33100+35110) = (26999+31283+33100+34862+37809) = (27646+31283+33100+34862+37809) = (26999+27646+30626+31283+33100+35110) = (26999+27646+31283+33100+34862+37809) = (26999+30626+31283+33100+35110+34862+37809) = (26999+27646+30626+31283+33100+35110+34862+37809)
	0919	Mod : STD = (22013+24044) = (25951+32239) / CFM ALL
	0920	Mod : (22249+24215) = (22249+24588) = (22249+25534) = (22249+24588+25534) = (22249+24215+24588+25534) = (22249+24215+24588+26270+34514)

CODE	DESIGNATION
0922	Mod :(20057+20059+20067+20069+20071+30020) = (20057+20059+20067+20069+20071+30354+31283) = (20057+20059+20067+20069+20071+31283+33100) = (20057+20059+20067+20069+20071+30020+30354)
0926	Mod : (25108+34637) = (35793+34637) = (22013+23672+34637) = (23672+24105+34637) = (24581+36529+34637) = (24785+36529+34637) = (25108+30020+34637) = (22013+23219+36529+34637) = (24105+25294+36529+34637) = (24105+25108+30020+34637) = (24581+30020+36529+34637) = (24785+30020+36529+34637) = (22013+23219+23672+35793+34637) = (22013+23219+23672+36529+34637) = (23672+24105+25294+35793+34637) = (23672+24105+25294+36529+34637) = (24785+27620+33497+34637+35793)
0928	Mod : (21678+26485+26925) = (21678+26999+26925) = (21678+27646+26925) = (21678+30631+26925) = (21678+30635+26925) = (21678+26999+33497+26925) = (21678+26999+27620+33497+26925) = (21678+26999+27646+33497+26925) = (21678+26925+26999+27620+33497+33503+37589) = (21678+26925+26999+27620+27646+33497+33503+37589)
0929	Mod : (21678+26925+26999+33503) = (21678+26925+26999+27620+27646+33497+33503)
0931	Mod : 21678 = (21678+28160+28917) = (21678+28160+28917+30660)
0934	Mod : (21678+22536+27522+33100+35227) = (21678+22536+27522+33300+35227) = (21678+23529+27522+33100+35227) = (21678+23529+27522+33300+35227) = (21678+23227+27522+33100+35227) = (21678+23227+27522+33300+35227) = (21678+22536+27522+33100+35865) = (21678+22536+27522+33300+35865) = (21678+23529+27522+33100+35865) = (21678+23529+27522+33300+35865) = (21678+23227+27522+33100+35865) = (21678+23227+27522+33300+35865) = (21678+22536+27522+27620+33100+33497+35865)
0935	STD = Mod : 28685 = 28686 = (28685+31528) = (28686+31528) = (28685+34506) = (28686+34506) = (27620+33497)
0936	Mod : 31039 = 31528 = (28685+31528+34506) = (28686+31528+34506) = (27620+31528+33497)
0937	Mod : 27620 = (27620+37285) = (27620+33497+37285)
0938	Mod : 27620 = (27620+37285) = (27620+33497+37285) = (22013+23219+23672+27620) = (23672+24105+25294+27620) = (23672+24105+25294+27620+37285)
0939	STD = (27620+33497) = (22013+23219+23672) = (23672+24105+25294) = (23672+24105+25294+27620+33497) = (22013+23219+23672+24785+27620+33497)
0940	Mod : (28479+35542+P6146) = (28916+35542+P6146)
0943	Mod : (21678+21858+25404+30626+31283+35542)
0944	Mod : (30020+31283+35542) = (24105+25404+28479+31283+30020+35542)
0945	Mod : (20024+24105+30020+35220+35542)
0946	Mod : (30020+35220+35542) = (20024+30020+35220+35542)
0947	Mod : (24105+24511+30020+31283+35542)
0948	Mod : (30020+31283+35542+P6146) = (28479+30020+31283+35542+P6146)
0950	Mod : (30020+35220+35542) = (24105+26925+30020+35220+35542)

	CODE	DESIGNATION
R	0951	Mod : (27276+30020+31395+35542+35220) = (27276+24105+30020+31395+35542+35220) = (24105+27276+30020+30977+31395+32207+35220+35542)
R	0952	Mod : (26925+35542) = (26925+30660+35542)
	0953	STD = Mod : 20067+20069+28474+28478
R	0954	Mod : (30020+34637+35220+35542) = (26526+26925+30020+30660+31283+35220+34637+35542)
R	0955	Mod : (26526+30020+35220+35542) = (30020+34637+35220+35542)
R	0956	Mod : (26526+30020+35220+35542+35485) = (30020+34637+35220+35542+35485)
R	0957	Mod : (21678+24105+30020+32207+35542)
R	0958	STD = Mod : 25072 = 27609 = (22562+25072) = (25888+27609) = (37987+27609)
R	0959	Mod : 22562 = 35864 = (22562+35864) = (22562+25888+27609) = (22562+27609+37987)
R	0960	Mod : 25888 = 37987 = (22562+37987) = (35864+37987) = (22562+25888) = (25888+35864) = (22562+25072+25888) = (22562+25072+37987)
R	0961	Mod : STD = (25888+27609) = (22562+25072) =(27609+37987)
	0962	Mod : (21678+24105+32207) = (21678+26335+28160+32207)
R	0963	STD = Mod : 25072 = (22562+25072) = (25888+27609) = (27609+37987)
	0964	Mod : 20343 = 31276 = (20343+27498) = (31276+27498)
	0965	Mod : 25240 = 25274 = 28283 = 28711 = (25240+28283) = (25240+28238+28719) = (25274+28238+28719)
R	0967	Mod : 23871 = (P0164+27522+28360+31371) = (31371+28360+38347) = (27522+31371+28360+38347)
	0968	Mod : (32494+32496) = (P0164+32494+32496)
R	0969	Mod : (31371+35220+35550) = (31371+35220+35550+28360+38347)
	0970	Mod : (20067+20069+20071+30020) = (20067+20069+20071+30534+31283) = (20067+20069+20071+30534+31283
R	0971	STD = Mod : 25072 = (22562+25072) = (25888+27609) = (37987+27609)
R	0972	Mod : 22562 = 35864 = (22562+35864) = (22562+27609+37987) = (22562+25888+27609)
R	0973	Mod : 25888 = 37987 = (22562+37987) = (35864+37987) = (22562+25888) = (25888+35864) = (25888+22562+25072) = (22562+25072+37987)
R	0974	Mod : 22562 = 35864 = (22562+25888+27609) = (22562+27609+37987)
R	0975	Mod : 37987 = 25888 = (25888+35864) = (35864+37987) = (22562+25072+37987) = (22562+25072+25888)
R	0976	Mod : 31371 = (27522+31371) = (31371+38360+38347) = (27522+31371+28360+38367)
R	0977	Mod : (24511+37871) = (24511+28479+31283+37871) = (24511+28479+31283+34862+37809+37871)
R	0978	Mod : STD = (25888+27609) = (37987+27609)
R	0979	Mod : 30051 = (30051+25888+27609) = (30051+37987+27609)
	0980	STD = (24105+31364) = (24105+31365) = (24105+31897) = (24105+31896) = (20105+32475) = (24105+32929) = (24105+31380) = (24105+31379) = (24105+31365+31896+31905) = (24105+31364+31897+31906) = (24105+31365+31905+32475) = (24105+31364+31906+32929) = (24105+31365+31905+31380) = (24105+31364+31906+31379)
	0981	Mod : 24105 = (24105+31364+31906) = (24105+31365+31905)
R	0982	Mod : (24498+30051) = (24642+30051) = (25568+30051) = (25888+30051) = (28651+30051) = (30051+37987)
R	0983	Mod : 20057 = (20057+25888+27609) = (20057+27609+37987)

	CODE	DESIGNATION
	0984	Mod : 25205 = 26111 = 26485 = 26999 = 28382 = 30241 = 30631 = (23885+26111) = (23885+26999) = (25205+26999+28495) = (26999+28382+28495)
R	0985	Mod: 27866 = 26117 = 26270 = (25529+27866) = (26851+27866) = (26117+26270) = (25529+26185+27866) = (25529+26208+27866) = (25529+26345+27866)
	0986	STD = Mod : (25204+26999+27917) = (26999+28495) = (26999+28218+28495) = (25204+26999+28495) = (24105+25294+26999+28495) = (24105+25294+26002+26999+28218+28495) = (24105+26002+26999+28218+28495+31070) = (25204+26002+26999+28218+28495+31070)
R	0987	Mod: 26851 = 25529 = 26185 = 26208 = 26345 = (25529+26185) = (25529+26208) = (25529+26345) = (25529+26851)
R	0988	Mod : STD = (25888+27609) = (22562+25072) =(27609+37987)
	0992	Mod : (28238+32635) = (28238+28951+32635)
R	0993	Mod : 21678 = (21678+35220+37999) = (21678+33100+34856) = (21678+33100+34997) = (21678+33100+34997+35220+37999)
R	0994	Mod : (25888+35864) = (22562+25072) = (22562+25888) = (22562+37987) = (35864+37987)
R	0996	Mod : (22562+24105) = (24105+35864) = (24105+22562+35864) = (22562+24105+25888+27609) = (24105+25888+35864+27609) = (22562+24105+27609+37987) = (24105+27609+35864+37987)
R	0997	Mod : (25888+36847) = (36847+37987) = (22562+25072+25888+36847) = (25888+28160+28917+36847) = (28160+28917+36847+37987) = (22562+25072+25888+28160+28917+36847)
R	0998	Mod : (21678+24105) = (21678+24105+33100+34898)
R	0999	Mod : STD = 20063 = 20151 = (31495+35270) = (20063+20151) = (20063+31112) = (20063+23092) = (22562+25072) = (20063+22562+25072) = (20063+22562+25888) = (20151+22562+25072) = (20151+22562+25888) = (20063+22562+37987) = (20151+22562+37987) = (20063+20151+31495+35270) = (20063+20151+22562+25072) = (20063+20151+22562+25888) = (20063+20151+25888+31495+35270+35864)
R	1000	Mod : (21678+33100) = (21678+33100+35220+37999)
R	1001	Mod : (20063+31495) = (20063+31495+25888+35864) = (20063+31495+35864+37987)
R	1002	Mod : (20063+22013+31495) = (20063+22013+25888+31495+35864) = (20063+22013+31495+35864+37987)
R	1003	Mod : (20151+31495) = (31112+31495) = (31495+23092) = (20063+31112+31495) = (20063+20151+31495) = (20063+25888+31112+31495+35864) = (20063+20151+25888+31495+35864) = (20063+20151+31495+35864+37987) = (20063+31112+31495+35864+37987)
R	1004	Mod : (21678+24105+33100) = (21678+24105+33300)
R	1005	Mod : (22013+31283) = (22013+31283+34862+37809)
R	1006	Mod : (21678+37871) = (21678+35220+37871) = (21678+33100+34856+35220+37871) = (21678+33100+34997+35220+37871)
R	1007	Mod : (21678+24105+37871) = (21678+24105+35220+37871) = (21678+24105+33100+34998+35220+37871)
R	1010	Mod : (24035+31283)=(24160+31283)=(24189+31283) = (24035+31283+34862+37809) = (24160+31283+34862+37809) = (24189+31283+34862+37809)
	1011	Mod : 31283 = (28479+31283) = (28702+31283) = (28916+31283) = (31283+34862+37809) = (28479+31283+34862+37809) = (28702+31283+34862+37809) = (28916+31283+34862+37809)

CODE	DESIGNATION
1012	Mod : (30363+31283) = (30363+31283+34862+37809)
1013	Mod : 25404 = (25404+26728) = (25404+26728+31283+34864)
1014	Mod : (25404+31283) = (25404+28479+31283) = (25404+28916+31283) = (25404+31283+34862+37809) = (25404+28479+31283+34862+37809) = (25404+2891631283+34862+37809)
1020	Mod : 31283 = (31283+34862+37809)
1022	Mod : 27522 = (27522+31371+31728) = (27522+28360+38347)
1023	Mod : (20137+30239) = (20137+30239+28360+38347)
1024	Mod : (26526+31283) = (26526+30660+31283) = (26526+31283+34862+37809) = (26526+30660+31283+34862+37809)
1025	(Mod : 27112+(56-5-A4 = 56-5-A5 = 56-5-B5 = 56-5-B6 = V2522 = V2524)) = (Mod : (20802+27112)+(V2522 = V2524)) = (Mod : (20141+20802+27112)+56-5-B6)
1026	Mod : (56-5-A4 = 56-5-A5 = 56-5-B5 = 56-5-B6 = V2522 = V2524) = Mod : 32217 = (Mod : 20802+(V2522=V2524)) = ((Mod : 20141+20802)+(56-5-A4 = 56-5-B5 = 56-5-B6 = 56-5-A5)) = (CFM56-5-A5/20141+20802+32979)
1027	Mod : (20139+21533+27276) = (23109+23408+27276+34540) = (20139+23109+23408+27276+34540) = (20139+21533+23109+23408+27276)
1030	Mod : (30660+31371) = (30660+31371+28360+38347
1031	Mod : (30660+31283+34637) = (26526+30660+31283+34637) = (30660+31283+34637+34862+37809) = (26526+30660+31283+34637+34862+37809)
1032	Mod : (26526+31283+34041) = (26526+30660+31283+34041) = (26526+31283+34041+34862+37809) = (26526+30660+31283+34041+34862+37809)
1033	Mod : (26526+26925+30660+31283+34041) = (26526+26925+30660+31283+34041+34862+37809)
1034	Mod : 38948 = (30479+38948) = (23900+30479+38948)
1035	Mod : 30096 = (36609+30096) = (36772+30096) = (36562+30096) = (34809+36609+30096) = (34809+36772+30096) = (34313+36562+30096) = (34809+37588+30096)
1036	STD = Mod : 36609 = 36772 = 36562 = (34809+36609) = (34809+36772) = (34313+36562) = (30096+32304) = (34809+37588) = (36609+30096+32304) = (36772+30096+32304) = (36562+30096+32304) = (34809+36609+30096+32304) = (34809+36772+30096+32304) = (34313+36562+30096+32304)
1037	Mod : 22013 = (22013+36609) = (22013+36772) = (22013+36562) = (22013+30096+32304) = (22013+34809+36609) = (22013+34809+36772) = (22013+34313+36562) = (22013+34809+37588) = (22013+36609+30096+32304) = (22013+36772+30096+32304) = (22013+36562+30096+32304) = (22013+34809+36609+30096+32304) = (22013+34809+36772+30096+32304) = (22013+34313+36562+30096+32304) = (22013+34809+37588+30096+32304)
1038	Mod : (22013+30096) = (22013+36609+30096) = (22013+36772+30096) = (22013+36562+30096) = (22013+34809+36609+30096) = (22013+34809+36772+30096) = (22013+34313+36562+30096) = (22013+34809+37588+30096)
1039	Mod : 34313 = 34809 = (34313+30096+32304) = (34809+30096+32304)
1040	Mod : (22013+34313) = (22013+34809) = (22013+34313+30096+32304) = (22013+34809+30096+32304)
1041	Mod : (22013+30096+34313) = (22013+30096+34809)
1042	Mod : (30096+37999) = (36609+30096+37999) = (36772+30096+37999) = (36562+30096+37999) = (34809+36609+30096+37999) = (34809+36772+30096+37999) = (34313+36562+30096+37999) = (34809+37588+30096+37999)

CODE	DESIGNATION
1043	Mod : (22013+30096+37999) = (22013+36609+30096+37999) = (22013+36772+30096+37999) = (22013+36562+30096+37999) = (22013+34809+36609+30096+37999) = (22013+34809+36772+30096+37999) = (22013+34313+36562+30096+379999) = (22013+34809+37588+30096+37999)
1045	Mod : 20343 = 31276 = (20343+27498) = (31276+27498)
1046	Mod : (22013+31283) = (25951+31283) = (22013+28479+31283) = (22013+31283+34862+37809) = (25951+31283+34862+37809) = (22013+28479+31283+34862+37809)
1047	Mod : (31283+P6911) = (P6911+28479+31283) = (22013+24044+31283+P6911) = (25951+31283+32239+P6911) = (31283+P6911+34862+37809) = (P6911+28479+31283+34862+37809) = (22013+24044+31283+P6911+34862+37809) = (25951+31283+32239+P6911+34862+37809)
1049	Mod :(22013+31283+P6911) = (25951+31283+P6911) = (22013+31283+34862+37809+P6911) = (25951+31283+34862+37809+P6911)
1050	Mod : (25990+31283) = (25990+31283+34862+37809)
1051	Mod: (20024+31283) = (20024+31283+34862+37809)
1052	Mod: (22013+31283) = (22013+31283+34862+37809)
1053	Mod: (20024+22013+31283) = (20024+22013+31283+34862+37809)
1054	Mod: 31283 = (20024+22013+31283) = (31283+34862+37809) = (20024+22013+31283+34862+37809) = (20024+22013+31283+34862+37809)
1055	Mod: (24105+28479+30020+31283) = (24105+28479+30020+31283+34862+37809)
1056	Mod : (28479+30439+31283+34041) = (28916+30439+31283+34041) = (28479+30439+31283+34041+34862+37809) = (28916+30439+31283+34041+34862+37809)
1057	Mod : 38948 = (30479+38948)
1058	Mod : (24511+28479+31283+34041) = (24511+28916+31283+34041) = (24511+28479+31283+34041+34862+37809) = (24511+28916+31283+34041+34862+37809)
1059	Mod : (24105+24511+30020+31283) = (24105+24511+30020+31283+34862+37809)
1062	Mod : (23408+38948) = (23408+30479+38948)
1063	Mod : (24035+31283) = (24189+31283) = (24105+31283+34862+37809) = (24189+31283+34862+37809)
1064	Mod : (22249+31283) = (22249+31283+34862+37809)
1065	STD = Mod : (27522+28360) = (27620+33497)
1066	Mod : (24035+25404+31283) = (24035+24404+31283+34862+37809)
1068	Mod : (25863+36998) = (25863+28551+34195+36998)
1069	STD = Mod : 26728 = (26728+31283+34864)
1070	STD = Mod : (34573+32992) = (35526+32998) = (34076+37588)
1071	Mod : 32997 = 34076 = 35526 = 34573 = (34573+32992+32997) = (35526+32998+34076) = (34076+37588+35526)
1072	Mod : (22013+31283) = (20024+22013+31283) = (22013+31283+34862+37809) = (20024+22013+31283+34862+37809)
1073	Mod : (20024+31283) = (20024+31283+34862+37809)
1074	Mod : (23672+24105+27620+34637+35201) = (24785+27620+34637+35201+35793) = (24105+24785+27620+30020+34637+35201+35793)
1075	Mod : (23672+24105+27620+34637+35201)
1076	Mod : 32011 = 28721 = 28960 = 32456
1077	Mod : 28960 = 28721 = 32011 = 32456
1078	Mod : 26398 = 23222 = 26057 = (26398+31897+32333) = (23222+31896+32332) = (23222+31897+32333) = (26398+31896+32332) = (26057+31897+32333) = (26057+31896+32332)

	CODE	DESIGNATION
R	1083	Mod : (20067+20069+21195+31283) = (20067+20069+21195+31283+34862+37809)
R	1084	Mod : (20067+20069+21195) = (20067+20069+21195+31283+34861) = (20067+20069+21195+31283+34862) = (20067+20069+21195+31283+34864)
R	1085	Mod: (35220+37999) = (31283+35220+37999)
	1087	Mod : 24064 = 24065 = 24066 = 24067 = (24064+24065)
	1090	STD = Mod : 23885 = (26999+28495)
R	1092	Mod: (26377+26999+30626+35220+37999) = (26377+26999+30626+31283+35220+37999)
R	1094	Mod: (21678+26999+35220+37999) = (21678+26999+35220+37999)
R	1095	Mod: (21678+26999+35220+33503+37999) = (21678+26377+26999+35220+33503+37999)
R	1096	Mod : (22013+26999+31283+35220) = (22013+27646+31283+35220) = (22013+26999+27646+31283+35220) = (22013+26999+31283+35220+37999) = (22013+26999+27646+31283+35220+37999)
R	1097	Mod: (21678+28479) = (21678+28916) = (21678+28479+31283+35220+37999)
R	1098	Mod: 22013 = (22013+30626+35110) = (22013+35220+37999) = (22013+35110+35220+37999) = (22013+35110+30626+35220+37999)
R	1099	Mod: (24105+30626) = (28160+30626) = (24105+30626+35220+37999) = (28160+30626+35220+37999)
R	1100	Mod: (22013+30626) = (22013+30626+35220+37999)
R	1101	Mod : (26965+35220) = (26925+35220+37999)
R	1102	Mod : (26398+31896) = (26398+31897) = (26398+35119) = (26398+32475) = (26398+32929) = (26398+31896+32332+32475) = (26398+31897+32333+32929) = (26398+31896+32332+35119)
R	1103	Mod : 31896 = 31897 = 35119 = 32475 = 32929 = (32929+37588) = (32401+37588) = (31896+32332+35119) = (31896+32332+32475) = (31897+32333+32929)
R	1105	Mod : (21678+32650) = (22013+38634) = (21678+32650+33100+34856) = (21678+32650+33100+34898)
R	1106	Mod : 21678 = (21678+27522+28360)
R	1107	Mod : (21678+22536) = (21678+23227) = (21678+23529) = (21678+22536+27522+28360) = (21678+23227+27522+28360) = (21678+23529+27522+28360)
R	1108	Mod : (56-5-B6+20268+36311) = (56-5-B5+20268+36297)
R	1109	Mod : (25205+20268/B4) = (23885+20268/B4) = (26999+20268/B4) = (28382+20268/B4) = (30241+20268/B4) = (26485+20268/B4) = (30631+20268/B4) = (25205+20268+36311/B6) = (23885+20268+36311/B6) = (26999+20268+36311/B6) = (28382+20268+36311/B6) = (30241+20268+36311/B6) = (26485+20268+36311/B6) = (30631+20268+36311/B6) = (26999+28382+28495+20268/B4) = (25205+26999+28495+20268/B4) = (26999+28382+28495+20268+36311/B6) = (25505+26999+28495+20268+36311/B6) = (25205+20268+36297/B5) = (26999+20268+36297/B5) = (30241+20268+36297/B5) = (23885+20268+36297/B5) = (28382+20268+36297/B5)= (30631+20268+36297/B5)
R	1110	Mod : 20268/B4 = (20268+36611/B6) = (20268+26999+28495/B4) = (20268+26999+28495+36311/B6) = (20268+36297/B5) = (20268+26999+28495+36297/B5)
R	1111	Mod : (20268/B4) = (20268+36311/B6) = (20268+36297/B5)
R	1112	Mod : PW = (26017+36847/56-5-A4/A5/B5/B7/B8) = (24105+36847/56-5-B6/IAE) = (24105+26017+36847/56-5-B6/IEA) = (24105+36297/56-5-B5) = (24105+26017+36847/56-5-B5)
R	1113	Mod : (36847/56-5-B4/B6/IAE) = (26017+36847/56-5-A1/A3/B4/B6/IAE) = (36847+36297/56-5-B5) = (26017+36847+36297/56-5-B5)
	1114	Mod : (20268+36847/56-5-A1/A3/B4) = (20268+36297+36847/56-5-B5) = (20268+36311+36847/56-5-B6)

	CODE	DESIGNATION
	1115	Mod : (36847/56-5-A1/A3/B4) = (36311+36847/56-5-B6) = (36297+36847/56-5-B5)
	1116	Mod : 28916 = 28479 = 26728 = (26728+31283+34864) = (28479+31283+34861)
R	1117	Mod : 36297 = (20268+24946+27773+36297) = (20268+24946+26965+36297)
R	1118	Mod : 56-5-A1/A3/B4/V2500A1/V2527A5/V2527EA5 = 36297/56-5-B5 = 36311/56-5-B6
R R	1119	Mod : (22013+37999) = (24105+37999) = (34105+28479+37999) = (24105+28916+37999) = (22013+28479+37999) = (22013+28916+37999)
R R	1120	Mod : (20268+24917+56-5-B4) = (20268+24917+36311+56-5-B6) = (20268+24917+36297/56-5-B5)
R	1121	Mod : (22013+37999) = (22013+28479+37999) = (22013+28916+37999)
R R R R	1122	Mod : (22013+37999) = (22013+27276+32207+37999) = (22013+31395+32207+37999) = (22013+27276+31395+32207+37999) = (22013+27276+30977+31395+37999) = (22013+27276+30977+31395+32207+37999)
R	1123	Mod : (30660+37999) = (30660+31283+37999)
R R R R	1124	Mod : (24785+26526+37999) = (24349+26526+37999) = (23779+24852+26256+37999) = (23779+24349+26526+37999) = (23779+24785+26526+37999) = (23779+24349+24785+26526+37999) = (23779+24785+24852+26526+37999)
R	1125	Mod : (26526+31283+37999) = (26526+30660+31283+37999)
R R R	1126	Mod : (24067+26526+37999) = (24067+34637+37999) = (24066+26526+37999) = (24066+34637+37999) = (24064+26526+37999) = (24065+26526+37999) = (24064+34637+37999) = (24065+34637+37999)
R R	1127	Mod : (P8232+22706+30365+31283+33907+37999) = (22706+30365+31283+33907+P8175+P8232+37999)
R R R	1130	Mod : (26526+37999) = (34637+37999) = (26526+34637+37999) = (26526+33503+37589+37999) = (33503+34637+37589+37999) = (26526+34637+33503+37589+37999)
R R	1131	Mod : (26526+33503+37999) = (34637+33503+37999) = (26526+34637+33503+37999)
R	1132	Mod : (21678+25404+31283+37999) = (21678+25404+31283+35110+37999)
R	1133	Mod : (21678+25404+30626+31283+37999)
R R	1134	Mod : (26377+26999+31283+37999) = (26377+26999+31283+35110+37999) = (26377+26999+30626+31283+35110+37999)
R R	1135	Mod : (21678+22536+27620) = (21678+23227+27620) = (21678+23529+27620) = (21678+22536+27620+37285) = (21678+22536+27620+33497+37285)
R	1136	Mod : (21678+27522) = (21678+27522+28360+38347)
R	1137	Mod : (21678+26999+37999) = (21678+26377+26999+37999)
R	1138	Mod : (21678+26999+33503+37999) = (21678+26999+26377+33503+37999)
R R	1139	Mod : (22013+26999+31283+37999) = (22013+27646+31283+37999) = (22013+26999+27646+31283+37999)
R R R R R R R R	1140	Mod : (21678+22536+27522) = (21678+23227+27522) = (21678+23529+27522) = (21678+23227+27522+33100+34997) = (21678+22536+27522+33100+34997) = (21678+23529+27522+33100+34898) = (21678+23529+27522+33100+34856) = (21678+23227+27522+33100+34898) = (21678+22536+27522+33100+34856) = (21678+22536+27522+33100+34898) = (21678+23227+27522+33100+34856) = (21678+22536+27522+27620+33497) = (21678+23529+27522+27620+33497) = (21678+22536+27522+28360+38347) = (21678+23227+27522+28360+38347) = (21678+23529+27522+28360+38347)

	CODE	DESIGNATION
R	1141	Mod : (25888+36847) = (22562+25072+25888+36847) = (25888+28160+28917+36847) = (21678+27522+27620+33100+33497) = (21678+27522+28360+33100+38347) = (21678+27522+28360+33300+38347) = (22562+25072+25888+28160+28917+36847)
R	1143	Mod : (21678+27522+27620+33100) = (21678+27522+27620+33100+37285) = (21678+27522+27620+33100+33497+37285)
R	1144	Mod : (21678+23529+27522+27620+35227) = (21678+22536+27522+27620+35865) = (21678+22536+27522+27620+35865) = (21678+22536+27522+27620+33497+35865+37285)
R	1145	Mod : (21678+22536+27522+27620+33100) = (21678+22536+27522+27620+33300) = (21678+23227+27522+27620+33100) = (21678+23227+27522+27620+33300) = (21678+23529+27522+27620+33100) = (21678+23529+27522+27620+33300) = (21678+23529+27522+27620+33100+33497+37285)
R	1146	Mod : (21678+22536+27522+27620+33100+35865) = (21678+23227+27522+27620+33100+35865) = (21678+23529+27522+27620+33100+35227) = (21678+23227+27522+27620+33300+35865) = (21678+23529+27522+27620+33100+35865) = (21678+22536+23227+27522+27620+33100+35227)
R	1147	Mod : (25205+31896+38073) = (25205+31897+38073) = (25205+35119+38073) = (25205+32929+38073) = (25205+32475+38073) = (26111+31896+38073) = (26111+31897+38073) = (26111+35119+38073) = (26111+32929+38073) = (26111+32475+38073) = (26485+31896+38073) = (26485+31897+38073) = (26485+35119+38073) = (26485+32929+38073) = (26485+32475+38073) = (26999+31896+38073) = (26999+31897+38073) = (26999+35119+38073) = (26999+32929+38073) = (26999+32475+38073) = (28382+31896+38073) = (28382+31897+38073) = (28382+35119+38073) = (28382+32929+38073) = (28382+32475+38073) = (30241+31896+38073) = (30241+31897+38073) = (30241+35119+38073) = (30241+32929+38073) = (30241+32475+38073) = (30361+31896+38073) = (30361+31897+38073) = (30361+35119+38073) = (30631+32929+38073) = (30361+32475+38073) = (25205+31896+32332+32475+38073) = (25205+31897+32333+32929+ 38073) = (25205+31896+32332+35119+38073) = (26111+31896+32332+32475+38073) = (26111+31897+32333+32929+38073) = (26111+31896+32332+35119+38073) = (26485+31896+32332+32475+38073) = (26485+31897+32333+32929+38073) = (26485+31896+32332+35119+38073) = (26999+31896+32332+32475+38073) = (26999+31897+32333+32929+38073) = (26999+31896+32332+35119+38073) = (28382+31896+32332+32475+38073) = (28382+31897+32333+32929+38073) = (28382+31896+32332+35119+38073) = (30241+31896+32332+32475+38073) = (30241+31897+32333+32929+38073) = (30241+31896+32332+35119+38073) = (30631+31896+32332+32475+38073) = (30631+31897+32333+32929+38073) = (30631+31896+32332+35119+38073) = (25205+26999+28495+31896+38073) = (25205+26999+28495+31897+38073) = (25205+26999+28495+35119+38073) = (25205+26999+28495+32929+38073) = (25205+26999+28495+32475+38073) = (26999+28382+28495+31896+38073) = (26999+28382+28495+31897+38073) = (26999+28382+28495+35119+38073) = (26999+28382+28495+32929+38073) = (26999+28382+28495+32475+38073) = (25205+26999+28495+31896+32332+32475+38073) = (25205+26999+28495+31897+32333+32929+38073) = (25205+26999+28495+31896+32332+35119+28073) = (26999+28382+28495+31896+32332+32475+38073) = (26999+28382+28495+31897+32333+32929+38073) = (26999+28382+28495+31896+32332+35119+38073)
R	1148	MSN : 0164 = 0168 = 0169 = 0179 = 0193 = 0221 = 222 = 0230 = 0294 = 0299 = 0301 = 0338 = 0348 = 0349 = 0362 = 0424 = 0429 = 0437 = 0444 = 0449 = 0476
R	1149	Mod : (21678+23227+27522+27620+33100+37986) = (21678+22536+27522+27620+33100+37986) = (21678+23227+27522+27620+33300+35865+37986)

	CODE	DESIGNATION
R	1150	Mod : (21678+33100+37871) = (21678+33100+35220+37871)
R	1151	Mod : (21678+24105+33100+37871) = (21678+24105+33300+37871) = (21678+24105+33100+35220+37871) = (21678+24105+33300+35220+37871)
R	1152	Mod : 22562 = 35864 = (22562+35864) = (25888+35864) = (22562+25888+27609) = (22562+27609+37987)
R	1153	Mod : 25888 = 37987 = (22562+25072+25888)
R	1154	Mod : STD = 24105 = (24105+25888+27609) = (24105+27609+37987) = (22562+24105+25072)
R	1157	Mod : (22562+24105) = (24105+35864) = (24105+22562+35864) = (24105+25888+35864) = (22562+24105+25888+27609) = (22562+24105+27609+37987) = (22562+24105+27609+35864+37987) = (22562+24105+25888+27609+35864)
R	1158	Mod : 37871 = (22562+25072+37871) = (25888+27609+37871) = (27609+37987+37871)
R	1159	Mod : (22562+37871) = (35864+37871) = (22562+35864+37871) = (25888+35864+37871) = (22562+25888+27609+37871) = (22562+27609+37987+37871)
R	1160	Mod : (25888+37871) = (37987+37871) = (22562+25072+25888+37871)
R	1161	Mod : (24105+37871) = (24105+25888+27609+37871) = (24105+27609+37987+37871) = (22562+24105+25072+37871)
	1162	Mod : 30020 = (24105+30020) = (30020+US) = (24105+30020+US)
R	1163	Mod : (22562+24105+37871) = (24105+35864+37871) = (24105+22562+35864+37871) = (22562+24105+25888+27609+37871) = (22562+24105+27609+37987+37871) = (22562+24105+27609+35864+37987+37871) = (22562+24105+25888+27609+35864+37871) = (24105+25888+35864+37871)
R	1164	Mod : (24105+25888+37871) = (24105+37987+37871)
R	1165	Mod : 22562 = 35864 = (22562+35864) = (22562+2588+27609)
R	1166	Mod : (33910+IAE) = (33909+CFM) = (IAE+35932) = (CFM+35932)
	1167	Mod : (V2530 / V2533 / 56-5-B1 / 56-5-B2 / 56-5-B3) = (V2530 / V2533 / 56-5-B1 / 56-5-B2 / 56-5-B3) + LLLLL = 24105 = (24105 + LLLLL) = (V2530 / V2533 / 56-5-B1 / 56-5-B2 / 56-5-B3) + 20268 = (V2530 / V2533 / 56-5-B1 / 56-5-B2 / 56-5-B3) + 20268 + LLLLL = (24105 + 20268) = (24105 + 20268 + LLLLL)
	1168	Mod : 20117 = 21678 = (20117+21678)
	1169	Mod : (21678+26377)=(20117+2637)
R	1170	Mod : (35220+PW) = (33910+35220+CFM) = (33909+35220+IAE) = (35220+35932+IAE) = (35220+35932+CFM)
R	1171	Mod : (P10861+56-5-B1/B2/B3/B4/B5/B6/B7/B8/B9)
R	1172	Mod : 24105 = (22562+24105+25888) = (24105+25888+35864) = (22562+24105+37987) = (24105+35864+37987) = (22562+24105+25072)
R	1173	Mod : 37871 = (22562+25072+37871) = (22562+25888+37871) = (22562+37987+37871) = (25888+35864+37871) = (35864+37987+37871)
R	1174	Mod : (22562+37871) = (35864+37871) = (22562+35864+37871) = (22562+25888+27609+37871)
R	1175	Mod : (24105+37871) = (22562+24105+25888+37871) = (24105+25888+35864+37871) = (22562+24105+37987+37871) = (24105+35864+37987+37871) = (22562+24105+25072+37871)
R	1176	Mod : (22562+24105+37871) = (24105+35864+37871) = (24105+22562+35864+37871) = (22562+24105+25888+27609+37871) = (24105+25888+35864+27609+37871) = (22562+24105+27609+37987+37871) = (24105+27609+35864+37987+37871)
R	1177	Mod : 37871 = (28479+31283+37871) = (28702+31283+37871) = (28916+31283+37871)

CODE	DESIGNATION
1178	Mod : (30363+37871) = (30363+31283+37871) = (30363+31283+34862+37809+37871)
1180	Mod : (31283+37999) = (31283+34862+37809+37999)
1181	Mod : STD = (31283+34862) = (31283+35220) = (35220+37999) = (31283+34862+37809) = (31283+35220+37999) = (31283+34862+35220+37809) = (31283+34862+35220+37809+37999)
1182	Mod : 22013 = (22013+31283) = (20024+22013) = (20024+22013+31283)
1183	Mod : 23699 = 24281 = (23698+23699) = (23698+24281) = (23699+24281) = (23698+23699+24281)
1184	Mod : STD = 26346 = (26346+US) = (22013+US) = (24105+US) = (31106+32311+US) = (24946+31106+US) = (31106+32238+US)
1185	Mod : (34665+37147) = (34665+38573)
1188	Mod : STD = 25398 = (22875+25398)
1189	Mod : 22536 = 23227 = 23529 = (22536+27522+28360) = (23227+27522+28360) = (23529++27522+28360) = (22536+27620+33497) = (23227+27620+33497+23529+27620+33497)
1190	Mod : 21678 = (21678+27522+28360) = (21678+27620+33497)
1191	Mod : (21678+22536+27620) = (21678+23227+27620) = (21678+23529+27620) = (21678+22536+27620+37285) = (21678+23227+27620+37285) = (21678+23529+27620+37285) = (21678+23227+27620+33497+37285) = (21678+23529+27620+33497+37285) = (21678+22536+27620+33497+37285)
1192	Mod : (21678+22536+27522+27620) = (21678+23227+27522+27620) = (21678+23529+27522+27620) = (21678+23227+27522+27620+37285) = (21678+23529+27522+27620+37285) = (21678+22536+27522+27620+37285) = (21678+22536+27522+27620+33100+34856) = (21678+22536+27522+27620+33100+34898) = (21678+23227+27522+27620+33100+34856) = (21678+23227+27522+27620+33100+34898) = (21678+23529+27522+27620+33100+34856) = (21678+22536+27522+27620+33497+37285) = (21678+23227+27522+27620+33497+37285) = (21678+23529+27522+27620+33497+37285)
1193	Mod : (21678+22536+27522+33100) = (21678+22536+27522+33300) = (21678+23529+27522+33100) = (21678+23529+27522+33300) = (21678+23227+27522+33100) = (21678+23227+27522+33300) = (21678+22536+27522+27620+33100+33497) = (21678+23227+27522+27620+33100+33497) = (21678+23529+27522+27620+33100+33497) = (21678+23529+27522+27620+33300+33497) = (21678+22536+27522+27620+33300+33497) = (21678+23227+27522+27620+33300+33497)
1194	Mod : (21678+23529+27522+27620+35227) = (21678+22536+27522+27620+35865) = (21678+22536+27522+27620+35227) = (21678+23529+27522+27620+35865) = (21678+23227+27522+27620+35227) = (21678+23277+27522+27620+35865) = (21678+22536+2752+27620+33497+35227+37285) = (21678+23529+27522+27620+33497+35227+37285) = (21678+23529+27522+27620+33497+35865+37285) = (21678+22536+27522+27620+33497+35865+37285) = (21678+23227+27522+27620+33497+35227+37285) = (21678+23227+27522+27620+33497+35865+37285) = (21678+22536+27522+27620+28360+35227+38347) = (21678+22536+27522+27620+28360+35865+38347) = (21678+23227+27522+27620+28360+35227+38347) = (21678+23227+27522+27620+28360+35865+38347) = (21678+23529+27522+27620+28360+35227+38347) = (21678+23529+27522+27620+28360+35865+38347)

CODE	DESIGNATION
1195	Mod : (21678+22536+27522+27620+33100) = (21678+22536+27522+27620+33300) = (21678+23227+27522+27620+33100) = (21678+23227+27522+27620+33300) = (21678+23529+27522+27620+33100) = (21678+23529+27522+27620+33300) = (21678+23529+27522+27620+33100+33497+37285) = (21678+23529+27522+27620+33300+33497+37285) = (21678+22536+27522+27620+33100+33497+37285) = (21678+22536+27522+27620+33300+33497+37285) = (21678+23227+27522+27620+33100+33497+37285) = (21678+23227+27522+27620+33300+33497+37285)
1196	Mod : (21678+22536+27522+27620+33300+35865) = (21678+22536+27522+27620+33100+35865) = (21678+23227+27522+27620+33100+35865) = (21678+23529+27522+27620+33100+35227) = (21678+23227+27522+27620+33300+35865) = (21678+23529+27522+27620+33100+35865) = (21678+22536+23227+27522+27620+33100+35227)
1197	Mod : (22249+26117+31283+34041+35220) = (22249+26270+31283+34041+35220)
1198	Mod : 22249 = (22249+26270+34514) = (22249+31283+34861) = (22249+31283+34862) = (22249+31283+34864)
1199	Mod : (22249+35220) = (22249+35220+37999) = (22249+31283+35220+37999) = (22249+24105+31283+35220)
1200	Mod : (22249+25529) = (22249+26117) = (22249+26270) = (22249+25529+31283+34864) = (22249+25529+31283+34862) = (22249+25529+31283+34861) = (22249+26270+31283+34864) = (22249+26270+31283+34862) = (22249+26270+31283+34861) = (22249+24105+26117+31283+34862)
1201	Mod : (22249+25529+35220) = (22249+26117+35220) = (22249+26270+35220) = (22249+26117+35220+37999) = (22249+26117+31283+35220) = (22249+24105+26270+31283+35220) = (22249+25529+26117+31283+35220) = (22249+24105+26117+31283+35220) = (22249+25529+26117+31283+35220) = (22249+26117+31283+35220+37999) = (22249+26117+31283+35220+36847) = (22249+26117+26270+31283+35220) = (22249+26270+31283+34862+35220+37809) = (22249+24105+25529+26117+31283+35220) = (22249+24105+26270+26117+31283+35220)
1202	Mod : (22249+30020+35220) = (22249+24105+30020+31283+35220)
1203	Mod : (22249+25529+30020+35220) = (22249+26270+30020+35220) = (22249+26117+30020+35220) = (22249+24105+26117+30020+31283+35220) = (22249+24105+26270+30020+31283+35220) = (22249+24105+25529+30020+31283+35220)
1204	Mod : (22249+26270+31283+34041) = (22249+26117+31283+34041) = (22249+26270+31283+34041+34862+37809) = (22249+26117+31283+34041+34862+37809)
1205	Mod : (22249+25529+30020+36847+31283) = (22249+26270+36847+30020+31283) = (22249+26117+30020+31283+35220+36847) = (22249+24105+30020+31283+35220+36847) = (22249+24105+30020+26117+31283+35220+36847)

	CODE	DESIGNATION
	1206	Mod : 25529 = 25819 = 26117 = 26270 = (25529+25819) = (26117+26270)
	1207	Mod : 20233 = 24365 = 25902 = (20233+24365)
	1208	Mod : 23698 = 23699 = 24281 = (23698+23699) = (23698+24281) = (23699+24281) = (23698+23699+24281)
	1209	Mod : 35220 = (20139+22129+35220)
R	1210	Mod : (22249+25529+31283+24105+36847) = (22249+26270+31283+24105+36847) = (22249+25529+26117+31283+24105+36847) = (22249+26117+26270+31283+24105+36847) = (22249+25529+31283+24105+36847) = (22249+24105+26117+31283+36847) = (22249+24105+26117+31283+35220+36847)
R	1211	Mod : (22249+30020+31283+36847+35542) = (22249+24105+26117+30020+31283+35220+35542+36847)
	1212	Mod : 22373 = (22373+25072+28897) = (22373+25072)
R	1213	Mod : STD = (26999+28495) = (26999+28495+31896) = (26999+28495+31897) = (26999+28495+32475) = (26999+28495+32929) = (26999+28495+31896+32332) = (26999+28495+31897+32333) = (26999+28495+31896+32332+35119)
	1214	Mod : 22199 = 24105 = (22199+24105)
	1215	Mod : (21946+24624) = (21946+26169) = (21946+26169) = (21946+26169+30299) = (21946+26169+30299+31285) = (21946+26169+30299+30308) = (21946+26169+30308+31285) = (21946+24624+30299)
R	1216	Mod : (26999+36998) = (25205+36998) = (26111+36998) = (26485+36998) = (28382+36998) = (30241+36998) = (30631+36998) = (26999+35165+36998) = (25205+26999+28495+36998) = (26999+28382+28495+36998)
	1218	Mod : (21946+24624+K0860) = (21946+24624+K4355) = (21946+26169+K0860) = (21946+26169+K4355) = (21946+26169+30299+K0860) = (21946+26169+30299+K4355) = (21946+26169+30299+31285+K0860) = (21946+26169+30299+31285+K4355) = (21946+26169+30299+30308+K0860) = (21946+26169+30299+30308+K4355) = (21946+26169+30308+31285+K0860) = (21946+26169+30308+31285+K4355) = (K0860+21946+24624+30299)

CODE	DESIGNATION
1219	Mod : (25205+31896) = (25205+31897) = (25205+35119) = (25205+32929) = (25205+32475) = (26111+31896) = (26111+31897) = (26111+35119) = (26111+32929) = (26111+32475) = (26485+31896) = (26485+31897) = (26485+35119) = (26485+32929) = (26485+32475) = (26999+31896) = (26999+31897) = (26999+35119) = (26999+32929) = (26999+32475) = (28382+31896) = (28382+31897) = (28382+35119) = (28382+32929) = (28382+32475) = (30241+31896) = (30241+31897) = (30241+35119) = (30241+32929) = (30241+32475) = (30631+31896) = (30631+31897) = (30631+35119) = (30631+32929) = (30631+32475) = (25205+31896+32332+32475) = (25205+31897+32333+32929) = (25205+31896+32332+35119) = (26111+31896+32332+32475) = (26111+31897+32333+32929) = (26111+31896+32332+35119) = (26485+31896+32332+32475) = (26485+31897+32333+32929) = (26485+31896+32332+35119) = (26999+31896+32332+32475) = (26999+31897+32333+32929) = (26999+31896+32332+35119) = (28382+31896+32332+32475) = (28382+31897+32333+32929) = (28382+31896+32332+35119) = (30241+31896+32332+32475) = (30241+31897+32333+32929) = (30241+31896+32332+35119) = (30631+31896+32332+32475) = (30631+31897+32333+32929) = (30631+31896+32332+35119) = (25205+26999+28495+31896) = (25205+26999+28495+31897) = (25205+26999+28495+35119) = (25205+26999+28495+32929) = (25205+26999+28495+32475) = (26999+28382+28495+31896) = (26999+28382+28495+31897) = (26999+28382+28495+35119) = (26999+28382+28495+32929) = (26999+28382+28495+32475) = (25205+26999+28495+31896+32402) = (25205+26999+28495+31897+32401) = (26999+28382+28495+31896+32402) = (26999+28382+28495+31897+32401) = (25205+26999+28495+31896+32332+32475) = (25205+26999+28495+31897+32333+32929) = (25205+26999+28495+31896+32332+35119) = (26999+28382+28495+31896+32332+32475) = (26999+28382+28495+31897+32333+32929) = (26999+28382+28495+31896+32332+35119)
1220	Mod : (25205+31896+35991) = (25205+31897+35991) = (25205+35119+35991) = (25205+31896+32332+35119+35991) = (26111+31896+35991) = (26111+31897+35991) = (26111+35119+35991) = (26111+31896+32332+35119+35991) = (26485+31896+35991) = (26485+31897+35991) = (26485+35119+35991) = (26485+31896+32332+35119+35991) = (26999+31896+35991) = (26999+31897+35991) = (26999+35119+35991) = (26999+31896+32332+35119+35991) = (28382+31896+35991) = (28382+31897+35991) = (28382+35119+35991) = (28382+31896+32332+35119+35991) = (30241+31896+35991) = (30241+31897+35991) = (30241+35119+35991) = (30241+31896+32332+35119+35991) = (30631+31896+35991) = (30631+31897+35991) = (30631+35119+35991) = (30631+31896+32332+35119+35991) = (25205+26999+28495+31896+35991) = (25205+26999+28495+31897+35991) = (25205+26999+28495+35119+35991) = (25205+26999+28495+31896+32332+35119+35991) = (26999+28382+28495+31896+35991) = (26999+28382+28495+31897+35991) = (26999+28382+28495+35119+35991) = (26999+28382+28495+31896+32332+35119+35991)
1223	Mod : (26645+31283) = (27846+30439+31283) = (26645+30439+31283) = (26645+31283+34862+37809) = (26645+30439+31283+34862+37809)
1227	Mod : 31283 = (31283+34862+37809) = (20067+20069+28474+28478+31283) = (20067+20069+28474+28478+35220) = (20067+20069+28474+28478+31283+34862+37809)

	CODE	DESIGNATION
R	1228	Mod : (20057+20059+20067+20069+35220)
	1229	Mod : STD = (20046+23450) = 23450
	1230	Mod : STD = 24215 = 24215+24588 = 24588
R	1231	Mod : (31283+37999) = (31283+34862+37809+37999)
	1232	Mod : (24215+32088) = (24215+32090) = (24215+32088+32090)
	1233	Mod : (24215+24588+26925+32088) = (24215+24588+26925+32090) = (24215+24588+26925+32088+32090)
	1234	Mod : (25205+28916) = (26111+28916) = (26485+28916) = (26999+28479) = (26999+28702) = (26999+28916) = (28382+28916) = (28916+30241) = (28916+30631) = (28916+30635) = (24075+25205+28916) = (25205+26999+28495+28916) = (26999+28382+28479+28495) = (26999+28382+28495+28702) = (26999+28382+28495+28916)
R	1235	Mod : 35220 = (35220+37999) = (31283+35220) = (31283+35220+37999) = (31283+34862+37809+35220) = (31283+34862+37809+35220+37999)
R	1236	Mod: (26526+35220+37999) = (34637+35220+37999)
R	1237	Mod : (24035+35220) = (24105+35220) = (34189+35220) = (24035+35220+37999)
	1238	Mod : (22013+26111) = (24105+26111) = (26002+26111) = (28218+26999) = (28218+28382) = (28218+30241) = (26002+28382) = (28218+30635) = (26999+28218+28382) = (26999+28218+28382+28495) = (25204+26999+27917+28218) = (24105+26999+28382+28495) = (25204+26002+26999+28218) = (25204+26002+26999+28218+28382+28495)
R	1239	Mod : 35220 = (31283+35220) = (31283+34862+35220+37809)
R	1240	Mod : (35220+35542) = (31283+35220+35542)
R	1243	STD = Mod : 24785 = (23672+24105+25294) = (22013+23219+23672+24785)
R	1244	Mod : 25108 = 35793 = (22013+23672) = (23672+24105) = (24785+25108) = (24785+35793)
R	1245	Mod : (23672+24105+27620) = (22013+23672+27620) = (24785+27620+35793) = (23672+24105+25294+27620+35793) = (24105+24785+27620+30020+35793)
R	1246	Mod : (24785+27620) = (24105+24785+27620) = (22013+23672+24785+27620) = (23672+24105+25294+27620)
	1247	Mod : 24105 = 26334= 26335 = (26335+31395+32207) = (26335+27276+32207) = (24105+27276+31395+32207) = (26334+27276+31395+32207) = (26335+27276+31395+32207) = (24105+27276+30977+31395+32207) = (26335+27276+30977+31395+32207)
	1248	Mod : 22013 = (22013+27276+32207) = (22013+31395+32207) = (22013+27276+31395+32207) = (22013+27276+30977+31395) = (22013+27276+30977+31395+32207)
	1249	Mod : (27276+30020+31395) = (24105+27276+30020+31395) = (27276+30020+30977+31395+32207) = (24105+27276+30020+30977+31395+32207)
R	1250	Mod : (27620+35793) = (24785+27620+35793)
	1251	Mod : 26925 = (24105+26925)
	1252	Mod : STD = 27979 = (24266+32310) = (20075+27979) = (24266+27979) = (24266+27979+32310)
R	1253	Mod : 25108 = 35793 = (24785+35793) = (24785+27620+33497+35793) = (23672+24105+25294+27620+33497+35793) = (22013+23219+23672+27620+33497+35793)
R	1254	Mod : 25108 = 35793 = (22013+23672) = (23672+24105) = (24581+36529) = (24785+36529) = (25108+30020) = (22013+23219+36529) =(24105+25294+36529) = (24105+25108+30020) = (24581+30020+36529) = (24785+30020+36529) = (22013+23672+27620+33497) = (24785+27620+33497+35793) = (23672+24105+27620+33497) = (22013+23219+23672+35793) = (22013+23219+23672+36529) = (23672+24105+25294+35793) = (23672+24105+25294+36529) = (24785+25108+27620+33497+35793) = (23672+24105+25294+27620+33497+35793)

	CODE	DESIGNATION
R R	1255	Mod : (27620+35891) = (23672+24105+27620+35891) = (23672+24105+27620+35891+37285)
	1256	Mod : 24404 = 24405 = 25530 = 27640 = (24405+27640)
R R R	1257	Mod : (20406+22013+28479+28960) = (20406+22013+28721+28916) = (20406+22013+28916+28960) = (20406+22013+24588+28479+28960) = (20406+22013+28479+28721) = (20406+22013+24588+28479+28721)
	1258	Mod : (26526+20343) = (26526+31276) = (26526+31276+27498) = (26526+20343+27498) = (26526+27498+31276+34637)
	1259	Mod : (20343+26526) = (26526+31276) = (26526+27498+31276+34637)
R R R	1260	Mod : (24349+34637) = (24852+34637) = (24785+34637) = (23779+24349+34637) = (23779+24852+26526+34637) = (23779+24349+24785+26526+34637) = (23779+24852+34637)
R	1261	Mod : (30020+35220) = (26526+30020+35220)
R R R	1263	Mod : (35220+34637) = (35220+34637+37999) = (26526+30660+31283+34637+35220) = (26526+30660+31283+31897+32401+34637+34862+35220+37809)
	1265	Mod : (20268+24946+27773) = (20268+27773+32311) = (20268+26965+27773+32311)
	1266	Mod : (22013+22561+30626) = (20082+22013+22561+30626)
	1267	Mod : (20268+27773+32311) = (20268+24946+27773+32150) = (20268+26965+27773+32311)
R R R R R R R R R R R R R	1268	Mod : (26526+26925+35220) = (26526+26925+35220+37999) = (26526+26925+30660+31283+35220) = (26526+26925+30660+31283+35220+37999) = (26526+26925+35220+36427+31897+32401) = (26526+26925+35220+36427+31896+32402) = (26526+26925+30660+31283+35220+36427) = (26526+26925+30660+31283+31897+35220) = (56526+26925+30660+31283+31896+35220) (26526+26925+30660+31283+31896+32402+35220) = (26526+26925+30660+31283+31897+32401+35220) = (26526+26925+30660+31283+31897+32401+35220+36427) = (26526+26925+30660+31283+31896+32402+36427+35220) = (26526+26925+30660+31283+31897+32401+35220+36427+37999)
	1269	Mod : (32087+32088) = (32087+32090) = (32087+32088+32090)
R R R	1270	Mod : (26925+34637+35220+35871) = (26526+26925+30660+31283+34637+35220+35871) = (26526+26925+30660+31283+31896+32402+34637+35220+35871+36427)
	1271	STD = Mod : 23885 = (26999+28495) = (26999+27917) = (34637+35350) = (26999+27917+28244+34825)
	1272	Mod : 28244 = 34637 = (23885+28244) = (26999+28244+28495) = (23885+26111+26999+28244)
R R R	1273	Mod : (26526+26925+30020+35220+35871) = (26526+26925+30020+30660+31283+35220+35871) = (26526+26925+30020+30660+31283+31897+35220+35871+36427+37588)
R R	1274	Mod : (26526+34041+35220) = (26526+30660+31283+34041+35220) = (26526+30660+31283+34041+31897+35220)
	1275	Mod : (24064+35220)=(24065+35220)=(24066+35220)=(24067+35220)
R R R R	1276	Mod : (26526+30020+35220+35542+35871) = (26526+26925+30020+35220+35542+35871) = (26526+26925+30020+30660+31283+35220+35542+35871) = (26526+26925+30020+30660+31283+31896+35220+35542+35871+36427)

	CODE	DESIGNATION
	1277	Mod : (26526+35220) = (23779+26526+35220)
	1278	Mod : 24349+35220 = 24785+35220 = 24852+35220 = (23779+24349+35220) = (23779+24785+35220) = (23779+24852+35220) = (23779+24349+24785+35220) = (23779+24785+24852+35220)
R	1280	Mod : (24064+26526) = (24065+26526) = (24066+26526) = (24067+26526) = (24065+34637) = (24066+34637) = (24067+34637) = (24064+34637) = (24065+24067+26526) = (24066+24067+26526) = (24064+24065+26526) = (24064+26526+34637) = (24066+26526+34637)
R	1281	Mod : (26526+34041+35220) = (34041+34637+35220)
R	1282	Mod : (25205+34637) = (26111+34637) = (26999+34637) = (28382+34637) = (30241+34637) = (30631+34637) = (30635+34637) = (26485+34637) = (23885+26111+34637) = (23885+26111+26526+34637)
R	1283	Mod : (26485+28916+34637) = (26526+26999+28479+34637) = (26526+26999+28382+28479+28495+34637) = (24075+25205+26526+26999+28382+28479+34637)
	1285	Mod : (21678+22536+27522+35227) = (21678+23227+27522+35227) = (21678+23529+27522+35227) = (21678+22536+27522+35865) = (21678+23227+27522+35865) = (21678+23529+27522+35865)
R	1286	STD = Mod : 28916 = 26526 = (26999+27917) = (28916+34637) = (26526+28916) = (26999+28495) = (28916+34864) =(28479+34864) = (28702+34864) = (26999+28479+28495) = (26526+26999+27917) = (26526+26999+28479+28495) = (26526+26999+28495+28916) = (26526+26999+28479+28495+28916)
	1287	Mod : 34041 = (20268+34041)
	1288	Mod : 34041 = (23893+25225+34041)
	1290	Mod : 26335+27276+30977+31395+32207+34041
R	1291	Mod : (25205+26526) = (26111+26526) = (26526+26999) = (26526+28382) = (26526+30241) = (26526+30631) = (26526+30635) = (26485+26526) = (26526+26999+30241) = (23885+26111+26526) = (23885+26526+26999) = (24075+25205+26526) = (24075+26526+28382) = (26111+26526+26999) = (26526+26999+28382+28495) = (23885+26111+26526+26999) = (26111+26526+28382+30635) = (26526+26999+34864) = (24075+25205+26526+26999+28495)
	1292	Mod : 21678+26335+28160+32207+34041
R	1293	Mod : (22706+30365+P8232+33907+31283) = (22706+30365+P8175+P8232+33907+31283) = (P8232+22706+30365+31283+33909+37809) = (P8175+P8232+22706+30365+31283+33907+37809) = (P8175+P8232+22706+30365+31283+33907+35220+37999)
R	1294	Mod : (25205+35871) = (23885+35871) = (26999+35871) = (28382+35871) = (30241+35871) = (26485+35871) = (30631+35871) = (25205+20268+35871) = (23885+20268+35871) = (26999+20268+35871) = (28382+20268+35871) = (28382+20268+35871) = (30241+20268+35871) = (26485+20268+35871) = (30631+20268+35871) = (26999+28382+28495+35871) = (25205+28495+26999+35871) = (20268+31701+25205+35871) = (20268+31701+23885+35871) = (20268+31701+26999+35871) = (20268+31701+28382+35871) = (20268+31701+30241+35871) = (20268+31701+30631+35871) = (20268+34818+25205+35871) = (20268+34818+23885+35871) = (20268+34818+26999+35871) = (20268+34818+28382+35871) = (20268+34818+30241+35871) = (20268+34818+26485+35871) = (20268+34818+30631+35871) = (20268+26999+35871+36311) = (20268+26999+35871+36297) = (26999+28382+28495+20268+35871) = (25205+26999+28495+20268+35871) = (20268+31701+26999+28382+28495+35871) = (20268+31701+25205+26999+28495+35871) = (20268+34818+26999+28382+28495+35871) = (20268+34818+25205+26999+28495+35871)

	CODE	DESIGNATION
R R	1295	Mod : 35871 = (20268+35871) = (20268+31701+35871) = (20268+34818+35871) = (20268+35871+36311) = (20268+35871+36297)
	1296	Mod : 34313 = 34809 = (32651+34313) = (32651+34809) = (32650+32651+34313) = (32650+32651+34809)
R	1297	Mod : 37871 = (31283+37871) = (31283+34862+37809+37871)
	1299	Mod : (20024+34313) = (20024+34809) = (20024+32651+34313) = (20024+32651+34809) = (20024+32650+32651+34313) = (20024+32650+32651+34809)
	1301	Mod : STD = (31283+34861) = (31283+34862) = (31283+34864)
	1302	Mod : 20024 = (20024+31283+34861) = (20024+31283+34862) = (20024+31283+34864)
	1303	Mod : 22013 = (20024+22013) = (20024+22013+31283+34861) = (20024+22013+31283+34862) = (20024+22013+31283+34864)
R	1305	Mod : (20024+31283) = (20024+31283+34862+37809)
R R R R R R	1306	Mod : (20024+32650+36562) = (20024+32650+36609) = (20024+32650+36772) = (20024+34035+36562) = (20024+34035+36609) = (20024+34035+36772) = (20024+32650+34809+36609) = (20024+32650+34809+36772) = (20024+32650+34313+36562) = (20024+34035+34809+36609) = (20024+34035+34809+36772) = (20024+34035+34313+36562) = (20024+32650+32651+34035+34313+36562)
R	1307	Mod : 28238 = (28238+28479) = (28238+28916) = (28238+28479+32635+35649)
R	1308	Mod : (28238+32635) = (28238+28479+32635)
	1309	Mod : (32619+35220)=(33239+35220)=(34156+35220)
R	1310	Mod : (24105+25888) = (24105+37897) = (22562+24105+25072+25888)
	1311	Mod : (22013+31283+35220) = (25951+31283+35220) = (22013+28479+31283+35220)
	1312	Mod : (22013+31283+35220+P6911)=(25951+31283+35220+P6911)
R	1313	Mod : (20082+22013) = (20082+22013+30626+35110)
R	1314	Mod : (22013+30626) = (20082+22013+30626)
R	1315	Mod : (26526+27498) = (26526+27498+34637)
R	1316	Mod : 30470 = 35436 = 34334 = (27624+28258) = (27624+30470)
	1318	Mod : (31283+35220+P6911) = (28479+31283+35220+P6911) = (22013+24044+31283+35220+P6911) = (25951+31283+32239+35220+P6911)
R	1319	Mod : (23208+24105+26925+30020+35871)
R R	1320	Mod : (26925+35220) = (24105+26925+35220) = (22013+26925+35220) = (26925+35220+37999) = (22013+26925+35220+37999)
	1321	Mod : (25205+20268) = (23885+20268) = (26999+20268) = (28382+20268) = (30241+20268) = (26485+20268) = (30631+20268) = (26999+28382+28495+20268) = (25205+26999+28495+20268)
	1322	Mod : 25205 = 23885 = 26999 = 28382 = 30241 = 26485 = 30631 = (26999+28382+28495) = (25205+26999+28495)

CODE	DESIGNATION
1323	Mod : (CFM Eng. 56-5-B1+20268+31701+25205)= (CFM Eng. 56-5-B1+20268+31701+23885) = (CFM Eng. 56-5-B1+20268+31701+26999)= (CFM Eng. 56-5-B1+20268+31701+28382) = (CFM Eng. 56-5-B1+20268+31701+30241)= (CFM Eng. 56-5-B1+20268+31701+26485) = (CFM Eng. 56-5-B1+20268+31701+30631)= (CFM Eng. 56-5-B1+20268+31701+26999+28382+28495) = (CFM Eng. 56-5-B1+20268+31701+25205+26999+28495) = (CFM Eng. 56-5-B1+20268+34818+25205)= (CFM Eng. 56-5-B1+20268+34818+23885) = (CFM Eng. 56-5-B1+20268+34818+26999)= (CFM Eng. 56-5-B1+20268+34818+28382) = (CFM Eng. 56-5-B1+20268+34818+30241)= (CFM Eng. 56-5-B1+20268+34818+26485) = (CFM Eng. 56-5-B1+20268+34818+30631)= (CFM Eng. 56-5-B1+20268+34818+26999+28382+28495) = (CFM Eng. 56-5-B1+20268+34818+25205+26999+28495) = (CFM Eng. 56-5-B3+20268+25205)= (CFM Eng. 56-5-B3+20268+23885) = (CFM Eng. 56-5-B3+20268+26999)= (CFM Eng. 56-5-B3+20268+28382) = (CFM Eng. 56-5-B3+20268+30241)= (CFM Eng. 56-5-B3+20268+26485) = (CFM Eng. 56-5-B3+20268+30631)= (CFM Eng. 56-5-B3+20268+26999+28382+28495) = (CFM Eng. 56-5-B3+20268+25205+26999+28495)
1324	(CFM Eng. 56-5-B3+20268) = (CFM Eng. 56-5-B1+20268+31701) = (CFM Eng. 56-5-B1+20268+34818) = (CFM Eng. 56-5-B3+20268+26999+28495) = (CFM Eng. 56-5-B1+20268+31701+26999+28495) = (CFM Eng. 56-5-B1+20268+34818+26999+28495)
1325	Mod : 31283 = 35220 = (35220+37999) = (31283+34862+37809) = (31283+35220+37999
1327	Mod : (21678+25404+26377+31283) = (21678+25404+26377+35220) = (21678+25404+26377+26999+31283) = (21678+25404+26377+26999+31283+34856+35110) = (21678+25404+26377+26999+31283+34862+37809) = (21678+25404+26999+30626+31283+33100+34856+35110) = (21678+25404+26999+30626+31283+33100+34898+35110) = (21678+25404+26377+30626+31283+33100+34856+35110) = (21678+25404+26377+26999+31283+34856+35110+34862+37809) = (21678+25404+26999+30626+31283+33100+34856+35110+34862+37809) = (21678+25404+26999+30626+31283+33100+34898+35110+34862+37809)
1328	Mod : (21678+22013+25404+26377+31283) = (21678+22013+25404+26377+26999+31283) = (21678+22013+25404+26999+31283+33100+34997) = (21678+22013+25404+26377+26999+31283+34997) = (21678+22013+25404+26377+26999+31283+34862+37809) = (21678+22013+25404+26377+26999+31283+35220+37999) = (21678+22013+25404+26999+31283+33100+34997+34862+37809) = (21678+22013+25404+26999+30626+31283+33100+34997+35110) = (21678+22013+25404+26377+26999+31283+34997+35110+34862+37809) = (21678+22013+25404+26377+26999+30626+31283+33100+34997 +35110) = (21678+22013+25404+26999+30626+31283+33100+34997+ 35110+34862+37809) = (21678+22013+25404+26377+26999+30626+31283+33100+34997+ 35110+34862+37809)
1329	Mod : (21678+22013+25404+26377+26999+31283+37999) = (21678+22013+25404+26377+26999+31283+34997+35110+37999) = (21678+22013+25404+26377+26999+30626+31283+33100+34997+35110+37999)

	CODE	DESIGNATION
R	1330	Mod : (21678+25404+26377) = (21678+25404+26999) = (21678+25404+26377+26999) = (21678+25404+26377+26999+31283+34862) = (21678+25404+26999+33100+34856+34861) = (21678+25404+26999+33100+34856+34862) = (21678+25404+26999+33100+34856+34864) = (21678+25404+26999+33100+34898+34861) = (21678+25404+26999+33100+34898+34862) = (21678+25404+26999+33100+34898+34864) = (21678+25404+26999+33100+34856+31283+34861) = (21678+25404+26999+33100+34856+31283+34862) = (21678+25404+26999+33100+34856+31283+34864) = (21678+25404+26999+33100+34898+31283+34861) = (21678+25404+26999+33100+34898+31283+34862) = (21678+25404+26999+33100+34898+31283+34864) = (21678+25404+26377+30626+31283+33100+34856+34862+35110) = (21678+25404+26377+30626+31283+33100+34862+34898+35110)
R	1331	Mod : (21678+25404+26999+30020+31283) = (21678+25404+26999+30626+31283+33100) = (21678+25404+26999+30626+31283+33300) = (21678+25404+26377+30626+31283+33100) = (21678+25404+26999+30020+31283+34862+37809) = (21678+25404+26377+30020+30626+31283+33300) = (21678+25404+26377+30626+31283+33100+35220) = (21678+25404+26999+30626+31283+33100+34862+37809) = (21678+25404+26999+30626+31283+33300+34862+37809)
R	1332	Mod : (21678+22013+25404+26999+31283+33100) = (21678+22013+25404+26377+31283+33100+35110) = (21678+22013+25404+26999+30626+31283+33100+35110) = (21678+22013+25404+26999+31283+33100+34862+37809) = (21678+22013+25404+26377+26999+30626+31283+33100+35110) = (21678+22013+25404+26999+30626+31283+33100+35110+34862+37809) = (21678+22013+25404+26377+26999+30626+31283+33100+35110+34862+37809)
	1333	Mod : 26526 = 34825 = 30170 = (28244+34825) = (28244+30170) = (26526+28244+30170) = (26526+28244+34825)
	1335	Mod : (24349+26526) = (24785+26526) = (23779+24349+26526) = (23779+24785+26526) = (23779+24852+26526) = (23779+24349+24785+26526) = (23779+24785+24852+26526)
R	1336	Mod: (30660+32494+32496+35865) = (27522+30660+31371+32494+32496+35865)
R	1337	Mod: (30660+32494) = (27522+30660+31371+32494)
R	1338	Mod : (32650+33100) = (32650+33300) = (21678+32650+33100) = (21678+32650+33300) = (22013+38634+33100) = (21678+22013+33100+38634)
R	1339	Mod: (24105+30020+31040) = (24105+30020+33299)
	1340	Mod : 24035 = 24160 = 24211 = (24035+24211) = (23450+24035) = (23450+24211) = (23450+24035) = (23450+24211) = (20406+23450+24035) = (20406+23450+24211) = (23450+24035+24211) = (23450+24035+24211)
R	1341	Mod: (22013+31040+P8572) = (22013+33299+P8572)
R	1342	Mod: (24105+31040+P8572) = (24105+33299+P8572)
R	1343	STD = Mod: 31040 = 33299 = (30439+31040)
	1344	Mod : 31896 = 32475 = (31896+32475) = (31896+32332+32475)

	CODE	DESIGNATION
R	1345	Mod : (26645+30020+31040+31283) = (26645+30020+33299+31283) = (26645+27846+30020+30439+31040+31283) = (26645+30020+31040+31283+34862+37809) = (26645+30020+33299+31283+34862+37809) = (26645+27846+30020+30439+31040+31283+34862+37809)
R	1346	Mod : (26645+30020+31040+35220) = (26645+30020+33299+35220) = (26645+30020+33299+31283+35220) = (26645+27846+30020+30439+31040+31283+35220)
R	1347	Mod : (30020+31040+35220+35542) = (30020+33299+35220+35542) = (26645+27846+30020+30439+31040+31283+35220+35542)
R	1348	Mod : (26645+31040+31283+37999) = (26645+33299+31283+37999) = (26645+30439+31040+31283+37999)
R	1349	Mod : (26645+33299+31283+34041) = (26645+30439+31040+31283+34041)
R	1350	STD = Mod : (26645+33299) = (26645+31040) = (27846+31040) = (28703+31040) = (30439+31040) = (31283+34864) = (26645+31283+34861+31040) = (26645+31283+34862+31040) = (26645+31283+34864+31040) = (26645+31283+34861+33299) = (26645+31283+34862+33299) = (26645+31283+34864+33299) = (26645+30439+31040+31283+34862)
	1351	Mod : 32619 = 33239 = (32619+33239)
R	1352	Mod : (21678+31283) = (20117+21678+31283)
R	1353	Mod : (21678+21858+31283) = (21678+21858+35220)
R	1354	Mod : (26377+31283) = (26377+26999+31283) = (26377+26999+30626+31283+35110)
R	1355	Mod : (26377+35220) = (26377+31283+35220) = (26377+26999+35220) = (26377+26999+31283+35220) = (26377+26999+30626+31283+35110+35220)
	1356	Mod : 31896 = 32475 = (31896+32475) = (31896+32332+32475)
	1357	Mod : STD = 32656 = 34221 = (32656+34221)
	1358	Mod : 34221 = (32656+34221)
	1359	Mod : 32619 = (28238+32619)
	1360	Mod : 28238 = (28238+32656)
	1361	Mod : 34221 = (28238+34221) = (32656+34221) = (28238+32656+34221)
	1362	Mod : 32656 = 34221 = (32656+34221)
R	1363	Mod : (21678+22013+26377+31283) = (21678+22013+26999+31283) = (21678+22013+26377+26999+31283)
	1364	Mod : (21678+22013+25404+26377) = (21678+22013+25404+26999) = (21678+22013+25404+26377+26999) = (21678+22013+25404+26377+31283+34864) = (21678+22013+25404+26377+31283+34861) = (21678+22013+25404+26377+26999+31283+34861) = (21678+22013+25404+26377+26999+30626+35110)

CODE	DESIGNATION
1365	Mod : (26925+30660+31283+34637) = (26526+26925+30660+31283+34637) = (26526+30660+31283+34637+34862)
1366	Mod : (21678+26377+31283) = (21378+26999+31283) = (21678+26377+26999+31283)
1367	Mod : (26999+35220) = (27646+35220) = (26999+31283+35220) = (27646+31283+35220) = (30361+31283+35220) = (26999+27646+31283+35220) = (26999+31283+34856+34862+35110+35220+37809)
1368	Mod : (22013+26999+30626+31283+33100+35220) = (22013+26999+30626+31283+33100+35220+37999)
1369	Mod : (22013+26999+31283) = (22013+27646+31283) = (22013+26999+27646+31283) = (22013+26999+31283+33100+34997) = (22013+26999+31283+34862+37809) = (22013+27646+31283+34862+37809) = (22013+26999+27646+31283+34862+37809) = (22013+26999+30626+31283+33100+34997+35110) = (22013+26999+31283+33100+34997+34862+37809) = (22013+26999+30626+31283+33100+34997+35110) = (22013+26999+30626+31283+33100+34997+35110+34862+37809)
1370	Mod : STD = (27620+33497) = (35220+37999) = (27620+28658+33497+35220+37999)
1371	Mod : (21678+26485+27620+26925) = (21678+26999+27620+26925) = (21678+27620+27646+26925) = (21678+27620+30631+26925) = (21678+27620+30635+26925) = (21678+26925+26999+27620+37285) = (21678+26925+27620+30361+37285) = (21678+26925+26999+27620+33503+37589) = (21678+26925+26999+27620+27646+33503+37589)
1372	Mod : (K0860+24624) = (26169+30299+K0860) = (26169+30299+K4355)
1374	Mod : 34665 = (CFM 56-5-B1/B2/B3/B3/B4/B5/B6/B7/B8/B9)
1376	Mod : (24105+35220) = (34041+35220) = (24105+35220+37999)
1379	Mod : 25888 = 37987 = (22562+25888) = (25072+25888) = (25888+30784) = (25888+35864) = (22562+37987) = (30784+37987) = (35864+37987) = (22562+25072+25888) = (25888+30784+35864) = (25615+25888+35864) = (22562+25888+28897) = (25888+30784+37987) = (22562+25616+25888+28897) = (22562+25888+28897+30784) = (22562+25072+25888+28897+30784)
1380	Mod : 28378 = (28378+31896) = (28378+31897) = (28378+31896+32402) = (20586+28378+31897+32401)
1381	Mod : (22013+30422) = (20586+22013+22802+30422)
1383	Mod : 24771 = (24771+33100+34856) = (24771+33100+34898)
1384	Mod : (25416+26358) = (25530+26358) = (25416+25530+26358) = (24404+25416+26358) = (24405+25416+26358)
1386	Mod : 25205 = 26111 = 26485 = 26999 = 28382 = 30241 = 30631 = 34825 = (23885+26111) = (28244+34825) = (25205+26999+28495) = (26999+28382+28495) = (26999+28244+30170) = (28244+28382+30170) = (25205+28244+34825) = (26485+28244+34825) = (28244+28382+34825) = (23885+26111+28244+24825) = (26999+28244+30241+34825) = (26999+28244+34825) = (26999+28244+34637+35350) = (26999+28244+28382+28495+34825) = (23885+26111+26999+28244+34825) = (25205+26999+28244+28495+34825) = (26999+28244+28382+28495+30170) = (26999+28244+28382+28495+34637+35350)
1387	Mod : (27650+28382) = (26999+27650+28244+34825) = (26999+27650+28244+28382+28495+34825)

CODE	DESIGNATION
1388	STD = Mod : 26963 = 28377 = 28667 = (25419+26963) = (25419+28667) = (28377+28667) = (27992+28377+28667) = (25419+26963+27992+28667) = (25419+26963+27992+28377) = (26963+28377+28667) = (25419+26963+28377) = (25419+26963+28667) = (25419+26963+28377+28667) = (25419+26963+27992+28377+28667)
1390	Mod : 32088 = 32090 = (32088+32090)
1391	Mod : (26925+32088) = (26925+32090) = (26925+32088+32090)
1392	Mod : (22013/56-5-B3) = (22013+31607) = (22013+31701) = (22013+31702) = (22013+34818) = (20268+22013)
1393	Mod : (56-5-B3+20268) = (56-5-B1+20268+31701) = (56-5-B1+20268+34818)
1394	Mod : 20268=(20268+31701)=(20268+34818)
1395	Mod : (26999+34637+34660+35350) = (26999+28244+34660+34825) = (26999+28244+33253+34825) = (26999+28244+33505+34825) = (28244+28382+33505+34825) = (26999+28244+34660+34637+35350) = (26999+28244+33253+34637+35350) = (26999+28244+33505+34637+35350) = (26999+28244+34660+34637+34825+35350) = (26999+28244+28382+28495+34660+34825) = (26999+28244+28382+28495+33253+34825) = (26999+28244+28382+28495+34660+34637+35350) = (26999+28244+28382+28495+34660+34637+34825+35350)
1397	Mod : (22013+31070+26999) = (25204+25205+31070) = (25204+26999+31070) = (26002+28218+30241+31070) = (26002+28218+28382+31070) = (22013+26002+26111+31070) = (24105+26002+26111+31070) = (26002+26999+28218+31070) = (26002+26111+28218+31070) = (25204+26002+26999+28218+31070) = (24105+26999+28382+28495+31070) = (25204+26999+27917+28218+31070) = (24105+25294+26002+26999+31070) = (22013+26002+26999+28218+31070) = (24105+26002+26999+28218+31070) = (25204+26999+28382+28495+31070) = (22013+26002+28218+30241+31070) = (22013+25204+26002+26999+28218+31070) = (24105+25294+26002+26999+28218+31070) = (25204+26002+26999+28218+28382+28495+31070) = (22013+26002+26999+28218+28382+28495+31070) = (24105+26002+26999+28218+28382+28495+31070) = (22013+25204+26002+26999+28218+28382+28495+31070) = (24105+25294+26002+26999+28218+28382+28495+31070)
1398	Mod : (25204+26999+31105) = (25204+26999+30823+31105) = (25204+26999+31105+31706) = (24105+25204+26999+31105) = (25204+25205+26999+28382+31105) = (25204+26999+28382+28495+31105) = (26002+28218+30241+31105+31706) = (22013+26002+26999+31070+31105+31706) = (24105+25204+26999+28382+28495+31105) = (24105+25294+26002+26999+28218+31105) = (25204+26002+26999+28218+30823+31105) = (24105+25294+26002+26999+28218+30823+31105) = (24105+25294+26002+26999+28218+31105+31706) = (24105+26002+26999+28218+31070+31105+31706) = (25204+26002+26999+28218+31070+31105+31706) = (22013+26002+26999+28218+30823+31105+31706) = (24105+25294+26002+26999+28218+310070+31105) = (24105+25294+26002+26999+28218+31070+31105+31706) = (25204+26002+26999+28218+28495+31070+31105+31706) = (22013+26002+26999+28218+28382+28495+31105+31706) = (25204+26002+26999+28218+28382+28495+31070+31105+31706) = (24105+25204+26002+26999+28218+28382+28495+31070+31105+31706)

	CODE	DESIGNATION
R	1399	Mod : (25204+26999+31105+31706+36998) = (25204+25205+26999+28382+31105+36998) = (24105+26999+31105+31709+31070+25294+26002+28218+36998)
R	1400	Mod : 25205 = 26111 = 26485 = 26999 = 28382 = 30241 = 30631 = 34825 = (23885+26111) = (28244+34825) = (28244+30241) = (25205+26999+28495) = (26999+28382+28495) = (26999+28244+30170) = (28244+28382+30170) = (26999+28244+34825) = (26999+28244+30241+34825) = (23885+26111+28244+34825) = (26999+28244+28382+28495+30170) = (26999+28244+28382+28495+34825) = (23885+26111+26999+28244+34825) = (25205+26999+28244+28495+34825) = (26999+28244+34647+35350) = (26999+28244+28382+28495+34637+35350)
R	1401	Mod : (27650+28382) = (26999+27650+28244+34825) = (27650+28244+28382+34825) = (26999+27650+28244+28382+28495+34825)
R	1402	Mod : (26999+28244+34660+34825) = (26999+28244+33253+34825) = (26999+28244+33505+34825) = (28244+28382+33505+34825) = (26999+28244+34660+34637+34825+35350) = (26999+28244+34660+34637+35350) = (26999+28244+34660+34637+35350) = (26999+28244+28382+28495+34660+34637+34825) = (26999+28244+28382+28495+34660+34637+34825+35350) = (26999+28244+28382+28495+34660+34637+35350) = (26999+28244+28382+28495+34660+34825) = (26999+28244+28382+28495+33253+34825)
	1404	Mod : STD = (31283+34861) = (31283+34862) = (31283+34864)
R	1405	Mod : (26999+28244+34660+34825+36998) = (25205+26999+28244+28382+33253+34637+34660+34825+35350+36998)
R	1406	Mod : 32401 = 32402 = 32929 = 32475 = (26497+28290+32929)
	1407	Mod : 21055 = (21055+25199) = (21055+25200)
	1408	Mod : 30626 = (26363+26792+28488+30626)
	1409	Mod : (21899+30363) = (21899+30363+31283+34864) = (21899+30363+31283+34861) = (21899+30363+31283+34862)
R	1410	Mod : (23672+26284+30206) = (23672+26285+30206) = (23672+26284+36136) = (23672+26285+36136)
R	1411	Mod : (23672+26284) = (23219+23672+24579+26285)
R	1412	Mod : (36962+56-5-A4/A5/B5/B6/V2522/V2524) = (26457+36932+56-5-A4/A5/B5/B6/V2522/V2524) = (26457+34251+36932+56-5-B5)
R	1413	Mod : (31132/56-5-B4=V2527E) = (23900+31132/56-5-B4=V2527E) = (23264+23900+26059+31132+56-5-B4) = (23264+23900+26058+26059+31132/56-5-B4)
R	1414	Mod : (31133+CFM 56-5-A3) = (31133+IAE V2527) = (23408+31133+IAE V2500) = (23262+23900+31133+V2527)
R	1415	Mod : (25615+30748+33323+56-5-B5/B6/B7+V319-100)
R	1416	Mod : (30748+56-5-A4/A5/B5/B6/B7/V2522/V2524/V2527M+V319-100)
R	1417	Mod : (23222+34540+37251) = (26057+34540+37251)
R	1418	Mod : (26057+34540) = (23222+34540) = (23222+32207+34540+V2527M) = (23222+32207+34540+56-5-B7)
R	1419	Mod : 28721 = 28960 = 32011= 32456 = (28721+31702)
R	1420	Mod : 36847 = (27725+33239+36847) = (28307+32619+36847) = (28307+33239+36847)
	1421	Mod : 31674/(56-5-B8=56-5-B9=6122=6124) = (20141+20802+31674)/56-5-B8

CODE	DESIGNATION
1422	Mod : (25404+28479) = (25404+28702) = (25404+28916) = (25404+28479+31283+34861) = (25404+26728+28479+31283+34862)
1423	Mod : (32619+35220) = (33239+35220) = (34156+35220) = (35220+35944) = (25893+32619+35220) = (26149+32656+35220) = (30660+33239+35220) = (25887+26338+34156+35220) = (26149+32656+35220+35944) = (26149+30660+32656+35220) = (25893+28307+30660+32619+35220) = (25893+28307+30660+33239+35220) = (25893+28307+32619+33239+35220) = (25887+26338+30660+34159+35220) = (26149+30660+32656+35220+35944) = (25893+28307+30660+32619+32239+35220)
1424	Mod : (32619+36847) = (33239+36847) = (34156+36847) = (25893+28307+33239+35220+36847) = (25893+28307+32619+33239+35220+36847)
1425	Mod : (30660/A4/A5/B5/B6/B7/B8/B9) = (30660/56-5-B4) = (30660+34862/A4/A5/B5/B6/B7/B8/B9) = (30660+35864/A4/A5/B5/B6/B7/B8/B9) = (36311+28160+30660/B6) = (28160+28917+30660/56-5-B4) = (22562+25072+30660/56-5-B4)
1426	Mod : (36847/56-5-B1/B2/B3/B4/B5/B6/B7/B8/B9/PW) = (36847+28160/56-5-B1/B2/B3/B4/B5/B6/B7/B8/PW) = (36847+37987/56-5-B1/B2/B3/B4/B5/B6/B7/B8/PW) = (36487+30660/56-5-B1/B2/B3/B4/B5/B6/B7/B8/PW) = (36847+25888/56-5-B1/B2/B3/B4/B5/B6/B7/B8/PW) = (36847+28160+30660/56-5-B1/B2/B3/B4/B5/B6/B7/B8/PW) = (36847+22562+28160/56-5-B1/B2/B3/B4/B5/B6/B7/B8/PW) = (36847+25888+28160/56-5-B1/B2/B3/B4/B5/B6/B7/B8/PW) = (36847+25888+30660/56-5-B1/B2/B3/B4/B5/B6/B7/B8/PW) = (36847+28160+28917/56-5-B1/B2/B3/B4/B5/B6/B7/B8/PW) = (30660+35864+36847/56-5-B9)
1427	(26363+26792+28488) = (26363+26792+28488+30626+35110)
1431	Mod : (28888+28160+30660) = (28888+28160+30660+34862) = (28888+28160+30660+35864) = (22562+25072+25888+28160+30660) = (22562+25888+27609+28160+30660/2527ea5)
1432	Mod : (20343+36847) = (31276+36847) = (27498+31276+36847)
1433	Mod : (P10861+32619) = (P10861+33239) = (P10861+22013+24044+32619+33239)
1434	Mod : 31283 = (28479+31283) = (28916+31283) = (31283+34862+37809) = (28916+31283+34862+37809) = (22013+24044+31283) = (25951+31283+32239) = (22013+24044+28479+31283) = (28916+31293+34862+37809) = (22013+24044+31283+34862+37809) = (25951+31283+32239+34862+37809) = (22013+24044+28479+31283+34862+37809) = (25951+28479+28916+30660+31283+32239)
1435	Mod : (31283+35220) = (28479+31283+35220) = (28479+28916+35220) = (22013+24044+31283+35220) = (25951+31283+32239+35220)
1436	Mod : 26377 = 26999 = (26377+26999) = (26377+26999+31283+34864) = (26377+26999+31283+34862) = (26377+26999+31283+34862+30626+35110) = (26377+26999+30626+31283+34864+35110)

CODE	DESIGNATION
1437	Mod : 31896 = 32475 = (31896+32332+35119)
1438	Mod : (24035+31897) = (24160+31897) = (24211+31897) = (24035+32929) = (24160+32929) = (24211+32929)
1439	Mod : (24035+31896) = (24160+31896) = (24211+31896) = (24035+35119) = (24035+31897) = (24035+32475) = (24160+32475) = (24211+32475) = (24035+31896+32332+35119) = (24160+31896+32332+35119) = (24211+31896+32332+35119)
1440	Mod : (30020+32088) = (30020+32090) = (24105+30020+32088+32090) = (24105+30020+32088+32090+37317)
1441	Mod : 24035 = 24160 = 24189 = (24035+31283+34862)
1444	Mod : 35220 = (28479+35220) = (28916+35220) = (35220+37999) = (24105+28479+35220) = (24105+28916+35220) = (24105+28702+35220) = (22013+28479+35220) = (22013+28916+35220) = (28479+35220+37999) = (28916+35220+37999) = (22013+28479+35220+37999)
1445	Mod : (34041+35220) = (28479+34041+35220) = (28916+34041+35220)
1446	Mod : (26925+34041+35220) = (26925+28479+34041+35220) = (26925+28916+34041+35220)
1447	Mod : 26485 = 26999 = 27646 = 30631 = (26999+27646) = (26999+33100+34856) = (26999+33100+34898) = (26999+31283+34864) = (26999+31283+34861) = (26999+31283+34862) = (26999+27646+31283+34862) = (26999+27646+31283+34861) = (26999+30626+31283+33100+34862+34898+35110) = (26999+30626+31283+33100+34856+34862+35110)
1448	Mod : (22013+26485) = (22013+26999) = (22013+27646) = (22013+30631) = (22013+26999+27646) = (22013+26999+33100+34997) = (22013+26999+31283+34864) = (22013+26999+27646+31283+34861) = (22013+26999+30626+31283+33100+34864+34887+35110)
1450	Mod : (24105+35220) = (26334+35220) = (26335+35220) = (26335+27276+31395+32207+35220) = (24105+27276+30977+31395+32207+35220) = (26335+27276+30977+31395+32207+35220)
1451	Mod :(26335+27276+31395+34041+35220)
1452	Mod : (26335+27276+30977+31395+32207+34041+35220)
1453	Mod : (20059+20067+20069+20071+21708+35220) = (20059+20067+20069+20071+37277+35220) = (20059+20067+20069+20816+21708+27063+35220) = (20059+20067+20069+20071+21708+33100+34856+35220) = (20059+20067+20069+20071+37277+31283+35220) = (20059+20067+20069+20071+37277+31283+35220+33100+34856) = (20059+20067+20069+20071+21708+31283+34856+34862) = (20059+20067+20069+20071+21708+31283+33100+34856+34862+35220)
1454	Mod : 36475 = (36475+36794+36795)

	CODE	DESIGNATION
	1455	Mod : (25205+31896+37999) = (25205+31897+37999) = (25205+35119+37999) = (25205+32929+37999) = (25205+32475+37999) = (25205+31896+32332+32475+37999) = (25205+31897+32333+32929+37999) = (25205+31896+32332+35119+37999) = (26111+31896+37999) = (26111+31897+37999) = (26111+35119+37999) = (26111+32929+37999) = (26111+32475+37999) = (26111+31896+32332+32475+37999) = (26111+31897+32333+32929+37999) = (26111+31896+32332+35119+37999) = (26485+31896+37999) = (26485+31897+37999) = (26485+35119+37999) = (26485+32929+37999) = (26485+32475+37999) = (26485+31896+32332+32475+37999) = (26485+31897+32333+32929+37999) = (26485+31896+32332+35119+37999) = (26999+31896+37999) = (26999+31987+37999) = (26999+35119+37999) = (26999+32929+37999) = (26999+32475+37999) = (26999+31896+32332+32475+37999) = (26999+31897+32333+32929+37999) = (26999+31896+32332+35119+37999) = (28382+31896+37999) = (28382+31897+37999) = (28382+35119+37999) = (28382+32929+37999) = (28382+32475+37999) = (28382+31896+32332+32475+37999) = (28382+31897+32333+32929+37999) = (28382+31896+32332+35119+37999) = (30241+31896+37999) = (30241+31897+37999) = (30241+35119+37999) = (30241+32929+37999) = (30241+32475+37999) = (30241+31896+32332+32475+37999) = (30241+31897+32333+32929+37999) = (30241+31896+32332+35119+37999) = (30631+31896+37999) = (30631+31897+37999) = (30631+35119+37999) = (30631+32929+37999) = (30631+32475+37999) = (30631+31896+32332+32475+37999) = (30631+31897+32333+32929+37999) = (30631+31896+32332+35119+37999) = (26999+28495+31897+37999) = (25205+26999+28495+31896+37999) = (25205+26999+28495+31897+37999) = (25205+26999+28495+35119+37999) = (25205+26999+28495+32929+37999) = (25205+26999+28495+32475+37999) = (25205+26999+28495+31896+32332+32475+37999) = (25205+26999+28495+31897+32333+32929+37999) = (25205+26999+28495+31896+32332+35119+37999) = (26999+28382+28495+31896+37999) = (26999+28382+28495+31897+37999) = (26999+28382+28495+35119+37999) = (26999+28382+28495+32929+37999) = (26999+28382+28495+32475+37999) = (26999+28382+28495+31896+32332+32475+37999) = (26999+28382+28495+31897+32333+32929+37999= (26999+28382+28495+31896+32332+35119+37999)
R	1456	Mod : 35220 = (35220+35503+37589)
R R	1457	Mod : (26645+31040+31283+34041+35220) (26645+32299+31283+34041+35220) = (26645+30439+31040+31283+34041+35220)
R R R R R R	1459	Mod : 35220 = (35220+31283) = (26645+31040+35220) = (26645+33299+35220) = (26645+33299+35220+37999) = (26645+31040+35220+37999) = (26645+30439+31040+31283+35220) = (26645+27846+30439+31040+31283+35220) = (26645+30439+31040+31283+35220+37999) = (26645+30439+31040+31283+34862+35220+37809)

	CODE	DESIGNATION
R	1460	Mod : 31283 = (30439+31040+31283) = (26645+33299+31283) = (26645+31040+31283) = (26645+30439+31040+31283) = (26645+27846+30439+31040+31283) = (26645+31040+31283+34862+37809) = (26645+33299+31283+34862+37809) = (26645+30439+31040+31283+34862+37809) = (26645+27846+30439+31040+31283+34862+37809)
R	1461	Mod : 22013 = (22013+20024) = (22013+38634+38975) = (20024+22013+38634+38975) = (22013+34809+37588) = (22013+34809+37588+36609) = (22013+34809+37588+36772) = (22013+20024+34809+37588) = (20024+22013+34809+37588+36609) = (20024+22013+34809+37588+36772) = (22013+34809+37588+38634+38975) = (20024+22013+34809+37588+38634+38975) = (22013+34809+36609+37588+38634+38975) = (22013+34809+36772+37588+38634+38975) = (20024+22013+34809+36609+37588+38634+38975) = (20024+22013+34809+36772+37588+38634+38975)
R	1462	Mod : (22013+36562) = (22013+36609) = (22013+36772) = (22013+34809+36609) = (22013+34809+36772) = (22013+34313+36562) = (22013+20024+36562) = (22013+20024+36609) = (22013+20024+36772) = (22013+20024+34809+36609) = (22013+20024+34809+36772) = (22013+20024+34313+36562) = (22013+36562+38634+38975) = (22013+36609+38634+38975) = (22013+36772+38634+38975) = (22013+34809+36609+38634+38975) = (22013+34313+36562+38634+38975) = (22013+34809+36772+38634+38975) = (20024+22013+36562+38634+38975) = (20024+22013+36609+38634+38975) = (20024+22013+36772+38634+38975) = (20024+22013+34313+36562+38634+38975) = (20024+22013+34809+36609+38634+38975) = (20024+22013+34809+36772+38634+38975)
	1464	Mod : 26256 = (26256+31283+34864) = (26256+31283+34861)
R	1465	Mod : (22013+34313) = (22013+34809) = (20024+22013+34313) = (20024+22013+34809) = (22013+34313+38634+38975) = (22013+34809+38634+38975) = (20024+22013+34313+38634+38975) = (20024+22013+34809+38634+38975)
	1466	Mod : STD = (31283+24862) = (31283+34861) = (31283+34861) = (31283+34864)
	1467	Mod : (20057+20059+20067+20069+20071) = (20057+20059+20067+20069+20071+32146) = (20057+20059+20067+20069+20816+27063) = (20057+20059+20067+20069+20071+31283+34864) = (20057+20059+20067+20069+20071+31283+34862)
R	1468	Mod : (24105+27276+35220) = (24105+31395+35220) = (26334+27276+35220) = (26334+31395+35220) = (26335+27276+35220) = (26335+31395+35220) = (24105+27276+31395+35220) = (26334+27276+31395+35220) = (26335+27276+31395+35220)
R	1469	Mod : (22013+35220) = (22013+35220+37999) = (22013+27276+31395+32207+35220) = (22013+27276+30977+31395+32207+35220) = (22013+27296+30977+31395+32207+35220+37999)
R	1472	Mod : (27276+35220) = (31395+35220) = (27276+31395+35220)
R	1473	Mod : (30660+32494+35227) = (27522+30660+31371+32494+35227)
R	1474	Mod : (30660+32494+32496) = (27522+30660+31371+32494+32496)
	1475	Mod : 22562 = (22562+30660+34861) = (22562+30660+34864)

	CODE	DESIGNATION
R	1477	Mod : (26526+26925+34367+35220) = (26526+26925+30660+31283+34637+35220) = (26526+26925+30660+31283+34637+35220+36427) = (26526+26925+30660+31283+31896+32402+34637+35220) = (26526+26925+30660+31283+31897+32401+34637+35220) = (26526+26925+30660+31283+31896+32402+34637+35220+36427) = (26526+26925+30660+31283+31897+32401+34637+35220+36427)
R	1478	Mod : (25205+26526+28916) = (26111+26526+28916) = (26526+26999+28479) = (26526+26999+28702) = (26526+26999+28916) = (26526+28382+28916) = (26526+28916+30631) = (23885+26111+26526+28916) = (24075+25205+26526+28916) = (26526+26999+28916+30241) = (23885+26526+26999+28916) = (24075+26526+28382+28479) = (26485+26526+28479+28916) = (26111+26526+26999+28479) = (25205+26526+26999+28495+28916) = (26526+26999+28382+28479+28495) = (26526+26999+28382+28495+28702) = (26526+26999+28382+28495+28916) = (24075+26526+28382+28479+28916) = (26111+26526+26999+28479+28916) = (24075+25205+26526+26999+28382+28479) = (24075+25205+26526+26999+28495+28916) = (26111+26526+28382+28479+28916+30635) = (26526+26999+28382+28479+28495+28916) = (26526+26999+28382+28479+28495+28916+30635)
R	1479	Mod : (26526+26925+34041+35220) = (26526+26925+30660+31283+34041+35220)
R	1481	Mod : (30020+34637+35220) = (26526+26925+30020+30660+31283+34637+35220) = (26526+26925+30020+30660+31283+31896+32402+34637+35220)
R	1482	Mod : (26645+35220) = (26645+31283+35220) = (26645+30439+31283+35220)
R	1483	Mod : 23119 = (22013+24044) = (23119+25951+32239) = (23119+31283+34861) = (23119+31283+34862) = (22013+24044+31283+34861)
R	1484	Mod : 23119 = (22013+24044) = (23119+25951+32239) = (23119+31283+34864) = (23119+31283+34862)
R	1485	Mod : (23119+31283) = (22013+24044+31283) = (23119+31283+34862+37809) = (22013+24044+31283+34862+37809)
	1486	Mod : 25404 = (25404+28160+28917) = (25404+28160+28917+31283+34864)
	1487	Mod : (22013+25404) = (22013+25404+28479+31283+34864)
	1488	Mod : (21678+21706+21766+21767+21768) = (21678+21706+21766+21767+21768+31283+34864)
	1489	Mod : 24105 = 28160 = (24105+30626+35110) = (28160+30626+35110)
	1490	Mod : STD = (28160+28917) = (28160+28917+31283+34864)
	1491	Mod : 22013 = 24015 = 28160 = (22013+31283+34864) = (24105+31283+34861) = (22013+31283+34861) = (24105+31283+34862) = (28160+31283+34861) = (28160+31283+34862) = (22013+30626+31283+34864+35110) = (24105+30626+31283+34862+35110) = (28160+30626+31283+34862+35110)
R	1492	Mod : (23119+31283) = (22013+24044+31283) = (23119+31283+34862+37809) = (23119+25951+31283+32239) = (22013+24044+31283+34862+37809)
	1493	Mod : STD = (31283+34864)
	1494	Mod : STD = (30626+35110)
R	1495	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) = (22013+28479+28721+30439) = (22013+28479+28960+30439)

	CODE	DESIGNATION
R	1496	Mod : (30020+31283+35542) = (28479+30020+31283+35542)
R	1497	Mod : (26999+32475) = (26999+32929) = (28382+32475) = (30631+32475) = (25205+32929) = (26999+31896+32402) = (26999+31897+32401) = (28382+31896+32402) = (30241+31896+32402) = (26999+28382+28495+32475) = (26999+28382+28495+32929) = (26999+31896+32332+32475) = (26999+31897+32333+32929) = (26999+28382+28495+31896+32402) = (26999+28382+28495+31897+32401) = (26999+28495+31897+32401+37999) = (26999+28382+28495+31896+32332+32475) = (26999+28382+28495+31897+32333+32929)
	1498	Mod : STD = 32651 = (32650+32651)
	1499	Mod : STD = (28160+28917)
	1500	Mod : 32088 = 32090 = (32088+28160+28917) = (32090+28160+28917)
	1501	Mod : (22013+32088) = (22013+32090) = (24105+32088) = (24105+32090) = (28160+32088) = (28160+32090)
	1502	Mod : STD = (31283+34864) = (31283+34861) = (31283+34862)
R	1503	Mod : 25205 = 26111 = 26999 = 28382 = 26485 = 30241 = 30631 = 30635 = (25205+26999+28495) = (26999+28495+28382) = (26999+28382+28495+37999)
R	1504	Mod : 25205 = 23885 = 26999 = 28382 = 30241 = 26485 = 30631 = (26999+28382+28495) = (25205+26999+28495) = (26999+28495+37999)
R	1505	Mod : (25205+20268) = (23885+20268) = (26999+20268) = (28382+20268) = (30241+20268) = (26485+20268) = (30631+20268) = (26999+28382+28495+20268) = (25205+26999+28495+20268) = (20268+26999+28495+37999)
R	1506	Mod : (26526+30020+35220) = (26526+26925+30020+30660+31283+35220) = (26526+26925+30020+30660+31283+31896+35220) = (26526+26925+30020+30660+31283+31897+35220) = (26526+26925+30020+30660+31283+31896+32402+35220) = (26526+26925+30020+30660+31283+31897+35220+32401)
R	1507	Mod : 31283 = (31283+34862+37809)
R	1508	Mod : (24035+31283) = (24160+31283) = (24189+31283) = (24035+31283+34862+37809)
R	1510	Mod : 22562 = (22562+28160+28917) = (22562+30660+34861) = (22562+30660+34864) = (22562+25888+27609)
	1511	Mod : 22562 = (22562+30660+34861) = (22562+30660+34864)
	1523	Mod : STD = 32401 = 32402 = 32475 = 32929 = (31896+32332) = (31897+32333) = (31897+32929) = (31896+32402) = (31897+32401)
R	1525	Mod : 28160 = (22562+25072+28160) = (28160+30660+34861) = (28160+30660+34864) = (25888+27609+28160)
	1526	Mod : 28160 = (22562+25072+28160) = (28160+30660+34861) = (28160+30660+34864)
R	1528	Mod : (22562+28160) = (22562+28160+30660+34861) = (22562+28160+30660+34864) = (22562+25888+27609+28160)
	1529	Mod : (22562+28160) = (25888+28160) = (22562+28160+30660+34861) = (22562+28160+30660+34864) = (25888+28160+30660+30660+34861) = (25888+28160+30660+34864)
	1532	Mod : ALL CFM = (31283+34861+ALL CFM) = (31283+34862+ALL CFM) = (31283+34864+ALL CFM)
	1533	Mod : ALL IAE = (31283+34861+ALL IAE) = (31283+34862+ALL IAE) = (31283+34864+ALL IAE)
	1535	Mod : 24035 = 24160 = 24189 = (24035+31283+34861) = (24035+31283+34862) = (24035+31283+34864) = (24160+31283+34861) = (24160+31283+34862) = (24160+31283+34864) = (24189+31283+34861) = (24189+31283+34862) = (24189+31283+34864)

CODE	DESIGNATION
1538	Mod : (26925+28479+34041) = (26925+28479+34041+34861) = (26925+28479+34041+34862)
1539	Mod : (30660+34041) = (30660+34041+34862)
1540	Mod : 20268 = (20268+25800) = (20268+24404+35404) = (20268+27727+35404) = (20268+24404+27727+35404) = (20268+24404+25800+35404) = (20268+25800+27727+35404) = (20268+24404+25800+27727+35404)
1542	Mod : 26645 = 27846 = 28703 = 30439 = (26645+31283+34861) = (26645+31283+34862) = (26645+31283+34864)
1549	STD = Mod : 23885 = (26999+28495) =(34637+35350)
1553	Mod : 25205 = 26485 = 26999 = 28382 = 30241 = 30631 = 30635 = (22013+25204+26999) = (22013+25204+28382) = (24105+25294+26999) = (24105+25294+28382) = (26999+28382+28495) = (24105+25204+28382) = (22013+25204+26999+28382+28495) = (24105+25294+26999+28382+28495) = (24105+25294+26002+26999+28218) = (22013+25204+26002+26999+28218+28382+28495) = (25204+26999) = (25204+26999+28382+28495) = (25204+25205+26999+28495) = (24105+25204+25205+25294+26002) = (24105+25294+26002+26999+28218+28382+28495) = (24105+25294+26002+26999+28218+28382+28495+30635) = (24105+26002+26999+28218+31070+31105) = (22013+25204+26002+26999+28218) = (22013+25204+26002+26999+28218+28382+28495)
1554	Mod : 36847 = (28160+28917+36847) = (22562+25072+36847) = (25888+27609+36847) = (22562+25072+28160+28917+36847) = (25888+27609+28160+28917+36847)

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

R

N°	ISSUE DATE	
28	APR 1999	
29	SEP 1999	
30	MAR 2000	
31	JUL 2000	
32	DEC 2000	
33	JUL 2001	
34	DEC 2001	
35	JUN 2002	
36	MAR 2003	
37	JAN 2004	
38	SEP 2004	
39	SEP 2005	
40	JUL 2006	
41	FEB 2007	
42	JUN 2008	

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

LIST OF EFFECTIVE TEMPORARY REVISIONS

M	TR NO	DATE	TITLE	EFFECTIVITY
	002-1A	OCT2005	FUEL FLOW AT TOP OF DESCENT	ALL
	036-2A	JAN2008	COLLINS WXR RADAR MULTISCAN	ALL
	041-1A	MAY2006	C/B RESET PROC FOR ACSC	ALL
	157-1A	APR2008	CIDS RESET PROCEDURE	ALL
	171-1A	JUL2008	LGCIU RESET PROCEDURE	ALL
	193-1A	NOV2008	STD OPERATING PROCEDURES	ALL
	196-1A	OCT2008	BRAKE TRANSFER CHECK	ALL
	211-1A	DEC2008	RNP-4 OPERATIONS	ALL
	990-3A	APR2008	AUTOMATIC LANDING IN JNB	ALL

SUBJECT : Fuel Flow indicating zero at Top Of Descent (TOD).

REASON FOR ISSUE : This Temporary Revision is issued to inform flight crews that : When the aircraft is at the Top of Descent (TOD), it is possible that for a few minutes the ECAM may erroneously indicate that the fuel flow is at zero, because the High Pressure Shut-Off Valve (HPSOV) is incorrectly detected to be closed. In such cases, the flight crew must monitor the engine parameters to check that the engine is operating correctly.

VALIDITY : All aircraft of the A320 family that have CFM 56 engines and the ECU 5AI, or 5BK, or 5BL Standard, but not the HMU P13 Standard.

FILING INSTRUCTIONS :

Update the Record of Temporary Revisions, and insert the following pages :

TR N° 002-1 page 1 of 2, following 3.00.36.
TR N° 002-1 page 2 of 2, facing 3.03.17, page 1.

This Temporary Revision has been issued after normal revision N° 39.
Do not remove it until instructed to do so.

SUBJECT : WEATHER RADAR – MULTISCAN FUNCTION

R **REASON FOR ISSUE 2 :**

R This Temporary Revision is reissued to provide Operators with more flexibility regarding the
R use of the weather radar : When the MULTISCAN switch is in the AUTO position and the
R GAIN is manually set, the Path Attenuation Compensation (PAC) alert is not available. In
R addition, the radar display corresponds to the current weather conditions, when the aircraft
R is above FL 150. Therefore, the flight crew can set the GAIN back to CAL, when the aircraft
R is above FL 150.

R **REASON FOR ISSUE 1 :**

When the MULTISCAN switch is in the AUTO position (tilt in automatic mode) and the GAIN is set to CAL (automatically calibrated), the radar display may not entirely correspond to the current weather. Therefore, this Temporary Revision is issued to indicate that, when the MULTISCAN switch is in the AUTO position, the GAIN should be manually set to +8 to ensure that the radar display provides an optimum reflection of the current weather condition.

In addition, the flight crew should temporarily set the MULTISCAN switch to MAN, if :

- The weather is good, or not significant, in order to check that the radar is operating correctly
- The weather display is ambiguous or unexpected, in order to better analyze the weather situation.

VALIDITY :

A320 Aircraft family equipped with the Multiscan function (Modification 33751)

FILING INSTRUCTIONS :

Update the Record of Temporary Revisions, and insert the following pages :

R TR N° 036-2 page 1 to 2 of 8, following 3.00.36.
R TR N° 036-2 page 3 of 8, facing 3.03.10 page 5.
R TR N° 036-2 page 4 of 8, facing 3.03.14 page 2.
R TR N° 036-2 page 5 of 8, facing 3.03.15 page 2.
R TR N° 036-2 page 6 of 8, facing 3.03.17 page 3.
R TR N° 036-2 page 7 of 8, facing 3.03.18 page 2.
R TR N° 036-2 page 8 of 8, facing 3.03.19 page 6.

This Temporary Revision has been issued after normal revision N° 41.
Do not remove it until instructed to do so.

SUBJECT :

C/B RESET PROC FOR ACSC.

REASON FOR ISSUE :

This Temporary Revision is issued for aircraft with the Air Conditioning System Controller 1803B0000-02, in order to provide Operators with the ACSC C/B reset procedure to apply in the case of a "PACK REGUL FAULT" is triggered on ground.

VALIDITY :

Aircraft with the Air Conditioning System Controller ACSC 1803B0000-02 (Modification 35863).

FILING INSTRUCTIONS :

Update the Record of Temporary Revisions, and insert the following pages :

TR N° 041-1 page 1 of 2, following 3.00.36
TR N° 041-1 page 2 of 2, facing 3.04.24 page 03

This Temporary Revision has been issued after normal revision N° 39.
Do not remove it until instructed to do so.

SUBJECT :

Improvement of the CIDS reset procedure following an uncommanded EVAC horn activation.

REASON FOR ISSUE :

This Temporary Revision is issued in order to provide Operators with an enhanced CIDS reset procedure in the case of an uncommanded EVAC horn activation.

VALIDITY :

A319/A320 aircraft that have a modified CIDS power supply (mod 24771) or,
A318/A319/A320 aircraft that have an enhanced CIDS (mod 33100 or 33300).

FILING INSTRUCTIONS :

Update the Record of Temporary Revisions, and insert the following pages :

TR N° 157-1 page 1 of 2, following 3.00.36
TR N° 157-1 page 2 of 2, facing 3.04.24 page 4.

This Temporary Revision has been issued after normal revision N° 41.
Do not remove it until instructed to do so.

SUBJECT :

LGCIU reset procedure

REASON FOR ISSUE :

This Temporary Revision (TR) is issued to update the LGCIU reset procedure on ground. The new procedure aims to prevent any retraction of the landing gear, when the aircraft is on ground during the LGCIU reset. Therefore, in accordance with the procedure, there should be no more pressure in the green hydraulic system before any LGCIU reset.

VALIDITY : All A318/A319/A320/A321 aircraft

FILING INSTRUCTIONS :

Update the Record of Temporary Revisions, and insert the following pages :

TR N° 171-1, Page 1 of 2, following 3.00.37.
TR N° 171-1, Page 2 of 2, facing 3.04.24 page 6.

This Temporary Revision has been issued after normal revision N° 42.
Do not remove it until instructed to do so.

SUBJECT : SOP

REASON FOR ISSUE :

In the previous FCOM general revision dated July 2006, Airbus standard callouts have been reviewed to harmonize, enhance and clarify them. Airbus recommended callouts were indeed provided both in the flight phase section and in the dedicated FCOM 3.03.90 – STANDARD CALLOUTS – chapter.

Following this revision, airlines highlighted that this redundancy might lead to potential discrepancy, and did not enable operators customizing their own callouts without changing the main Standard Operating Procedures.

Consequently all callouts were removed from the flight phase section and replaced by action lines.

Example :

– **ORDER** . . . . **"FLAPS 1"**
– **FLAPS 1** . . . . **SELECT**
– **CONFIRM/ANNOUNCE** . . . . **"FLAPS 1"**

Replaced by
– **FLAPS 1**. . . . . **SELECT**

This Temporary Revision is issued in order to clarify that the Standard Operating Procedures (SOPs) and the task sharing for selection of flaps and landing gear remain unchanged : The PF orders a configuration change, before the PNF selects.

Therefore for the same example the FCOM is revised as follows :

– **FLAPS 1** . . . . **ORDER**
– **FLAPS 1** . . . . **SELECT**

VALIDITY : All A318/A319/A320/A321 aircraft that have the FD crossed bars at GO-AROUND (Mod 25863) and the RNP pushbutton (Mod 36998)

FILING INSTRUCTIONS :

Update the Record of Temporary Revisions and insert the following pages :

TR N° 193-1 page 1 of 14, following 3.00.36.
TR N° 193-1 page 2 of 14, following TR N° 193-1 page 1 of 14.
TR N° 193-1 page 3 of 14, facing 3.03.12 P3.
TR N° 193-1 page 4 of 14, facing 3.03.12 P5.
TR N° 193-1 page 5 of 14, facing 3.03.18 P4.
TR N° 193-1 page 6 of 14, facing 3.03.18 P5.
TR N° 193-1 page 7 of 14, facing 3.03.18 P6.
TR N° 193-1 page 8 of 14, facing 3.03.18 P7.
TR N° 193-1 page 9 of 14, facing 3.03.18 P8.
TR N° 193-1 page 10 of 14, facing 3.03.19 P7.
TR N° 193-1 page 11 of 14, facing 3.03.19 P8.
TR N° 193-1 page 12 of 14, facing 3.03.19 P9.
TR N° 193-1 page 13 of 14, facing 3.03.19 P10.
TR N° 193-1 page 14 of 14, facing 3.03.23 P1.

This Temporary Revision has been issued after normal revision N° 42.
Do not remove it until instructed to do so.

SUBJECT :

BRAKE CHECK – STANDARD CALLOUT

REASON FOR ISSUE :

This Temporary Revision is issued to cover aircraft with BSCS EM^2 electrical braking system :
With this BSCS system standard there is no more need to check that the pressures on the BRAKES PRESS indicator remain at zero.

VALIDITY :

All A320 Family aircraft with BSCS EM^2 system (Mod 26925)

FILING INSTRUCTIONS :

Update the Record of Temporary Revisions and insert the following pages :

TR N° 196-1, Page 1 of 2, following 3.00.36.
TR N° 196-1, Page 2 of 2, facing 3.03.90, Page 6.

This Temporary Revision has been issued after normal revision N° 42.
Do not remove it until instructed to do so.

SUBJECT : RNP-4 OPERATIONS

REASON FOR ISSUE : This temporary revision is issued to provide Operators with the procedures corresponding to RNP-4 operations in oceanic or remote areas.

VALIDITY : All A320 Family Operators with GPS Primary installed.

FILING INSTRUCTIONS :

Update the Record of Temporary Revisions, and insert the following pages :

TR N° 211-1, Page 1 of 2, following 3.00.36.
TR N° 211-1, Page 2 of 2, facing 3.01.22 Page 2.

This Temporary Revision has been issued after normal revision N° 42.
Do not remove it until instructed to do so.

SUBJECT :

AUTOMATIC LANDING IN JOHANNESBURG

R **REASON FOR ISSUE 3** :

R This Temporary Revision is reissued to inform Operators that even A319 aircraft that have
R IAE engines are not permitted to perform automatic landings on the Johannesburg 03R and
R 21L runways. This is due to the fact that several hard landings occured on A319 equipped
R with IAE engines, on runway 21L. For operators that have A319 with IAE engines, this
R Temporary Revision replaces FCOM Volume 3 TR N° 61-1.

REASON FOR ISSUE 2 :

This Temporary Revision is reissued to indicate that the autoland limitation on Johannesburg 21L runway is not applicable to A319 aircraft equipped with IAE engines, and A318 aircraft.

REASON FOR ISSUE 1 :

This Temporary Revision is issued in order to recommend that automatic landings not be performed on the Johannesburg (03R/21L) runway, in order to avoid hard landings.

VALIDITY :

R A320, A321 and A319 aircraft.

FILING INSTRUCTIONS :

Update the Record of Temporary Revisions, and insert the following pages :

TR N° 990-3 page 1 of 2, following 3.00.36.
TR N° 990-3 page 2 of 2, facing 3.01.22, page 4.

This Temporary Revision has been issued after normal revision N° 41.
Do not remove it until instructed to do so.

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
0009	S1.6UPT2HO

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V CH SEC ---PAGE-- SEQ- --REV-- ----VALIDATION CRITERIA-----
                            ----------------------REASONS OF CHANGE-------------------
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3 01 22  002B      200  REV042  CODE 1216

                      - INCORPORATION OF MOD 36998

3 03 02  001       100  REV042  36998

                      - INCORPORATION OF MOD 36998

3 03 06  010       200  REV042  21125+36998

                      - INCORPORATION OF MOD 36998

3 03 06  012       207  REV042  31896+36998

                      - INCORPORATION OF MOD 31896
                      - INCORPORATION OF MOD 36998

3 03 10  005       200  REV042  34660+36998

                      - INCORPORATION OF MOD 34660
                      - INCORPORATION OF MOD 36998

3 03 11  001       200  REV042  20081+36998

                      - INCORPORATION OF MOD 36998

3 03 12  003       105  REV042  36998

                      - INCORPORATION OF MOD 36998

3 03 16  001       205  REV042  25240+36998=25274+36998

                      - INCORPORATION OF MOD 36998

3 03 16  002       105  REV042  36998

                      - INCORPORATION OF MOD 36998

3 03 19  002       105  REV042  36998

                      - INCORPORATION OF MOD 36998

3 03 19  003       500  REV042  CODE 1399

                      - INCORPORATION OF MOD 36998

3 03 19  005       105  REV042  36998

                      - INCORPORATION OF MOD 36998

3 03 19  006       500  REV042  CODE 1405

                      - INCORPORATION OF MOD 25205
                      - INCORPORATION OF MOD 33253
                      - INCORPORATION OF MOD 36998

3 03 19  007       205  REV042  26999+36998

                      - INCORPORATION OF MOD 36998

3 03 19  009       102  REV042  36998

                      - INCORPORATION OF MOD 36998
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V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA----- / -----REASONS OF CHANGE-----
3	03	19	011	200	REV042	24064+36998=24066+36998
						- INCORPORATION OF MOD 36998
3	03	23	001	200	REV042	CODE 1068
						- INCORPORATION OF MOD 36998
3	03	23	002	202	REV042	26497+36998
						- INCORPORATION OF MOD 36998
3	03	90	003	105	REV042	36998
						- INCORPORATION OF MOD 36998
3	04	34	001	100	REV042	CODE 0458
						- INCORPORATION OF MOD 31579
3	04	34	017	105	REV042	36998
						- INCORPORATION OF MOD 36998

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

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	3	00	00	001	001	REV042		ALL
	3	00	10	001	001	REV042	INTRODUCTION	ALL
	3	00	10	002	001	REV042	INTRODUCTION	
	3	00	10	003	001	REV042	INTRODUCTION	ALL
	3	00	10	004	001	REV042	INTRODUCTION	
	3	00	10	005	001	REV042	INTRODUCTION	ALL
	3	00	10	006	001	REV042	INTRODUCTION	
	3	00	10	007	001	REV042		ALL
	3	00	10	008	001	REV042		
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	3	00	36	001	001	REV042	LETR	ALL
	3	00	70	001	001	REV042	CROSS REFERENCE TABLE	ALL
	3	00	75	001	001	REV042	HIGHLIGHTS	ALL
	3	00	80	001	001	REV042	LIST OF EFFECTIVE PAGES	ALL
	3	00	85	001	001	REV042	LIST OF MODIFICATIONS	ALL
	3	01	00	001	001	REV032	STD=28680+37199=36475+36794	ALL
	3	01	00	002	202	REV041	27620+34637	
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	3	01	20	001	138	REV032	CODE 0568	ALL
	3	01	20	002	125	REV042	CODE 0344/B4/2527/27E	
	3	01	20	003	001	REV042	CODE 0687	ALL
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	3	01	20	004A	030	REV038	320-200	ALL
	3	01	20	005	001	REV042		ALL
	3	01	20	006	050	REV042	56-5-B4	
	3	01	20	007	001	REV031		ALL
	3	01	20	008	001	REV024		
	3	01	20	009	110	REV024	MOD:20268 CFM 56-5-A1/A3/B4	ALL
	3	01	20	010	120	REV026	MOD:20268 CFM 56-5-A1/A3/B4	
	3	01	21	001	110	REV038		ALL
	3	01	21	002	100	REV024	MOD:20056	
	3	01	22	001	002	REV042	CODE 1036	ALL
	3	01	22	002	200	REV042	CODE 1219	
	3	01	22	002A	205	REV042	CODE 0202	ALL
	3	01	22	002B	200	REV042	CODE 1216	ALL
	3	01	22	003	007	REV042	CFM	ALL
	3	01	22	004	100	REV040	25225	
	3	01	24	001	200	REV036	M:27230+28568	ALL
	3	01	24	002	001	REV024		
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	3	01	29	002	001	REV024		

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3	01	34	001	302	REV040	CODE 0373	ALL
3	01	35	001	105	REV039	CODE 0137	ALL
3	01	49	001	160	REV039	CODE 0960	ALL
3	01	49	002	115	REV042	CODE 1379	
3	01	49	003	155	REV028	CODE 0973/V2500=CFM ALL	ALL
3	01	70	001	050	REV033	STD OR US/CFM 56-5-B	ALL
3	01	70	002	035	REV037	CFM 56-5-B4	
3	02	00	001	210	REV042	30626+35220	ALL
3	02	00	002	102	REV041	CODE 0322	
3	02	00	003	205	REV042	CODE 1501	ALL
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3	02	00	005	105	REV037	M:32650=34035	ALL
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3	02	00	007	400	REV042	26925+28479+31283+35220	ALL
3	02	00	008	105	REV042	31283=31283+34862+37809	
3	02	00	009	301	REV042	CODE 0969	ALL
3	02	00	010	354	REV042	CODE 0679 / CFM ALL	
3	02	00	011	100	REV041	25529=25819=26117=26270	ALL
3	02	01	001	001	REV040		ALL
3	02	01	002	001	REV040		
3	02	01	002A	001	REV040		ALL
3	02	01	003	001	REV041		ALL
3	02	01	004	001	REV032		
3	02	01	005	001	REV037		ALL
3	02	01	006	001	REV042		
3	02	01	007	001	REV042		ALL
3	02	10	001	001	REV039		ALL
3	02	10	002	001	REV042		
3	02	10	003	001	REV041		ALL
3	02	10	004	001	REV030	CODE 1184	
3	02	10	005	200	REV036	CODE 0396	ALL
3	02	10	006	100	REV030	M:23742	
3	02	10	006A	130	REV037	M:20268/CFM 56-5-B4	ALL
3	02	10	007	001	REV033	CODE 0461	ALL
3	02	10	008	001	REV033	CODE 0276	

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

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3		02	21	001	100	REV037	M:30626	ALL
3		02	21	002	103	REV039	30626	
3		02	21	002A	115	REV039	CODE 1408	ALL
3		02	21	003	220	REV035	CODE 0247	ALL
3		02	21	004	001	REV036		
3		02	21	005	210	REV040	M:(20059+20084)=(30066+30067	ALL
3		02	21	006	103	REV042	30626=20082+30626	
3		02	21	006A	205	REV042	30626+35220	ALL
3		02	21	007	001	REV042		ALL
3		02	21	008	100	REV042	31283=31283+34862+37809	
3		02	21	009	100	REV039	35220	ALL
3		02	21	010	001	REV024		
3		02	21	011	110	REV039	35220	ALL
3		02	21	012	110	REV039	35220	
3		02	21	013	300	REV037	CODE 0710	ALL
3		02	21	014	200	REV037	M:20056+30626	
3		02	22	001	101	REV042	CODE 1459	ALL
3		02	22	002	102	REV042	CODE 1235	
3		02	22	003	100	REV042	CODE 1325	ALL
3		02	22	003A	001	REV042	CODE 1181	ALL
3		02	22	004	301	REV042	CODE 1201	ALL
3		02	22	005	203	REV042	CODE 0888	ALL
3		02	22	006	202	REV042	CODE 1237	
3		02	22	007	400	REV042	CODE:0122	ALL
3		02	22	008	001	REV038	CODE 0813	
3		02	23	001	100	REV036	28479=28702=28916	ALL
3		02	23	002	100	REV034	30660=34862=30660+34862	
3		02	24	001	002	REV042		ALL
3		02	24	001A	001	REV042	STD=35220+37999	ALL
3		02	24	002	100	REV031	CODE 0233	ALL
3		02	24	003	120	REV042	37317/CFM/PW	ALL
3		02	24	004	500	REV037	CODE 0722	
3		02	24	005	417	REV042	CODE 0896/CFM	ALL
3		02	24	006	300	REV042	CODE 0897	
3		02	24	007	200	REV027	CODE 0111	ALL
3		02	24	008	600	REV042	CODE 0728	

M	V	CH	SEC	PAGE	SEQ	REV	VALIDATION CRITERIA	EFFECTIVITY
	3	02	24	009	525	REV039	CODE 0033	ALL
	3	02	24	010	001	REV042		
	3	02	24	011	100	REV041	CODE 0061	ALL
	3	02	24	012	204	REV042	CODE 1000	
	3	02	24	013	200	REV037	M:20024+21678	ALL
	3	02	24	014	510	REV042	CODE 1331	
	3	02	24	015	200	REV026	CODE 0393	ALL
	3	02	24	016	320	REV037	CODE 0129	
	3	02	24	017	250	REV033	CODE:0350	ALL
	3	02	24	018	340	REV040	CODE 0207	
	3	02	24	019	100	REV036	M:22013=24105=28160	ALL
	3	02	24	020	410	REV035	21678+21706+21768+21858	
	3	02	24	021	100	REV035	21678	ALL
	3	02	24	022	400	REV040	CODE 1371	
	3	02	24	023	310	REV031	M:21285+21678+25404/CFM	ALL
	3	02	24	024	415	REV038	CODE 0598	
	3	02	24	025	200	REV037	CODE 0751	ALL
	3	02	24	026	200	REV037	CODE 1099	
	3	02	24	027	200	REV037	CODE 0765	ALL
	3	02	24	028	001	REV040		
	3	02	25	001	100	REV041	M:32090	ALL
	3	02	26	001	001	REV032		ALL
	3	02	26	002	105	REV041	CODE 0308	
	3	02	26	003	100	REV037	31283=31283+34862+37809	ALL
	3	02	26	004	200	REV041	M:27498+36847=31891+36847	
	3	02	26	005	001	REV041		ALL
	3	02	26	006	204	REV042	CODE 0415	
	3	02	26	006A	001	REV042		ALL
	3	02	26	006B	102	REV042	CODE 0625	ALL
	3	02	26	007	120	REV042	CODE 0318/CFM/PW	ALL
	3	02	26	008	100	REV042	35220=35220+37999	
	3	02	26	009	001	REV040		ALL
	3	02	26	010	001	REV041		
	3	02	26	011	806	REV042	CODE 0532	ALL
	3	02	26	012	407	REV042	CODE 0402	
	3	02	27	001	102	REV042	35220=35220+37999	ALL
	3	02	27	002	200	REV042	CODE 0014	
	3	02	27	003	001	REV042	STD=27846=(27846+28916)	ALL
	3	02	27	004	200	REV042	CODE 0013	

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3	02	27	005	001	REV037	STD	ALL
3	02	27	006	100	REV033	26910=26910+35220+37999	
3	02	27	007	101	REV042	35220=35220+37999	ALL
3	02	27	008	200	REV042	CODE 0056	
3	02	27	009	001	REV037		ALL
3	02	27	010	105	REV037	M:25335=27276	
3	02	27	011	110	REV031	25410	ALL
3	02	27	012	101	REV042	35220=35220+37999	
3	02	27	013	101	REV042	35220=35220+37999	ALL
3	02	27	013A	100	REV037	M:22013=24105=26334=26335	ALL
3	02	27	014	001	REV037		ALL
3	02	27	015	100	REV037	M:22013=24105=26334=26335	ALL
3	02	27	016	240	REV033	M:21964+22087	
3	02	27	017	102	REV042	35220=35220+37999	ALL
3	02	27	018	001	REV042		
3	02	27	019	100	REV042	CODE 0631	ALL
3	02	27	020	100	REV040	M:22013=24105=26334=26335	
3	02	27	021	001	REV024		ALL
3	02	27	022	001	REV024		
3	02	27	023	001	REV042		ALL
3	02	28	001	200	REV037	CODE 1305	ALL
3	02	28	002	200	REV037	CODE 1051	
3	02	28	003	205	REV037	CODE 1051	ALL
3	02	28	004	001	REV024		
3	02	28	005	001	REV026	STD=31283	ALL
3	02	28	006	100	REV041	CODE 1183/CFM ALL	
3	02	28	007	205	REV042	CODE 1051	ALL
3	02	28	007A	100	REV042	20024	ALL
3	02	28	008	215	REV039	CODE 0469	ALL
3	02	28	008A	200	REV042	CODE 1073	ALL
3	02	28	009	110	REV039	20024	ALL
3	02	28	010	100	REV039	20024	
3	02	29	001	001	REV042	STD=25220+37999	ALL
3	02	29	002	001	REV042		
3	02	29	003	201	REV039	CODE 1101	ALL
3	02	29	004	102	REV037	30660=28479+30660	

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

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	3	02	29	006	001	REV025		
	3	02	29	007	101	REV039	M:35220	ALL
	3	02	29	008	206	REV042	CODE 0843	
	3	02	29	009	001	REV024		ALL
	3	02	29	010	101	REV039	M:35220	
	3	02	29	011	200	REV042	CODE 1450	ALL
	3	02	29	012	001	REV024		
	3	02	29	013	203	REV042	CODE 1320	ALL
	3	02	29	014	120	REV037	CODE 0395	
	3	02	29	015	120	REV037	26925=26925+35220+37999	ALL
	3	02	29	016	001	REV037	STD=35220+37999	
	3	02	30	001	001	REV037		ALL
	3	02	30	002	105	REV039	M:35220	
	3	02	30	003	110	REV040	CODE 1239	ALL
	3	02	30	004	105	REV039	M:35220	
	3	02	30	005	001	REV024	CODE 1188	ALL
	3	02	30	006	001	REV027		
	3	02	30	007	001	REV024		ALL
	3	02	30	008	001	REV042		
	3	02	30	008A	001	REV042		ALL
	3	02	30	009	110	REV040	CODE 1239	ALL
	3	02	30	010	110	REV040	CODE 1239	
	3	02	30	011	110	REV040	CODE 1239	ALL
	3	02	30	012	110	REV040	CODE 1239	
	3	02	30	013	110	REV039	CODE 1239	ALL
	3	02	31	001	200	REV037	CODE 1050	ALL
	3	02	31	002	001	REV040		
	3	02	31	003	110	REV040	35220=35220+37999	ALL
	3	02	31	004	100	REV042	30368	
	3	02	31	005	001	REV042		ALL
	3	02	32	001	001	REV030		ALL
	3	02	32	002	103	REV042	26925=26925+35220+37999	
	3	02	32	003	300	REV037	CODE 0084	ALL
	3	02	32	004	103	REV039	CODE 1209	
	3	02	32	004A	002	REV042		ALL
	3	02	32	005	200	REV042	CODE 0047	ALL
	3	02	32	006	001	REV042		

M V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
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3	02	32	008	001	REV042		
3	02	32	009	120	REV042	CODE 0227	ALL
3	02	32	010	204	REV042	CODE 1435	
3	02	32	011	203	REV042	CODE 0014	ALL
3	02	32	012	100	REV039	35220	
3	02	32	013	105	REV042	26925=26925+P6911	ALL
3	02	32	014	100	REV037	M:26925	
3	02	32	015	105	REV042	26925	ALL
3	02	34	001	140	REV024	CODE 0416	ALL
3	02	34	002	415	REV040	CODE 0431	
3	02	34	003	205	REV040	CODE 0437	ALL
3	02	34	004	301	REV042	CODE 1268	
3	02	34	005	200	REV042	CODE 0048	ALL
3	02	34	006	001	REV040		
3	02	34	007	305	REV041	CODE 1106	ALL
3	02	34	008	110	REV039	M:35220	
3	02	34	009	300	REV042	CODE 0863	ALL
3	02	34	010	107	REV036	23510=23672	
3	02	34	010A	100	REV042	CODE 0985	ALL
3	02	34	011	105	REV037	CODE 1020	ALL
3	02	34	012	100	REV042	35220=35220+37999	
3	02	34	013	305	REV042	CODE 1283	ALL
3	02	34	014	110	REV042	35220	
3	02	34	015	150	REV042	CODE 0146	ALL
3	02	34	015A	150	REV042	34637	ALL
3	02	34	016	102	REV039	34637=26526+34637	ALL
3	02	34	017	105	REV040	CODE:0205	ALL
3	02	34	018	105	REV037	CODE 1020	
3	02	34	019	500	REV040	CODE 1293	ALL
3	02	34	020	001	REV040		
3	02	34	021	253	REV042	CODE 1109/56-5-B4	ALL
3	02	34	022	110	REV042	CODE 1504	
3	02	34	023	110	REV040	CODE 1504	ALL
3	02	34	024	130	REV040	CODE 1111/56-5-B4	
3	02	34	025	130	REV040	CODE 1111/56-5-B4	ALL
3	02	36	001	001	REV024	STD=20084+38025	ALL
3	02	36	002	001	REV034	STD=20084+38025	

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	3	02	36	004	102	REV042	CODE 1153	
	3	02	36	005	001	REV036	CODE 0994	ALL
	3	02	36	006	200	REV040	M:35220+35550	
	3	02	36	007	001	REV042		ALL
	3	02	36	008	001	REV042		
	3	02	46	001	215	REV039	CODE 1030	ALL
	3	02	49	001	001	REV024		ALL
	3	02	52	001	001	REV024	CODE 0188	ALL
	3	02	70	001	126	REV041	CODE 1420/CFM	ALL
	3	02	70	002	130	REV030	CODE:0046/56-5-B	
	3	02	70	003	120	REV038	CODE 1020/56-5-B	ALL
	3	02	70	004	120	REV041	CODE 0451/CFM ALL	
	3	02	70	005	020	REV024	CFM ALL	ALL
	3	02	70	006	010	REV041	CFM ALL	
	3	02	70	007	020	REV032	CFM	ALL
	3	02	70	008	110	REV037	CODE 1020/CFM	
	3	02	70	009	020	REV042	CFM	ALL
	3	02	70	010	060	REV042	56-5-B1/2/3/4/5/6/7/8/9	
	3	02	70	011	110	REV040	CODE 1020/CFM	ALL
	3	02	70	012	205	REV040	CODE 1014	
	3	02	70	013	210	REV037	CODE 1012	ALL
	3	02	70	014	103	REV037	M:30660 = (30660+34862)	
	3	02	70	015	121	REV042	CODE 1020/CFM	ALL
	3	02	70	016	200	REV040	CODE 1423	
	3	02	70	016A	220	REV041	CODE 1424/CFM	ALL
	3	02	70	017	207	REV042	CODE 0045	ALL
	3	02	70	018	110	REV037	CODE 1020/CFM	
	3	02	70	019	110	REV037	M:31283/CFM	ALL
	3	02	70	020	165	REV041	CODE 1113/56-5-B4/B6/IAE	
	3	02	70	021	190	REV041	CODE 1426	ALL
	3	02	70	022	310	REV038	CODE 0962	
	3	02	70	022A	124	REV041	CODE 0340/CFM	ALL
	3	02	70	023	124	REV041	CODE 0340/CFM	ALL
	3	02	70	024	120	REV024	CODE 1535 CFM ALL	
	3	02	70	025	020	REV037	CFM ALL	ALL
	3	02	70	026	020	REV024	CFM ALL	

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

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	3	02	70	028	140	REV042	35220/IAE/CFM	
	3	02	70	029	120	REV041	36847/B4/B5/B6/B7/B8/B9/PW	ALL
	3	02	70	030	144	REV042	CODE 0077	
	3	02	70	031	220	REV041	CODE 0270	ALL
	3	02	70	032	250	REV041	CODE 1114/56-5-A1/A3/B4	
	3	02	70	033	100	REV042	36847	ALL
	3	02	70	034	212	REV041	CODE 1114/56-5-A1/A3/B4	
	3	02	70	035	134	REV041	CODE 1115/56-5-A1/A3/B4	ALL
	3	02	70	036	200	REV041	CODE 1432	
	3	02	70	037	215	REV041	CODE 1114/56-5-A1/A3/B4	ALL
	3	02	70	038	212	REV042	CODE 0083/A1/A3/B4	
	3	02	70	039	100	REV042	36847	ALL
	3	02	80	001	001	REV040		ALL
	3	02	80	002	205	REV039	CODE 1258	
	3	02	80	003	001	REV038		ALL
	3	02	80	004	001	REV039		
	3	02	80	005	200	REV039	CODE 1259	ALL
	3	02	80	006	001	REV042		
	3	02	80	007	001	REV042		ALL
	3	02	80	007A	001	REV042		ALL
	3	02	80	008	326	REV038	CODE 0508/CFM 56-5-B4	ALL
	3	02	80	009	001	REV025		ALL
	3	02	80	010	001	REV034		
	3	02	80	010A	105	REV042	31276=20343=31276+27498	ALL
	3	02	80	011	001	REV042	STD	ALL
	3	02	80	012	001	REV042	STD	
	3	02	80	012A	001	REV040	STD	ALL
	3	02	80	012B	001	REV040	STD	ALL
	3	02	80	012C	001	REV040	STD	ALL
	3	02	80	013	001	REV042		ALL
	3	02	80	014	001	REV042		
	3	02	80	015	205	REV042	CODE 1001	ALL
	3	02	80	016	025	REV027	CFM ALL	
	3	02	80	017	001	REV042	STD	ALL
	3	02	80	018	105	REV042	26925	
	3	02	80	018A	001	REV042	STD	ALL

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3	02	80	019	100	REV040	22249	ALL
3	02	80	020	100	REV042	CODE 1206	
3	02	80	021	001	REV039	STD	ALL
3	02	90	001	001	REV028		ALL
3	02	90	002	001	REV037	STD=M:32208+24105	
3	02	90	003	001	REV039		ALL
3	02	90	004	001	REV037		
3	02	90	005	001	REV037		ALL
3	02	90	006	001	REV037		
3	02	90	007	001	REV037	STD	ALL
3	02	90	008	001	REV037	STD	
3	03	00	001-2	001	REV027		ALL
3	03	01	001	001	REV039		ALL
3	03	02	001	100	REV042	36998	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	CODE 1212	ALL
3	03	04	004	100	REV037	M:26925	
3	03	04	005	001	REV036		ALL
3	03	04	006	100	REV025	CODE 0199	
3	03	04	007	110	REV042	CODE 0086/CFM ALL	ALL
3	03	04	008	001	REV024	CODE 1388	
3	03	05	001	001	REV024		ALL
3	03	05	002	001	REV024		
3	03	05	003	001	REV042		ALL
3	03	05	004	001	REV042		
3	03	05	005	001	REV042		ALL
3	03	05	006	001	REV042		
3	03	06	001	001	REV024		ALL
3	03	06	002	100	REV037	CODE 0435	
3	03	06	003	001	REV039	STD	ALL
3	03	06	004	001	REV042		
3	03	06	004A	202	REV042	20024+24373	ALL
3	03	06	005	102	REV042	CODE 0071	ALL
3	03	06	006	001	REV042	CODE 1230	

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	3	03	06	009	001	REV042	CODE 0353	ALL
	3	03	06	010	200	REV042	21125+36998	
	3	03	06	011	110	REV042	CODE 0819	ALL
	3	03	06	012	207	REV042	31896+36998	
	3	03	06	013	001	REV042	STD	ALL
	3	03	06	014	200	REV042	20406+26358	
	3	03	06	015	001	REV042		ALL
	3	03	06	016	100	REV042	21646=21946+33503+37589	
	3	03	06	017	001	REV042		ALL
	3	03	06	018	001	REV042	STD	
	3	03	07	001	001	REV042	STD=34809+37588	ALL
	3	03	07	002	200	REV037	CODE 1391	
	3	03	07	003	001	REV033		ALL
	3	03	08	001	030	REV042	CFM 56-5-B1/B2/B3/B4	ALL
	3	03	08	002	020	REV042	CFM ALL	
	3	03	08	003	040	REV030	B1/B2/B3/B4/B5/B6/B7/B8/B9	ALL
	3	03	09	001	120	REV042	20024/CFM	ALL
	3	03	09	002	125	REV042	CODE 1351/CFM	
	3	03	09	003	001	REV042		ALL
	3	03	10	001	001	REV034		ALL
	3	03	10	002	100	REV039	M:26925	
	3	03	10	003	200	REV024	MOD:21964+22087	ALL
	3	03	10	004	001	REV041	STD	
	3	03	10	005	200	REV042	34660+36998	ALL
	3	03	10	005A	001	REV039		ALL
	3	03	10	006	001	REV042	STD = (20139+22129)	ALL
	3	03	11	001	200	REV042	20081+36998	ALL
	3	03	11	002	141	REV042	CODE 0801/CFM	
	3	03	12	001	001	REV042		ALL
	3	03	12	002	247	REV042	CODE 1439/CFM/PW	
	3	03	12	003	105	REV042	36998	ALL
	3	03	12	004	100	REV042	CODE 0189	
	3	03	12	005	001	REV042	STD	ALL
	3	03	12	006	001	REV037		
	3	03	13	001	101	REV036	CODE 0780	ALL

M	V	CH	SEC	PAGE	SEQ	REV	VALIDATION CRITERIA	EFFECTIVITY
	3	03	14	001	100	REV027	CODE 0189	ALL
	3	03	14	002	200	REV041	CODE 0173	
	3	03	15	001	001	REV035	CODE 0116	ALL
	3	03	15	002	100	REV040	33253=33505=34660	
	3	03	16	001	205	REV042	25240+36998=25274+36998	ALL
	3	03	16	002	105	REV042	36998	
	3	03	16	003	101	REV040	CODE 0783	ALL
	3	03	17	001	100	REV039	CODE 0036	ALL
	3	03	17	002	100	REV039	CODE 1503	
	3	03	17	003	310	REV040	CODE 0412	ALL
	3	03	17	004	103	REV041	M:26358	
	3	03	18	001	100	REV027	M: 26018	ALL
	3	03	18	002	405	REV040	CODE 1395	
	3	03	18	003	001	REV042	CODE 0980	ALL
	3	03	18	004	001	REV042		
	3	03	18	005	100	REV042	26497	ALL
	3	03	18	006	001	REV042		
	3	03	18	007	110	REV042	26925	ALL
	3	03	18	008	001	REV042		
	3	03	18	008A	001	REV042		ALL
	3	03	18	009	001	REV036		ALL
	3	03	19	001	200	REV040	CODE 0837	ALL
	3	03	19	002	105	REV042	36998	
	3	03	19	002A	001	REV042		ALL
	3	03	19	003	500	REV042	CODE 1399	ALL
	3	03	19	004	100	REV042	CODE 1103	
	3	03	19	005	105	REV042	36998	ALL
	3	03	19	006	500	REV042	CODE 1405	
	3	03	19	007	205	REV042	26999+36998	ALL
	3	03	19	008	200	REV042	26925+26965=26925+33376	
	3	03	19	009	102	REV042	36998	ALL
	3	03	19	010	001	REV042		
	3	03	19	011	200	REV042	24064+36998=24066+36998	ALL
	3	03	19	012	100	REV039	M:23742	
	3	03	19	013	001	REV042		ALL
	3	03	20	001	001	REV042		ALL
	3	03	20	001A	001	REV042		ALL

M	V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
3		03	20	002	001	REV041		ALL
3		03	21	001	001	REV024		ALL
3		03	22	001	040	REV032	CODE 1118/ENG	ALL
3		03	22	002	040	REV032	CODE 1118/ENG	
3		03	22	003	001	REV035		ALL
3		03	22	004	001	REV042		
3		03	22	005	001	REV042		ALL
3		03	22	006	001	REV042		
3		03	23	001	200	REV042	CODE 1068	ALL
3		03	23	002	202	REV042	26497+36998	
3		03	23	003	100	REV036	CODE 0158	ALL
3		03	23	004	100	REV036	CODE 0156	
3		03	24	001	100	REV042	20081	ALL
3		03	24	002	001	REV042	CODE 0754	
3		03	25	001	020	REV042	CODE 0919/CFM	ALL
3		03	25	002	001	REV042		
3		03	25	003	235	REV038	CODE 1485/CFM	ALL
3		03	26	001	100	REV030	CODE 0213	ALL
3		03	90	001	001	REV040		ALL
3		03	90	002	001	REV040		
3		03	90	003	105	REV042	36998	ALL
3		03	90	003A	001	REV042		ALL
3		03	90	004	001	REV042		ALL
3		03	90	005	001	REV040		ALL
3		03	90	006	001	REV042		
3		03	90	007	001	REV042		ALL
3		03	90	008	001	REV040	STD	
3		03	90	009	001	REV040	STD	ALL
3		04	00	001	315	REV041	CODE 0553	ALL
3		04	00	002	001	REV042		
3		04	00	003	001	REV042		ALL
3		04	10	001	100	REV037	31040=33299	ALL
3		04	10	002	005	REV042	CFM ALL	
3		04	10	003	001	REV040		ALL
3		04	10	004	110	REV024	MOD:25225	
3		04	21	001	001	REV032		ALL
3		04	21	002	001	REV024		

M	V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
	3	04	23	001	001	REV036		ALL
	3	04	23	001A	001	REV036		ALL
	3	04	23	002	201	REV033	CODE 1023	ALL
	3	04	23	003	100	REV024	CODE 0317	ALL
	3	04	24	001	001	REV040		ALL
	3	04	24	002	001	REV033		
	3	04	24	003	001	REV040	STD=26792+28488	ALL
	3	04	24	003A	001	REV040		ALL
	3	04	24	004	203	REV042	27140+33100=27140+33300	ALL
	3	04	24	005	202	REV042	CODE 1338	ALL
	3	04	24	006	503	REV042	CODE 1195	
	3	04	24	007	001	REV042		ALL
	3	04	25	001	200	REV041	CODE 1269	ALL
	3	04	25	002	200	REV041	32087+32088=32087+32090	
	3	04	25	003	100	REV041	M:32090	ALL
	3	04	27	001	001	REV028		ALL
	3	04	27	002	001	REV036		
	3	04	27	003	001	REV042		ALL
	3	04	27	004	001	REV036		
	3	04	27	005	001	REV040		ALL
	3	04	27	005A	001	REV040		ALL
	3	04	27	006	001	REV040		ALL
	3	04	27	007	001	REV036		ALL
	3	04	27	008	001	REV042		
	3	04	27	009	100	REV042	CODE 0167	ALL
	3	04	27	010	001	REV039		
	3	04	27	011	001	REV039		ALL
	3	04	27	012	001	REV036		
	3	04	28	001	100	REV024	MOD:20024	ALL
	3	04	30	001	001	REV039		ALL
	3	04	30	002	001	REV039		
	3	04	31	001	001	REV039	STD = MOD (28925+34282)	ALL
	3	04	31	002	001	REV039	STD=28925+34282	
	3	04	32	001	001	REV042		ALL
	3	04	32	002	001	REV042	STD=25951+32239	

M V CH SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
3 04 32	003	001	REV038		ALL
3 04 32	004	001	REV037	STD	
3 04 34	001	100	REV042	CODE 0458	ALL
3 04 34	002	100	REV032	CODE:0317	
3 04 34	003	001	REV031		ALL
3 04 34	004	001	REV040		
3 04 34	005	001	REV026		ALL
3 04 34	006	110	REV038	CODE 0937	
3 04 34	007	001	REV038	STD	ALL
3 04 34	008	001	REV038		
3 04 34	009	001	REV038	STD	ALL
3 04 34	010	001	REV038		
3 04 34	011	100	REV037	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	REV040	CODE 0264	
3 04 34	015	120	REV024	CODE 0063	ALL
3 04 34	016	101	REV042	34637	
3 04 34	017	105	REV042	36998	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	205	REV039	CODE 0449	ALL
3 04 46	001	210	REV039	CODE 1337	ALL
3 04 46	002	105	REV039	CODE 0976	
3 04 46	003	100	REV039	31371=31371+28360+38347	ALL
3 04 70	001	001	REV024		ALL
3 04 70	002	100	REV042	CODE 1071	
3 04 70	003	130	REV042	CODE 0739/CFM	ALL
3 04 70	004	020	REV041	CFM ALL	
3 04 70	005	020	REV039	CFM ALL	ALL
3 04 70	006	020	REV042	CODE 1343/CFM=PW	
3 04 70	007	020	REV042	CFM ALL	ALL
3 04 70	008	007	REV042	CFM ALL	
3 04 70	009	001	REV030		ALL
3 04 70	010	001	REV030		
3 04 80	001	100	REV042	26925=26925+34809+37588	ALL
3 04 80	002	200	REV037	M(26925+32088)=(26925+32090)	
3 04 80	003	001	REV032		ALL

M	V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
	3	04	90	001	120	REV040	M:26925 M:CFM	ALL
	3	04	90	002	120	REV042	20024/CFM	
	3	04	90	003	001	REV041		ALL
	3	04	91	001	001	REV040		ALL
	3	04	91	001A	100	REV040	20268	ALL
	3	04	91	002	260	REV040	CODE 0095/56-5-B4	ALL
	3	04	91	003	100	REV025	M:24917	ALL
	3	04	91	004	001	REV040	STD	
	3	04	91	005	001	REV040		ALL
	3	04	91	006	001	REV026		
	3	04	91	007	001	REV040	STD	ALL
	3	04	91	008	100	REV036	20056	
	3	04	91	008A	001	REV033		ALL
	3	04	91	009	100	REV037	M:20056	ALL
	3	04	91	010	001	REV028		
	3	04	91	011	001	REV042		ALL
	3	04	91	012	001	REV042		
	3	04	91	013	100	REV042	21729	ALL
	3	04	91	014	001	REV042		
	3	04	91	015	001	REV028		ALL
	3	04	92	001	001	REV040		ALL
	3	04	92	002	001	REV036		
	3	04	92	003	001	REV042	STD=34809+37588	ALL
	3	04	92	004	001	REV040		
	3	04	92	005	001	REV042	STD=34809+37588	ALL
	3	04	92	006	001	REV040		
	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		
	3	05	05	005	001	REV032		ALL
	3	05	05	006	001	REV039		
	3	05	06	001	130	REV036	CODE:1344/56-5-B4/B5/B6	ALL
	3	05	06	002	070	REV027	CODE 0452/56-5-B4	
	3	05	06	003	070	REV027	CFM 56-5-B4	ALL
	3	05	06	004	070	REV038	CFM 56-5-B4	

M	V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
	3	05	06	005	075	REV027	CFM 56-5-B4	ALL
	3	05	06	006	077	REV038	CFM 56-5-B4	
	3	05	06	007	070	REV036	STD=32619/CFM 56-5-B4	ALL
	3	05	06	008	070	REV027	CFM 56-5-B4	
	3	05	06	009	135	REV036	CODE:0521/56-5-B4	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-B	ALL
	3	05	10	002	170	REV027	CODE 0370 CFM 56-5-B4	
	3	05	10	003	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	10	004	170	REV027	CODE 0370 CFM 56-5-B4	
	3	05	10	005	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	10	006	170	REV027	CODE 0370 CFM 56-5-B4	
	3	05	10	007	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	10	008	170	REV027	CODE 0370 CFM 56-5-B4	
	3	05	10	009	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	15	001	245	REV037	CODE 1350 56-5-B4	ALL
	3	05	15	002	145	REV037	CODE 1355 56-5-B4	
	3	05	15	003	145	REV037	CODE 1355 56-5-B4	ALL
	3	05	15	004	145	REV037	CODE 1355 56-5-B4	
	3	05	15	005	170	REV035	CODE:0370/56-5-B4	ALL
	3	05	15	006	170	REV037	CODE:0370/56-5-B4/T=L	
	3	05	15	007	130	REV030	CODE:0370/56-5-B4	ALL
	3	05	15	008	001	REV025		
	3	05	15	009	130	REV030	CODE:0370/56-5-B4	ALL
	3	05	15	010	130	REV030	CODE:0370/56-5-B4	
	3	05	15	011	130	REV030	CODE:0370/56-5-B4	ALL
	3	05	15	012	130	REV030	CODE:0370/56-5-B4	
	3	05	15	013	130	REV030	CODE:0370/56-5-B4	ALL
	3	05	15	014	130	REV030	CODE:0370/56-5-B4	
	3	05	15	015	130	REV030	CODE:0370/56-5-B4	ALL
	3	05	15	016	130	REV030	CODE:0370/56-5-B4	
	3	05	15	017	130	REV030	CODE:0370/56-5-B4	ALL
	3	05	15	018	130	REV030	CODE:0370/56-5-B4	
	3	05	15	019	130	REV030	CODE:0370/56-5-B4	ALL
	3	05	15	020	130	REV030	CODE:0370/56-5-B4	
	3	05	20	001	125	REV027	M:25800/ CFM 56-5-B4	ALL
	3	05	20	002	170	REV042	CODE 0370 CFM 56-5-B4	
	3	05	20	003	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	20	004	170	REV027	CODE 0370 CFM 56-5-B4	

M	V	CH	SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
	3	05	20	005	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	20	006	170	REV027	CODE 0370 CFM 56-5-B4	
	3	05	20	007	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	20	008	170	REV027	CODE 0370 CFM 56-5-B4	
	3	05	20	009	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	20	010	170	REV027	CODE 0370 CFM 56-5-B4	
	3	05	20	011	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	20	012	170	REV027	CODE 0370 CFM 56-5-B4	
	3	05	20	013	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	20	014	170	REV027	CODE 0370 CFM 56-5-B4	
	3	05	20	015	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	20	016	170	REV027	CODE 0370 CFM 56-5-B4	
	3	05	20	017	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	25	001	140	REV027	M:25800/CFM 56-5-B	ALL
	3	05	25	002	170	REV031	CODE 0370/CFM 56-5-B4	
	3	05	25	003	170	REV031	CODE 0370/CFM 56-5-B4	ALL
	3	05	25	004	170	REV031	CODE 0370/CFM 56-5-B4	
	3	05	25	005	170	REV031	CODE 0370/CFM 56-5-B4	ALL
	3	05	30	001	120	REV027	M:25800/56-5-B	ALL
	3	05	30	002	170	REV027	CODE 0370 CFM 56-5-B4	
	3	05	30	003	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	05	35	001	001	REV038		ALL
	3	05	35	002	326	REV038	CODE 0610/56-5-B4	
	3	05	35	003	326	REV038	CODE 0610/CFM 56-5-B4	ALL
	3	05	35	004	001	REV026		
	3	05	35	005	326	REV038	CODE 0610/CFM 56-5-B4	ALL
	3	05	35	006	001	REV026		
	3	05	35	007	326	REV038	CODE 0610/CFM 56-5-B4	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		
	3	05	40	001	125	REV027	M:25800/CFM 56-5-B4	ALL
	3	05	40	002	180	REV029	CODE 0370 CFM 56-5-B4	
	3	05	40	003	180	REV029	CODE 0370 CFM 56-5-B4	ALL
	3	05	50	001	001	REV025		ALL
	3	05	50	002	001	REV026		

M V CH SEC	---PAGE--	SEQ-	--REV--	----VALIDATION CRITERIA-----	-----EFFECTIVITY-----
3 05 50	003	001	REV039		ALL
3 05 50	004	001	REV024		
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	326	REV037	CODE 0610/CFM 56-5-B4	ALL
3 06 30	001	125	REV027	M:25800/CFM 56-5-B	ALL
3 06 30	002	170	REV038	CODE 0370 CFM 56-5-B4	
3 06 30	003	170	REV027	CODE 0370 CFM 56-5-B4	ALL
3 06 30	004	170	REV032	CODE 0370 CFM 56-5-B4	
3 06 30	005	170	REV032	CODE 0370 CFM 56-5-B4	ALL
3 06 30	006	170	REV032	CODE 0370 CFM 56-5-B4	
3 06 30	007	170	REV032	CODE 0370 CFM 56-5-B4	ALL
3 06 30	008	170	REV032	CODE 0370 CFM 56-5-B4	
3 06 30	009	170	REV032	CODE 0370 CFM 56-5-B4	ALL
3 06 30	010	170	REV032	CODE 0370 CFM 56-5-B4	
3 06 30	011	170	REV032	CODE 0370 CFM 56-5-B4	ALL
3 06 30	012	130	REV030	M:25800/56-5-B4	
3 06 30	013	170	REV027	CODE 0370 CFM 56-5-B4	ALL
3 06 40	001	125	REV032	M:25800/CFM 56-5-B	ALL
3 06 40	002	170	REV036	CODE 0370/CFM 56-5-B4	
3 06 40	003	170	REV032	CODE 0370 CFM 56-5-B4	ALL
3 06 40	004	170	REV032	CODE 0370 CFM 56-5-B4	
3 06 40	005	170	REV032	CODE 0370 CFM 56-5-B4	ALL
3 06 40	006	170	REV032	CODE 0370 CFM 56-5-B4	
3 06 40	007	001	REV024		ALL
3 06 50	001	125	REV027	M:25800/CFM 56-5-B	ALL
3 06 50	002	170	REV027	CODE 0370 CFM 56-5-B4	
3 06 50	003	170	REV027	CODE 0370 CFM 56-5-B4	ALL
3 06 50	004	170	REV027	CODE 0370 CFM 56-5-B4	
3 06 50	005	170	REV032	CODE 0370/CFM 56-5-B4	ALL
3 06 50	006	170	REV032	CODE 0370/CFM 56-5-B4	
3 06 50	007	170	REV032	CODE 0370/CFM 56-5-B4	ALL
3 06 50	008	170	REV032	CODE 0370/CFM 56-5-B4	
3 06 50	009	170	REV032	CODE 0370/CFM 56-5-B4	ALL
3 06 50	010	170	REV032	CODE 0370/CFM 56-5-B4	
3 06 50	011	170	REV032	CODE 0370/CFM 56-5-B4	ALL
3 06 50	012	170	REV032	CODE 0370/CFM 56-5-B4	

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

M	V	CH	SEC	PAGE	SEQ	REV	VALIDATION CRITERIA	EFFECTIVITY
	3	06	50	013	130	REV030	M:25800/56-5-B4	ALL
	3	06	50	014	170	REV027	CODE 0370 CFM 56-5-B4	
	3	06	50	015	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	06	55	001	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	06	60	001	170	REV027	CODE 0370 CFM 56-5-B4	ALL
	3	06	70	001	002	REV024		ALL
	3	06	70	002	001	REV039		
	3	06	70	003	001	REV026		ALL
	3	07	00	001	100	REV042	25590	ALL
	3	07	10	001	001	REV042		ALL
	3	07	10	002	100	REV042	25590	
	3	07	10	003	001	REV042		ALL
	3	07	10	004	100	REV042	25590	
	3	07	10	005	100	REV042	25590	ALL
	3	07	10	006	100	REV042	25590	
	3	07	20	001-LEBBU	001	REV042	LIST OF OEB & FCOM BULLETINS	ALL
	3	07	30	001	001	REV025		ALL
	3	07	30	002	001	REV025		

M V T	REV	MOD SB	MP	TITLE	VALIDITY
.	041	....	P8232	INDICATING/RECORDING SYSTEMS - FWC - INTRODUCE IAS DISCREPANCY AND DUAL PITOT MONITORING ON FWC H2F1	ALL
.	035	20024	......	FUEL- INSTALL A CENTRE TANK SYSTEM-	ALL
.	038	20056	......	AIR CONDITIONING- AVIONICS EQUIPMENT- GROUND COOLING- INSTALL COOLING SYSTEM-	ALL
.	035	20059	......	AIR CONDITIONING - CARGO COMPARTMENT - VENTILATION - INSTALL SYSTEM IN AFT COMPARTMENT -	ALL
.	035	20063	......	OXYGEN - FLIGHT CREW SYSTEM - INSTALL A 77.1 CU/FT BOTTLE IN COMPOSITE MATERIAL -	ALL
.	035	20067	......	FIRE PROTECTION - FWD CARGO COMPARTMENT - INSTALL SMOKE DETECTION SYSTEM -	ALL
.	035	20069	......	FIRE PROTECTION - AFT CARGO COMPARTMENT - INSTALL SMOKE DETECTION SYSTEM -	ALL
.	035	20071	......	FIRE PROTECTION - CARGO COMPARTMENT FIRE EXTINGUISHING - INSTALL A SINGLE SHOT SYSTEM -	ALL
.	035	20075	......	LANDING GEAR - INSTALL TYRE PRESSURE INDICATING SYSTEM (MESSIER) -	ALL
.	035	20081	......	LIGHTS - EXTERIOR LIGHTS - INSTALL SYNCHRONIZED STROBE LIGHTS	ALL
.	038	20084	......	AIR CONDITIONING - AFT CARGO COMPARTMENT - INSTALL HEATING SYSTEM	ALL

M V T	REV	MOD SB	MP	TITLE	VALIDITY
.	035	20137	......	COMMUNICATIONS - RADIO MANAGEMENT - INSTALL A 3RD RMP -	ALL
.	038	20268	......	WINGS-WING TIP FENCES-INTRODUCE WING TIPS INCLUDING FENCES-	ALL
.	035	20406	......	NAVIGATION - AIR DATA - PROVIDE QFE BARO SETTING	ALL
.	039	21125	......	NAVIGATION - ATC MODE "S" - ACTIVATE SELECTIVE INTERROGATION FUNCTION -	ALL
.	038	21285	......	ENGINE CONTROLS-MODIFY POWER SUPPLY FOR HP FUEL SOLENOID	ALL
.	038	21678	......	ELECTRICAL POWER-AC/DC ESSENTIAL POWER DISTRIBUTION-PROVIDE PROVISIONS FOR ETOPS-	ALL
.	038	21706	......	AIR CONDITIONING - VENTILATION CONT. ISOLATION VALVES - CHANGE POWER SUPPLY FOR ETOPS -	ALL
.	042	21708	......	FIRE PROTECTION-CARGO COMPARTMENT FIRE EXTINGUISHING-INSTALL A FLOW METERING SYSTEM FOR ETOPS	ALL
.	038	21729	......	AIR CONDITIONING -AVIONICS VENTILATION- IMPROVE ACCURANCY OF SKIN TEMPERATURE READING	ALL
.	038	21768	......	AIR CONDITIONING - PROVIDE EMERGENCY POWER SUPPLY FOR AFT CARGO COMPT HEATING CONTROLLER FOR EROPS -	ALL

M V T	REV	MOD	MP SB	TITLE	VALIDITY
.	038	21858	....	COMMUNICATIONS - INSTALL HF1 FOR EROPS	ALL
.	038	21899	....	AIR CONDITIONING-AVIONICS VENTILATION- INSTALL A NRV AT AIR INLET	ALL
.	038	21946	....	OXYGENE - COCKPIT - INSTALL MODIFIED LP OXYGEN SUPPLY SOLENOID VALVE	ALL
.	038	21964	....	FLIGHT CONTROLS - ELAC/EFCS SYSTEM - INTRODUCE SOFTWARE L62	ALL
.	038	21988	....	FUEL - IMPROVE LOW LEVEL WARNING	ALL
.	038	21992	....	INDICATING/RECORDING SYSTEMS - INTRODUCE CFDIU BATCH 2	ALL
.	038	22087	....	FLIGHT CONTROLS - FCDC - INSTALL SOFTWARE L45	ALL
.	038	22249	....	AUTO FLIGHT - ACTIVATE WINDSHEAR FUNCTION	ALL
.	038	22373	....	ELECTRICAL POWER - DC GENERATION - INTRODUCE IMPROVED BCL	ALL
.	038	22536	....	NAVIGATION - INSTALL A BENDIX TCAS II COLLISION AVOIDANCE SYSTEM	ALL
.	038	22706	....	INDICATING/RECORDING SYSTEMS - CENTRAL WARNING SYSTEM - INSTALL SDAC A320/321 STANDARD	ALL
.	038	22769	....	NAVIGATION - GPWS - INSTALL GPWC MARK V WITH INTERFACE WITH CFDS	ALL

M V T	REV	MOD MP SB	TITLE	VALIDITY
.	038	23119	HYDRAULIC POWER-BLUE MAIN HYDRAULIC POWER-IMPROVE MAINTENANCE STATUS OF BLUE HYDRAULIC RESERVOIR	ALL
.	038	23208	LANDING GEAR - WHEELS AND BRAKES - INTRODUCE BSCU STD 6	ALL
.	038	23315	NAVIGATION - ILS - INSTALL NEW BENDIX RIA 35A ILS RECEIVERS (P/N 204.1230.3521)	ALL
.	042	23510	NAVIGATION - ADIRS - ADAPT SHELVES FOR 4 MCU ADIRS INSTALLATION	ALL
.	038	23661	ENGINE FUEL AND CONTROL - CFM 56 - EIU - INTRODUCE VERSION 13	ALL
.	038	23698	AUXILIARY POWER UNIT - CONTROL AND MONITORING - INTRODUCE A NEW ECB	ALL
.	038	23699	AUXILIARY POWER UNIT - CONTROL AND MONITORING - MODIFY WIRE HARNESSES FOR NEW ECB 817-1	ALL
.	038	23742	AUTO FLIGHT - FCU - INTRODUCE FCU STANDARD M10	ALL
.	038	23779	MINOR IMPROVEMENTS INTRODUCED FROM A/C 508 (ST2) TO A/C 521 (ST2)	ALL
.	042	23900	GENERAL - INCREASE DESIGN WEIGHT TO 61T MZFW	ALL
.	038	24035	INDICATING/RECORDING SYSTEMS - GENERAL- DEFINE CPIP3	ALL

M V T	REV	MOD MP SB	TITLE	VALIDITY
.	038	24064	AUTO FLIGHT-FMS-INTRODUCE FMGC A320/321 B1 STD WITH OPTIONS AND 400 KILOWORDS FOR CFM 56 VERSIONS	ALL
.	038	24075	NAVIGATION - SATELLITE NAVIGATION - INSTALL SUPPLEMENTARY MEANS OF NAV BASED ON HONEYWELL GPS (HYBRID ARCHI.)	ALL
.	038	24215	AUTO FLIGHT - FAC - INSTALL TWO FACS P/N BAM 0509	ALL
.	035	24251	POWER PLANT - A320 - CFM 56 - INSTALL DERATED ENGINES CFM 56-B4	ALL
.	038	24349	NAVIGATION - ADIRS - INTRODUCE STD P/N AC06	ALL
.	038	24373	FUEL - TANK LEVEL SENSING - INTRODUCE MODIFIED LOW FUEL PRESSURE WARNING CONTROL	ALL
.	038	24511	FLIGHT CONTROLS -S.E.C. SYSTEM INTRODUCE A320/A321 S.E.C STANDARD P/N BAM0508	ALL
.	042	24579	NAVIGATION - ADIRS - INSTALL 4MCU ADIRS WITH GPS CAPABILITY	ALL
.	038	24588	AUTO FLIGHT-FAC-INTRODUCE FAC P/N BAM 510	ALL
.	038	24645	LANDING GEAR-MLG-LGCIU-INTRODUCTION OF STANDARD UNIT P/N A4C	ALL

M V T	REV	MOD MP SB	TITLE / VALIDITY
.	038	24783	ENGINE FUEL AND CONTROL-FUNCTIONAL INTERFACE-INTRODUCE EIU VERSION 14 ON CFM56 ENGINES ALL
.	038	24785	NAVIGATION-ADIRS-INTRODUCE 4MCU ADIRU HONEYWELL P/N C06 ALL
.	038	24917	FLIGHT CONTROLS-INTRODUCE ELAC STD L69J ALL
.	038	24946	LANDING GEAR - MLG - MESSIER - INTRODUCE BRAKES P/N C202253 ALL
.	038	25199	FLIGHT MANAGEMENT AND GUIDANCE SYSTEM- INSTALL FMGC ON A320/321 (CFM 56-5A/5B) ALL
.	038	25204	NAVIGATION-ADIRS-INSTALL HONEYWELL ADIRS WITH GPS PRIMARY NAVIGATION CAPABILITY ALL
.	038	25205	NAVIGATION-PRIMARY MEANS USING HONEYWELL GPS (HYBRID ARCHITETURE) PROVIDING RAIM FUNCTION (CL) ALL
.	038	25225	AUTO FLIGHT-FMGC-REDUCE VAPP FOR A320 CFM/IAE ALL
.	038	25240	AUTO FLIGHT - FMGC - PROVIDE ACARS AND PRINTER INTERFACES IN FMS (CFM VERSION) ALL
.	038	25241	COMMUNICATIONS - RADIO MANAGEMENT - INSTALL A NEW STD RMP1 AND RMP2 WITH VHS SPACING 8, 33KHZ ALL

M V T	REV	MOD MP SB	TITLE	VALIDITY
.	038	25242	COMMUNICATIONS - RADIO MANAGEMENT - INSTALL A NEW STD RMP3 (3) WITH VHF SPACING 8, 33KHZ	ALL
.	042	25294	NAVIGATION - ADIRS - INSTALL HONEYWELL ADIRS CAPABLE OF A319 A/C	ALL
.	038	25404	EXHAUST-THRUST REVERSER CONTROL AND INDICATING-ACTIVATE ADDITIONAL THRUST REVERSER LOCK CONTROL	ALL
.	038	25410	INDICATING RECORDING SYSTEM-FWC-INTRODUCE F.W.C. E1 STANDARD	ALL
.	038	25419	ICE AND RAIN PROTECTION-WINDSHIELD RAIN PROTECTION-DESACTIVATION OF RAIN REPELLENT SYSTEM	ALL
.	038	25590	INDICATING/RECORDING SYSTEMS - FWC - DEFINE OEB REMINDER WITHIN FWC STD -E1 AND SUBSEQUENT	ALL
.	038	25800	POWER PLANT-GENERAL-INTRODUCE CFM56-5B/P	ALL
.	035	25863	AUTO FLIGHT - FCU - DEFINE FLIGHT DIRECTOR ENGAGEMENT IN CROSSED BARS AT GO AROUND	ALL
.	038	25888	A.P.U.-POWER PLANT-INTRODUCE ALLIED SIGNAL APU 131-9(A)	ALL
.	038	25893	ENGINE FUEL AND CONTROL-CONTROLLING INTRODUCE ECU SOFTWARE STD5 BH FOR CFM56-5B -SAC-	ALL

M V T	REV	MOD MP SB	TITLE	VALIDITY
.	040	26001	NAVIGATION-ADIRS-INTRODUCE HONEYWELL 4 MCU P/N AC09	ALL
.	038	26017	INDICATING/RECORDING SYSTEMS-FLIGHT WARNING COMPUTER (FWC)-INTRODUCE FWC ST2 E2	ALL
.	038	26018	INDICATING/RECORDING SYSTEMS-DISPLAY MANAGEMENT COMPUTER (DMC)-INTRODCUE DMC V32 STD	ALL
.	038	26169	COM-CVR-INSTALL A SOLID STATE COCKPIT VOICE RECORDER (SSCVR) LORAL FAIRCHILD P/N 200-0012-00 (SFE)	ALL
.	038	26270	NAVIGATION - SINGLE PWS - COLLINS SINGLE PWS ACTIVATION	ALL
.	038	26335	FLIGHT CONTROLS-GENERAL- DELETION OF L.A.F. FEATURE FROM A320 A/C (SERIAL SOLUTION)	ALL
.	038	26358	AUTOFLIGHT-FLIGHT CONTROL UNIT- (FCU) INTRODUCE SEXTANT MODULAR FCU	ALL
.	035	26363	AIR CONDITIONING-AIR COOLING SYSTEM- INTRODUCE MODIFIED RAM AIR OUTLET	ALL
.	038	26377	NAVIGATION - ILS - INSTALL ADDITIONAL WIRING PROVISIONS FOR MMR INSTALLATION	ALL
.	038	26443	NAVIGATION - VOR/MARKER - INSTALL TWO VOR/MARKER RECEIVERS 900 COLLINS P/N 822-0297-020	ALL

M V T	REV	MOD / SB	MP	TITLE	VALIDITY
.	042	26444	....	COMMUNICATIONS - VHF SYSTEM - INSTALL TWO COLLINS VHF 900 TRANSCEIVERS	ALL
.	038	26497	....	AUTO FLIGHT-GENERAL-ACTIVATE GLOBAL SPEED PROTECTION AND F/D DISENGAGEMENT UPON SPEED CONSTRAINTS	ALL
.	038	26526	....	NAVIGATION - GPWS - ACTIVATE ENHANCED FUNCTIONS OF THE EGPWS	ALL
.	038	26645	....	AUTO-FLIGHT-FAC INTRODUCE FAC STD BAM 0513	ALL
.	041	26726	....	INDICATING/RECORDING SYSTEM-SDAC- INTRODUCE SDAC (NEW TECHNOLOGY)	ALL
.	039	26728	....	INDICATING/RECORDING SYSTEM - FWC - INTRODUCE FWC STANDARD H2E2	ALL
.	038	26785	....	PNEUMATIC-ENG BLEED AIR SYS-INTRODUCE A TEMP THERMOSTAT WITH MODIFIED LIMITATION SETTINGS (P/N 341E020000)	ALL
.	038	26792	....	AIR CONDITIONING-PACK TEMPERATURE CTRL- INTRODUCE MODIFIED PACK TEMPERATURE CONTROLLER	ALL
.	038	26910	....	FLIGHT CONTROL -ELAC SYSTEM- INTRODUCE E.L.A.C. WITH ENHANCED RELAYS	ALL
.	042	26925	....	LANDING GEAR-ALTERNATE BRAKING- INTRODUCE MODIFIED ALTERNATE BRAKING SYSTEM	ALL

M V T	REV	MOD MP SB	TITLE	VALIDITY
.	035	26963	ICE AND RAIN PROTECTION-WINSHIELD RAIN PROTECTION-ACTIVATION OF RAIN REPELLENT SYS.(FLUID COMPATIBLE WITH OZONE RULES)	ALL
.	039	26965	LANDING GEAR-WHEELS AND BRAKES- INTRODUCE BSCU COMMON STD	ALL
.	038	26968	AUTO FLIGHT-FMGC-INTRODUCE FMGC CAM0102 FOR A319 AUTOLAND AND GPS/ACARS FOR CFM ENGINES	ALL
.	038	26999	NAVIGATION - MMR - INSTALL COLLINS MMR PROVIDING ILS AND GPS FUNCTION	ALL
.	042	27140	ELECTRICAL POWER-GENERAL-DEFINE NEW ELECTRICAL GENERATION CONCEPT FOR SINGLE AISLE A/C	ALL
.	038	27230	EQUIPMENT/FURNISHINGS - ELECTRICAL SERVICE SUPPLY - INSTALL A 15 VDC KID PC POWER SYSTEM IN ENTIRE CABIN	ALL
.	038	27276	FLIGHT CONTROLS-ELAC SYSTEM-INTRODUCE ELAC SOFTWARE "L80"	ALL
.	038	27498	ELECTRICAL POWER - GENERAL - AC-DC MAIN DISTRIBUTION - INSTALL AC-DC SHEDDABLE BUSBARS	ALL
.	038	27522	INFORMATION SYSTEM - AIR TRAFFIC AND INFORMATION SYSTEM (ATIMS) - INSTALL ATSU COMPUTER FOR ACARS	ALL
.	038	27572	OXYGEN-PASSENGER OXYGEN-INTRODUCE MODIFIED CHEMICAL OXYGEN CONTAINER -15 MIN- PURITAN	ALL

M V T	REV	MOD MP SB	TITLE	VALIDITY
.	038	27620	NAVIGATION-STANDBY DATA : ALTITUDE AND HEADING - INSTALL INTEGRATED STANDBY INSTRUMENT SYSTEM (ISIS)	ALL
.	038	27698	NAVIGATION - TCAS - INSTALL ALLIED SIGNAL TCAS COMPUTER P/N 066-50000-2220 (WITH CHANGE 7.0)	ALL
.	038	27773	LANDING GEAR-NORMAL BRAKING- INTRODUCE STD 8 BSCU (TWIN VERSION)	ALL
.	038	28160	ELEC PWR-AC EMERGENCY GENERATION- ACTIVATE A319/A321 ELECTRICAL EMERGENCY CONFIGURATION ON A320 A/C	ALL
.	039	28244	NAVIGATION-GPWS-INTRODUCE EGPWS P/N 206-206 AND INHIBIT AUTOMATIC DEACTIVATION ENHANCED FUNCTIONS	ALL
.	042	28307	ENGINE FUEL AND CONTROL-FADEC SYSTEM- CFM56-5B-SAC-INTRODUCE ECU SOFTWARE 5BI	ALL
.	038	28382	NAVIGATION - MMR - ACTIVATE GPS PRIMARY FUNCTION (HYBRID) IN SEXTANT MMR (WITH HONEYWELL OR LITTON ADIRU)	ALL
.	038	28479	INDICATING RECORDING SYSTEM-FWC- INTRODUCE FWC STANDARD H2/E3P	ALL
.	038	28488	AIR CONDITIONING-PACK TEMP.CTRL INTRODUCE MODIFIED PACK TEMP. CTRL P/N 759D0000-02	ALL
.	038	28568	ELECTRICAL POWER - AC GENERATION - INSTALL ELECTRICAL OUTLETS IN COCKPIT	ALL

M V T	REV	MOD MP SB	TITLE	VALIDITY
.	041	28651	APU-CONTROL AND MONITORING-INTRODUCE OF VERSATILE ECB ON GTCP 36-300	ALL
.	038	30239	INFORMATION SYSTEM - ATIMS - MODIFY ATSU AIRCRAFT INTERFACE SOFTWARE ACCORDING TO SERVICE PROVIDERS LIST	ALL
.	042	30308	COMMUNICATIONS - COCKPIT VOICE RECORDER - REINTRODUCE SSCVR ALLIED SIGNAL P/N 980-6022-001	ALL
.	038	30363	INDICATING/RECORDING SYSTEMS - FWC - ACTIVATE SPECIFIC FWC PROCEDURE	ALL
.	038	30365	INDICATING RECORDING SYSTEM-SDAC-INTRODUCE STANDARD SDAC P/N 350E5500202	ALL
.	038	30368	INDICATING RECORDING SYSTEMS-EIS-INSTALL DMC, DU AND DISKETTES FOR EIS2	ALL
.	041	30439	AUTO-FLIGHT-FLIGHT AUGMENTATION COMPUTER-INTRODUCE FAC SOFTWARE STANDARD P/N B397BAM0515	ALL
.	042	30626	AIR CONDITIONING-AIR COOLING-INSTALL A NEW ECS	ALL
.	041	30660	INDICATING/RECORDING SYSTEMS - FWC - INSTALL FWC STANDARD H2E4	ALL
.	042	30748	GENERAL-FLIGHT ENVIRONMENTAL ENVELOPE-EXTENSION TO 12100 M (39800 FT)	ALL

M V T	REV	MOD	MP SB	TITLE	VALIDITY
.	042	30784	....	AIRBORNE AUXILIARY POWER (APU) - GENERAL - INCREASE OPERATION ENVELOPE TO 39800 FT FOR GTCP 36-300	ALL
.	038	30941	....	NAVIGATION-ADIRU-INSTALL HONEYWELL ADIR U 4 MCU AD11 (NEW HARD)	ALL
.	042	30977	....	FLIGHT CONTROLS - ELAC SYSTEM - INTRODUCE ELAC SOFTWARE "L90"	ALL
.	041	31040	....	AUTO-FLIGHT - FLIGHT AUGMENTATION COMPUTER (FAC) - INTRODUCE FAC SOFTWARE "BAM0616"	ALL
.	042	31105	....	NAVIGATION - ADIRS - INSTALL HONEYWELL ADIRU 4MCU P/N HG2030AE21 (A318 COEFF CFM ADDED)	ALL
.	038	31106	....	LANDING GEAR - NORMAL BRAKING - INTRODUCE STD 9 BSCU (TWIN VERSION)	ALL
.	041	31152	....	LANDING GEAR-STEERING-SUPPLY NOSE WHEEL STEERING WITH YELLOW HYDRAULIC POWER IN PLACE OF GREEN HYDRAULIC POWER	ALL
.	038	31276	....	ELECTRICAL POWER - GENERAL - INSTALL A COMMERCIAL SHEDDING PUSH-BUTTON SWITCH IN COCKPIT	ALL
.	041	31283	....	INDICATING RECORDING SYSTEM-FWC-INTRODUCE FWC STANDARD H2 F1	ALL
.	038	31365	....	AUTO-FLIGHT-FMGC-INSTALL FMGC P/N B546CAM0103 (CFM GPS/ACARS)	ALL

M V T	REV	MOD MP SB	TITLE	VALIDITY
.	038	31371	INFORMATION SYSTEMS - ATIMS - DEFINE AND INSTALL MODIFIED SOFTWARE ATSU A/C INTERFACE UPGRADED	ALL
.	042	31375	NAVIGATION - EGPWS - ACTIVATE OBSTACLE OPTION ON THE EGPWS	ALL
.	038	31395	FLIGHT CONTROLS - ELAC SYSTEM - INTRODUCE ELAC STD L81	ALL
.	038	31495	INDICATING/RECORDING SYSTEM-EIS2- INSTALL MODIFIED EIS2 SOFTWARE	ALL
N	042	31579	AUTOFLIGHT-FMGC-INSTALL FMGC P/N B546CAM0104 (CFM GPS+ACARS)	ALL
.	042	31706	NAVIGATION-ADIRS-INTRODUCE HONEYWELL ADIRU 4 MCU P/N HG2030AE22	ALL
.	042	31896	AUTOFLIGHT-FMGC-INSTALL FMGC CFM C13042AA01 (EQUIPPED WITH FMS2) HONEYWELL	ALL
.	040	32042	AUTO FLIGHT - FMGC - ACTIVATE MORA DISPLAY ON ND	ALL
.	038	32087	COMMUNICATIONS-ANTI HIJACK CAMERA MONITORING-INSTALL A COCKPIT DOOR SURVEILLANCE SYSTEM	ALL
.	038	32088	EQUIPMENT FURNISHINGS-CURTAINS AND PARTITIONS-MODIFIED INTRUSION AND PENETRATION RESISTANT COCKPIT DOOR	ALL

M V T	REV	MOD MP SB	TITLE	VALIDITY
.	038	32090	DOORS-PASSENGER COMPARTMENT FIXED INTERIOR DOORS-INSTALL ELECTRICAL COCKPIT DOOR RELEASE SYSTEM	ALL
.	042	32207	FLIGHT CONTROLS - ELAC SYSTEM - INTRODUCE ELAC SOFTWARE L82	ALL
.	042	32494	INFORMATION SYSTEMS-ATIMS-ATSU PROVIDE ATSU A/C INTERFACE SOFTWARE CSB 3.2C CAPABLE OF VDL MODE 2	ALL
.	042	32619	ENGINE FUEL AND CONTROL - FADEC SYSTEM INTRODUCE NEW FADEC SOFTWARE "5BK" ON SAC CFM56-5B ENGINES	ALL
.	041	32650	FUEL - QUANTITY INDICATION - INTRODUCE FUEL LEAK DETECTION	ALL
.	042	33100	COMMUNICATIONS-CIDS-INTRODUCE ENHANCED CIDS (A318 VERSION) AND RELATED SYSTEMS ON SINGLE AISLE FAMILY	ALL
.	042	33239	ENGINE FUEL AND CONTROL - FADEC SYSTEM - INSTALL "5BL" STANDARD ECU SOFTWARE FOR CFM56-5B ENGINES (A318 CAPABLE)	ALL
.	042	33253	NAVIGATION - WEATHER RADAR SYSTEM - INSTALL HONEYWELL DUAL CONTROL UNIT CAPABLE OF AUTO-TILT FUNCTION	ALL
.	042	33299	AUTO FLIGHT - FLIGHT AUGMENTATION COMPUTER - INSTALL FAC STANDARD BAM0617 FOR A318	ALL
.	042	33376	LANDING GEAR - NORMAL BRAKING - INSTALL BSCU STD L4.5	ALL

M V T	REV	MOD MP SB	TITLE	VALIDITY
.	042	33751	NAVIGATION-WEATHER RADAR SYSTEM-INSTALL COLLINS DUAL CONTROL PANEL TO ACTIVATE MULTISCAN FUNCTION	ALL
.	041	33907	INDICATING/RECORDING SYSTEMS - FWC - INTRODUCE IAS DISCREPANCY AND DUAL PITOT MONITORING ON FWC H2F1	ALL
.	042	34428	AIR CONDITIONING - PACK TEMPERATURE CONTROL - INSTALL IMPROVED AIR COND. SYSTEM CONTROLLER PN 1803B0000-01	ALL
N	042	34571	INDICATING/RECORDING SYSTEMS-ELECTRONIC INSTRUMENT SYSTEM(EIS)- INSTALL DISPLAY MANAGEMENT COMPUTER SOFTWARE EIS2 S4-2	ALL
.	042	34573	AUTO FLIGHT - FLIGHT MANAGEMENT AND GUIDANCE COMPUTER (FMGC)-INSTALL FMS2 HONEYWELL P1C11 ON A/C WITH CFMI PPS	ALL
.	042	34637	NAVIGATION- T2CAS- INSTALL ACSS TRAFFIC AND TERRAIN COLLISION AVOIDANCE SYSTEM (T2CAS)	ALL
.	042	34660	NAVIGATION - WEATHER RADAR SYSTEM - INSTALL COLLINS TRANSCEIVER FULLY COMPLIANT WITH MULTI-SCAN FUNCTION	ALL
.	042	34825	NAVIGATION- GPWS - USE LATERAL GPS POSITION WITH AUTOMATIC DESELECTION	ALL
.	042	35216	LANDING GEAR - NORMAL BRAKING - INSTALL BSCU STD L4.8 (EM2)	ALL

M V T	REV	MOD	MP SB	TITLE	VALIDITY
.	041	35220	....	INDICATING/RECORDING SYSTEMS - FLIGHT WARNING COMPUTER (FWC) - INSTALL FWC STANDARD H2F3	ALL
.	042	35350	....	NAVIGATION-T2CAS (TRAFFIC 2 COLLISION AVOIDANCE SYST) - ACTIVATE AUTOMATIC DEACTIVATION OF T2CAS-TAWS	ALL
.	042	35485	....	INDICATING/RECORDING SYSTEM-ELECTRONIC INSTRUMENT SYSTEM (EIS)-INSTALL DISPLAY MANAGEMENT COMPUTER SOFTWARE EIS2 S6-1	ALL
.	042	35550	....	PNEUMATIC - ENGINE BLEED AIR SUPPLY SYSTEM - INSTALL BMC STD 9 CAPABLE OF A318 PW	ALL
.	042	35793	....	NAVIGATION - ADIRU - INSTALL HONEYWELL ADIRU P/N HG2030-AE23	ALL
.	042	35863	....	AIR CONDITIONING - PACK TEMPERATURE CONTROL - INSTALL AIR CONDITIONING CONTROLLER P/N 1803B0000-02	ALL
.	042	36462	....	ENGINE FUEL AND CONTROL - FADEC SYSTEM-INSTALL "5BM" STANDARD ECU SOFTWARE FOR CFM 56-5B ENGINES	ALL
.	042	36627	....	NAVIGATION - TRAFFIC AND TERRAIN COLLISION AVOIDANCE SYSTEM - INSTALL T2CAS STD 2 (-11111)	ALL
.	041	36847	....	INDICATING RECORDING SYSTEM - FLIGHT WARNING COMPUTER (FWC)-INSTALL FWC STANDARD H2-F4	ALL

M V T	REV	MOD SB	MP	TITLE / VALIDITY
N	042	36998	......	NAVIGATION - GENERAL - INSTALL P/B IN THE COCKPIT ACTIVATING LOGICS OF LAT DEV SCALE DISPLAY ALL
.	042	37317	......	ELECTRICAL POWER - AC ESSENTIAL GENERATION SWITCHING - INSTALL AUTO SWITCHING SYSTEM FOR AC AND DC ESS BUS ALL
.	042	37356	......	NAVIGATION - MMR - INSTALL COLLINS MMR STANDARD P/N 822-1152-122 ALL
.	042	37782	......	COMMUNICATIONS - AUDIO MANAGEMENT - MODIFY AMU POWER SUPPLY TO COPE WITH DC ESSENTIAL BUS LOSS ALL

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.

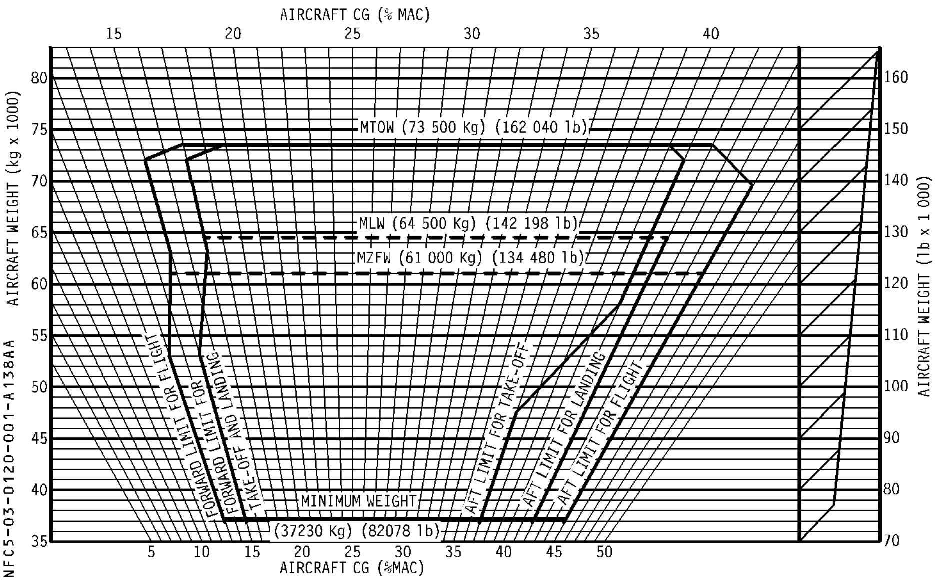
KIND OF OPERATIONS

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 : 180

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 16.31 m (53.51 ft) aft of the aircraft nose.
- The CG must always be within these limits, regardless of fuel load.

WEIGHT LIMITATIONS

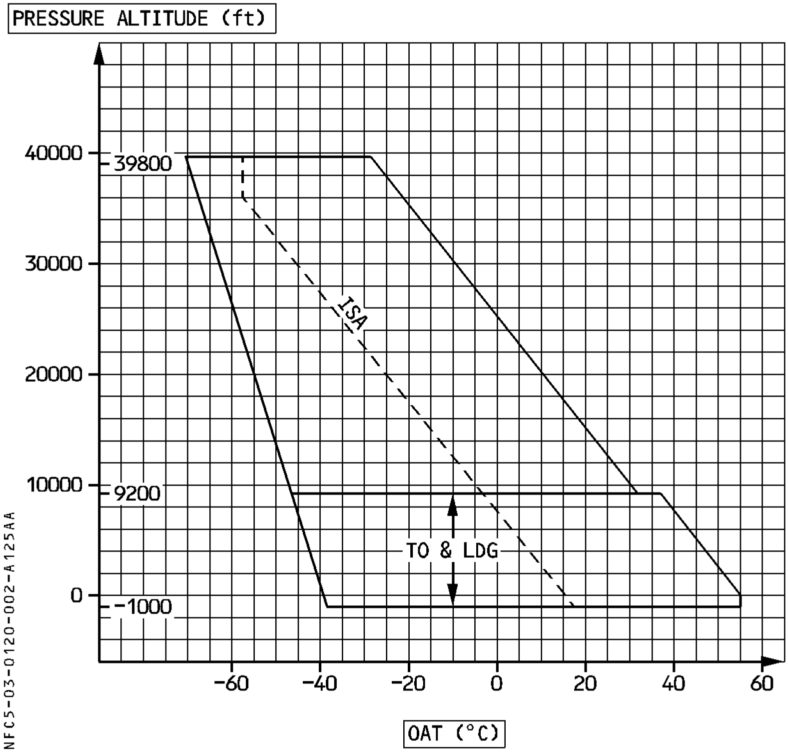
Maximum taxi weight . . . . 73 900 kg (162 922 lb)
Maximum takeoff weight (brake release) . . . . 73 500 kg (162 040 lb)
Maximum landing weight . . . . 64 500 kg (142 198 lb)
Maximum zero fuel weight . . . . 61 000 kg (134 480 lb)
Minimum weight . . . . 37 230 kg (82 078 lb)

In exceptional cases (in flight turn back or diversion), an immediate landing at weight above maximum landing weight is permitted, provided the pilot follows the overweight landing procedure.

FLIGHT MANEUVERING LOAD ACCELERATION LIMITS

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

ENVIRONMENTAL ENVELOPE



AIRPORT OPERATIONS

- Runway slope (mean) . . . . ± 2 %
- Runway altitude . . . . 9200 feet
- Nominal runway width . . . . 45 meters
- Wind for takeoff and landing :

R · Maximum crosswind demonstrated . . . . 38 knots (gust included)

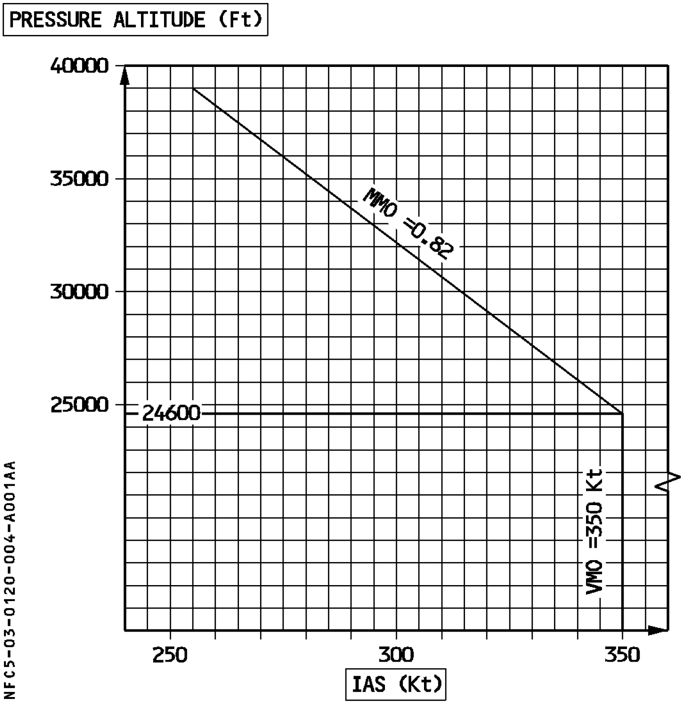
R · Maximum tailwind . . . . 10 knots

- Wind for passenger / cargo door operation :
  - · Maximum wind for passenger door operation : . . . . 65 knots
  - · Maximum wind for cargo door operation : 40 knots (or 50 knots, if the aircraft nose is oriented into the wind, or the cargo door is on the leeward side).
  - · The cargo door must be closed, before the wind speed exceeds 65 knots.

SPEED LIMITATIONS

MAXIMUM OPERATING SPEED VMO/MMO

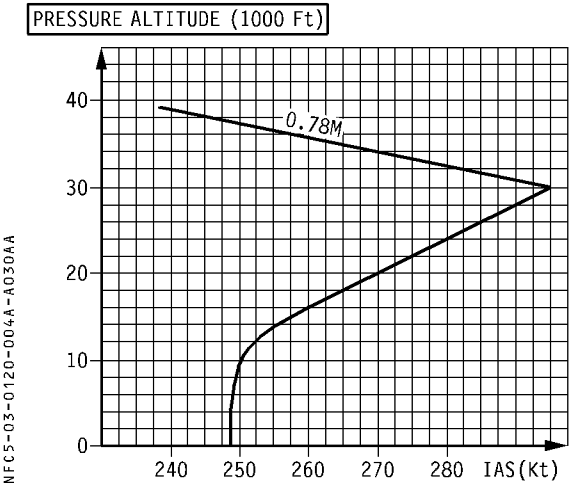
R



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

MAXIMUM DESIGN MANOEUVERING SPEED VA

(Applies in alternate or direct flight control laws only).



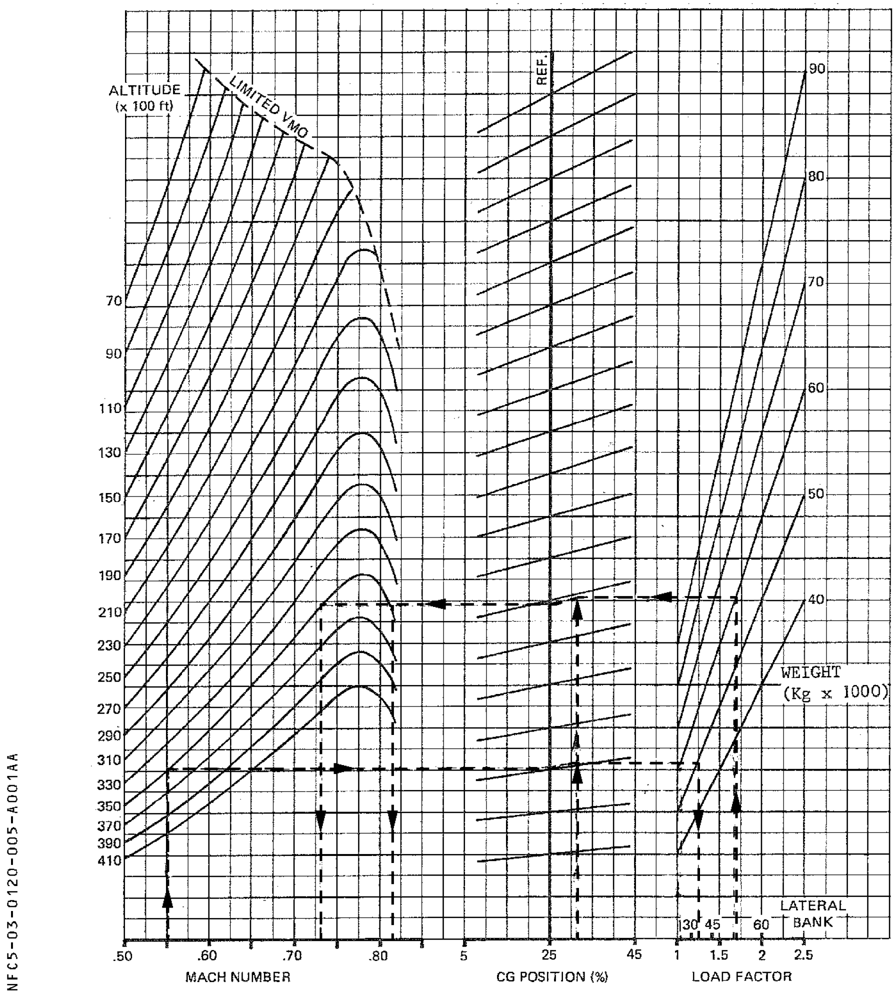
If alternate or direct law is active, full ailerons and rudder application should be confined to speeds below VA.
If alternate or direct law is active manoeuvres involving angle of attack near stall should be confined to speeds below VA.

CAUTION

Rapid and large alternating control inputs, especially in combination with large changes in pitch, roll, or yaw (e.g. large sideslip angles) may result in structural failures at any speed, even below VA.

R

BUFFET ONSET



Examples :

1. Determine Maximum Bank Angle limited by buffet :
   DATA : M = 0.55, FL = 350, CG = 31 %, WEIGHT = 50000 kg
   RESULT : load factor = 1.25 g or 35° bank
2. Determine low and high speed limited by buffet :
   DATA : 52° bank or 1.7 g, WEIGHT = 60000 kg, CG = 31%, FL = 350
   RESULT : M = 0.73 (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
-2000	112	111.5	109.5	109
0	110	109.5	107.5	107
2000	108	107.5	105.5	105
4000	107.5	107	105	104.5
6000	105.5	105	103	103
8000	103	103	101	100.5
9200	105.5	101	99	98.5
10000	100	100	98	97.5
12000	96.5	96.5	94.5	94
14100	93.5	93	91	91

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	35	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 knots

WINDSHIELD WIPERS IN USE

· Maximum speed . . . . 230 knots

COCKPIT WINDOW OPEN

· Maximum speed . . . . 200 knots

TAXI SPEED

R When the taxi weight is higher than 76 000 kg (167 550 lb), do not exceed a taxi speed of 20 kt during a turn.

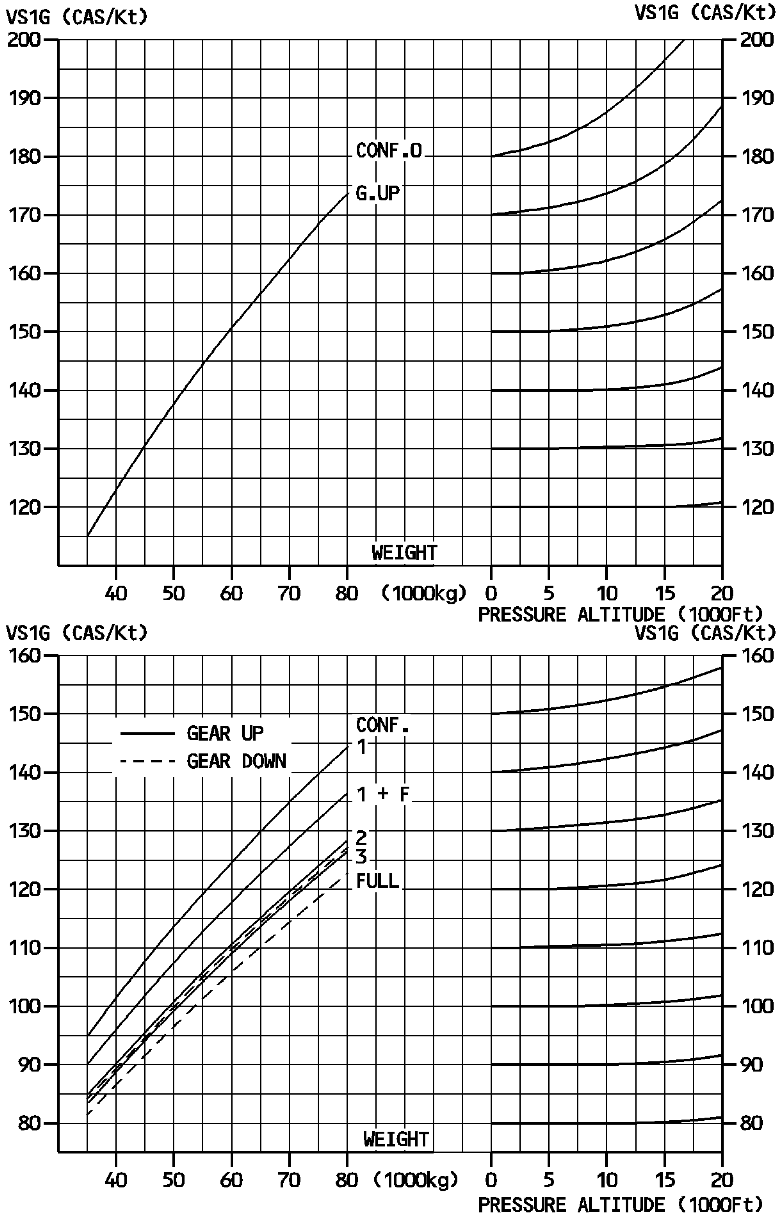
STALLING SPEEDS

The following graphs serve to determine the VS according to the configuration.
These graphs have been established for

· Basic forward CG
  - 23 % CG location in clean configuration
  - 25 % CG location in takeoff, approach and landing configuration
· Alternate forward CG
  - forward CG limit. See 3.01.20 p 1.

In most cases the CG location remains within the CG envelope below. Consequently the basic forward CG must be retained for any performance determination.
In some rare cases, if more forward CG is anticipated during any part of the flight, the alternate forward CG must be retained for any performance determination.

STALLING SPEEDS (BASIC FORWARD C.G.)



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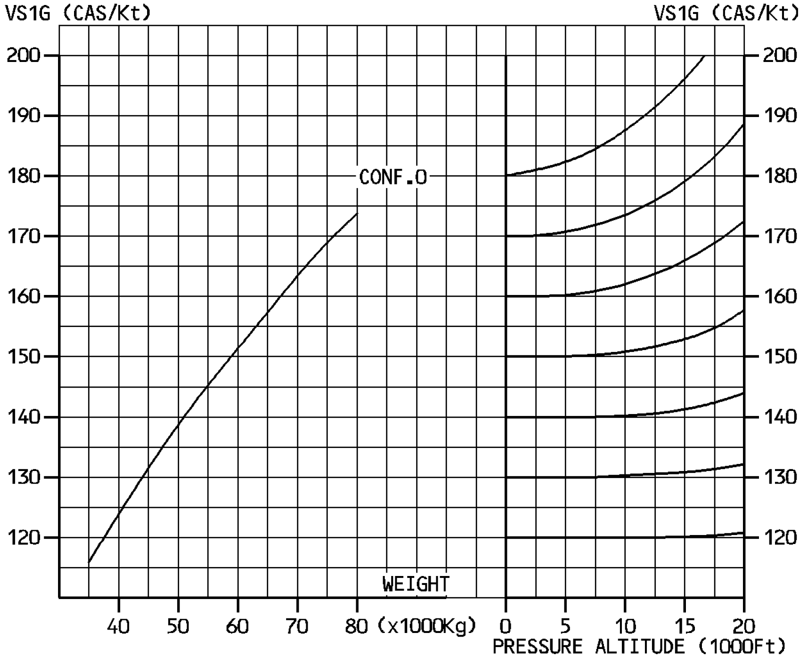
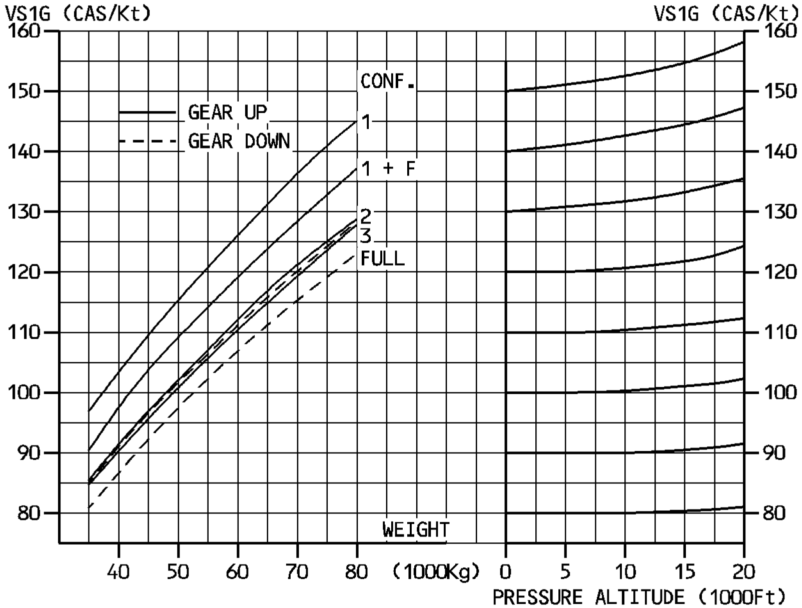
STALLING SPEEDS (ALTERNATE FORWARD C.G.)





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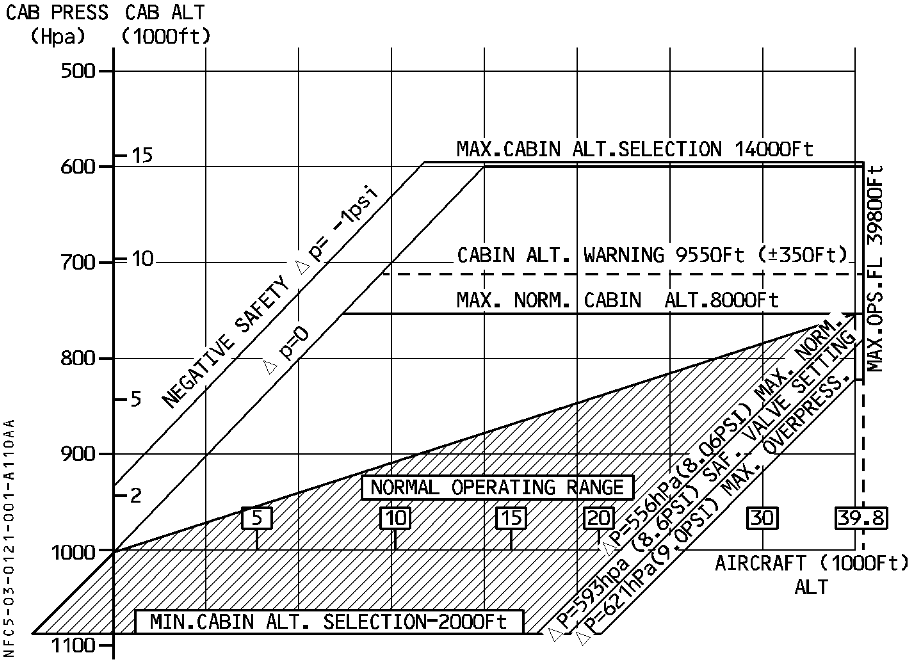
CABIN PRESSURE

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



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

RAM AIR INLET

Only open if differential pressure is lower than 1 psi.

AIR CONDITIONING WITH LP GROUND UNIT

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

AIR CONDITIONING WITH HP GROUND UNIT

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

AVIONICS VENTILATION

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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
R Straight-in LNAV/VNAV approach . . . . applicable DA
Circling approach . . . . applicable MDA - 100 ft (or MDH - 100 ft)
R ILS approach when CAT2 or CAT3 is not displayed on the 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

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

FLIGHT MANAGEMENT FUNCTION

FMGS lateral and vertical navigation has been certified for after takeoff, en route, and terminal area operations, for instrument approach procedures (except ILS, LOC, LOC-BC, LDA, SDF and MLS), and for missed approach procedures.
RNP accuracy with GPS PRIMARY, or radio updating, has been demonstrated to be :

	With AP ON in NAV	With AP OFF and FD ON in NAV	With AP OFF and FD OFF
En route	1 NM	1 NM	1.1 NM
In terminal area	0.5 NM	0.51 NM	0.51 NM
In approach	0.3 NM	0.3 NM	Not authorized

Without GPS PRIMARY (or GPS deselected or inoperative), the accuracy has been demonstrated, provided the appropriate RNP value is checked or entered on the MCDU, and HIGH accuracy is displayed.
Without GPS PRIMARY (or GPS deselected or inoperative), navigation accuracy is a function of ground radio navaid infrastructure, or elapsed time since the last radio update.
The FMGS is also certified for navigation within BRNAV, PRNAV, and RNP 10 airspace.
RNP10 oceanic/remote area operations are approved with GPS PRIMARY or, without GPS PRIMARY (or GPS deselected or inoperative), provided time limitations in IRS only navigation (acceptable to operational authorities), are established.
FMGS approval is based on the assumption that the navigation database has been validated for intended use.
Obstacle clearance and adherence to airspace constraints remains the flight crew's responsibility.
Fuel, time predictions/performance information is provided for advisory purposes only.
NAV mode may be used after takeoff, provided FMGS runway updating has been checked.

FLIGHT MANAGEMENT FUNCTION

NO CHANGE

R The FMGS is also certified for navigation within BRNAV, PRNAV, RNP-4 and RNP-10 airspace. RNP10 oceanic/remote area operations are approved with GPS PRIMARY or, without GPS PRIMARY (or GPS deselected or inoperative), provided time limitations in IRS only navigation (acceptable to operational authorities), are established.

FMGS approval is based on the assumption that the navigation database has been validated for intended use.

Obstacle clearance and adherence to airspace constraints remains the flight crew's responsibility.

Fuel, time predictions/performance information is provided for advisory purposes only.

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

TAKEOFF IN GPS PRIMARY

For certain airports, where the difference between the local coordinate system and WGS 84 (geodesic standard used by GPS, FMS) is not negligible, an incorrect NAV guidance may occur after takeoff.
GPS must be deselected for takeoff from these airports, until a safe altitude is reached.

USE OF NAV AND FINAL APP MODES FOR NON PRECISION APPROACH

NAV, or NAV and FINAL APP mode may be used for VOR, VOR/DME, NDB, NDB/DME or RNAV (including GPS) approach, but not for ILS, LOC, LOC-BC, LDA, SDF, or MLS final approach.
For instrument procedures not coded in the WGS 84 coordinate system, the GPS must be deselected, unless the shift between the local coordinate system and the WGS 84 is found acceptable for the intended operation.

Note : *1. The assesment of this shift can be done :*
- *in flight, monitoring the navaid raw data in non RNAV procedures,*
- *on ground performing a GPS survey of the procedure waypoints.*

2. RNAV (GPS) and RNP RNAV approach procedures require WGS 84 coordinates and GPS.

FINAL APP mode guidance capability with GPS PRIMARY has been demonstrated down to MDH/DH (barometric) 250 feet.
VOR, VOR/DME, NDB or NDB/DME approach procedures may be performed, in NAV, or NAV and FINAL APP mode, provided AP or FD is used, and :
- GPS PRIMARY is available. In this case, the reference navaid may be unserviceable, or the airborne radio equipment may be inoperative, or not installed, provided operational approval is obtained.
- Without GPS PRIMARY :
  - The reference navaid and the corresponding airborne equipment is serviceable, tuned, and monitored during the approach, or
  - The radio navaid coverage supports the RNP value, specified for the approach procedure, and an operational approval is obtained.

For GPS approach, GPS PRIMARY must be available.
RNAV approach without GPS PRIMARY may be performed only if the radio navaid coverage supports the RNP value and HIGH accuracy is displayed on the MCDU with the specified RNP, and operational approval is obtained.
NAV mode may be used in the terminal area, provided :
– GPS PRIMARY is available, or
– HIGH accuracy is displayed, and the appropriate RNP is checked or entered on the MCDU, or
– Navaid raw data is monitored.
The lateral deviation (LAT DEV) display, controlled by the RNP pushbutton, is only used for RNP operations.
The lateral deviation (LAT DEV) display must not be used during non RNP SID, STAR approaches and missed approaches.

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 permitted.

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 the FMA.
R If the flight crew performs an automatic approach without autoland, the autopilot must be
R 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 the 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
- CAT III with DH :
  Minimum decision height . . . . 20 feet
  2 autopilots must be engaged in APPR mode and CAT 3 DUAL must be displayed on the FMA.
- CAT III without DH :
  2 autopilots must be engaged in APPR mode and CAT 3 DUAL must be displayed on the FMA.
  Minimum Runway Visual Range . . . . 75 meters

ENGINE OUT

CAT II and CAT III fail passive autoland are only approved in configuration 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 ROLL OUT

Headwind : 30 knots
Tailwind : 10 knots
Crosswind : 20 knots

Note : *Wind limitation is based on the surface wind reported by the tower. If the wind displayed on ND exceeds the above–noted autoland limitations, but the tower reports a surface wind within the limitations, then the autopilot can remain engaged. If the tower reports a 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 CONF 3 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 2500 feet.
- At or below the maximum landing weight.
- At approach speed (VAPP) = VLS + wind correction.
  Minimum wind correction 5 knots ; maximum 15 knots.

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

AUTOMATIC LANDING IN CAT I OR BETTER WEATHER CONDITIONS

The automatic landing system's performance has been demonstrated on runways equipped with CAT II or CAT III ILS approaches. However automatic landing in CAT I or better weather
R conditions is possible on CAT I ground installations or on CAT II/III ground installations 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 terrain profile before the runway have no adverse effect on AP/FD guidance. In particular the effect of terrain discontinuities within 300 meters before the runway threshold must be evaluated.
- The crew is aware that LOC or GS beam fluctuations, independent of the aircraft systems, may occur and the PF is prepared to immediately disconnect the AP and take appropriate action, should unsatisfactory guidance occur.
- At least CAT2 capability is displayed on the FMA and CAT II/CAT III procedures are used.
- Visual references are obtained at an altitude appropriate to the performed CAT I
R approach, otherwise go–around is initiated.

TR N° 990-3 PAGE 2 OF 2

NO CHANGE

AUTOMATIC LANDING IN JOHANNESBURG

Do not perform an automatic landing on the Johannesburg 03R/21L runway.
The flight crew can perform a CAT II automatic approach, but the flight crew must disconnect the AP no later than at 80 ft AGL.

ELECTRICAL

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

Electrical Outlets

It is forbidden to use the electrical outlets during takeoff and landing.

In Seat Power Supply System (ISPSS)

Airworthiness approval of the ISPSS for Portable Electronic Devices (PED) does not constitute an operational approval to connect a PED to the system. The In Seat Power Supply System (ISPSS) for PED, carried by the passengers, must be switched off during takeoff and landing.

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FLIGHT CONTROL

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

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GENERAL

FUEL AND ADDITIVE SPECIFICATIONS

- See engine manufacturer specification
R - Fuel system has been certified for JET A1, JP 8, JET A, JP 5, RT, TS-1, JET B, JP 4 and
R N°3 JET.

MAXIMUM ALLOWED WING FUEL IMBALANCE

· INNER TANKS (outer tanks balanced)

Tank Fuel Quantity (Heavier tank)	Maximum allowed imbalance
Full	1 500 kg (3 306 lb)
4 300 kg (9 479 lb)	1 600 kg (3 527 lb)
2 250 kg (4 960 lb)	2 250 kg (4 960 lb)

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)*

* 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.

Note : *In exceptional conditions (i.e., fuel system failures) the above-mentioned maximum fuel imbalance values may be exceeded without significantly affecting the aircraft handling qualities. The aircraft remains fully controllable in all phases of the flight.*

FUEL TEMPERATURE

R

	JET A1/ JP 8/ N°3 JET	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.

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

R 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

R **FUEL MIXABILITY**

R The various types of fuel can be mixed in all proportions.
R The freezing point of a fuel mixture varies, based on non-linear laws. Therefore, the only
R reliable way to obtain an accurate freezing point of a mixture of fuels is to make a freeze
R point measurement.
R If this is not possible, the freezing point of the mixture should be considered to be the same
R as the highest freezing point, when the fuel type with the lowest quantity is 10 % or more
R of the mixture.
R For example, assuming that fuel type A has a higher freezing point than fuel type B :
R – If the mixture of fuel type A and type B contains less than 10 % of fuel type A, the
R freezing point of the mixture can be considered as that of fuel type B
R – If the mixture of fuel type A and type B contains more than 10 % of fuel type A, the
R freezing point of the mixture can be considered as that of fuel type A.

HYDRAULIC

Normal operating pressure 3000 psi ± 200

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GENERAL

BRAKES

Maximum brake temperature for takeoff (brake fans (◁) off) . . . . 300° C

R The braking system is not designed to hold the aircraft in a stationary position when a high
R thrust level is applied on at least one engine. During ground procedures that require a thrust
R increase with braking, the flight crew must ensure that the aircraft remains stationary.

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
R pushbutton, or by applying firm action on the brake pedals.

TAXI WITH DEFLATED TIRES

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.
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.

NOSEWHEEL STEERING (NWS)

The nosewheel steering angle is limited to 75° when using the handwheels.
For towing and pushback, the nosewheel steering angle is limited to 95°.
Towbarless towing and pushback on the nose landing gear is approved for the “accepted towbarless towing vehicles” that are listed in the Airbus SIL 09–002, but the nosewheel steering angle must be limited to 85°.

INERTIAL REFERENCE SYSTEM

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

R – For latitude greater than 82 degrees North
R – For latitude greater than 73 degrees North, between 90 degrees and 120 degrees West
R (magnetic polar region)
R – For latitude greater than 60 degrees South.

Flight outside of the above–noted limits is not permitted.

GROUND PROXIMITY WARNING SYSTEM (GPWS)

– Aircraft navigation is not to be predicated upon the use of the terrain display.
The terrain display is intended to serve as a situational awareness tool only, and may not provide the accuracy on which to solely base terrain avoidance maneuvering.
The GPWS database, display, and alerting algorithms currently do not account for man made obstructions.
– The GPWS predictive functions should be inhibited (TERR pushbutton switched 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 GPWS database
R · For either specific takeoff runways with associated SID procedures, or for approach
R trajectories with associated procedures, that have been identified as potentially
R triggering false terrain alerts.

ISIS

When both PFDs are lost, the ISIS bugs function must not be used.

COCKPIT FIXED OXYGEN SYSTEM

MINIMUM FLIGHT CREW OXYGEN PRESSURE

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

* REF TEMPERATURE :
. On ground : (OAT + COCKPIT TEMP) / 2
. In flight : CAB TEMP (deg. C) – 10 deg. C
or
CAB TEMP (deg. F) – 18 deg. F

** MINIMUM BOTTLE PRESSURE TO TAKE INTO ACCOUNT :
- Preflight checks
- The use of oxygen, when only one flight crewmember is in the cockpit
- Unusable quantity (to ensure that the regulator functions with minimum pressure)
- Normal system leakage

and
· Protection after loss of cabin pressure, with mask regulator on NORMAL (diluted oxygen):
R – During an emergency descent : For all cockpit members for 13 minutes
R – During cruise at FL 100 : For 2 flight crewmembers for 107 minutes.

or
R · Protection in case of smoke, with 100 % oxygen : For all cockpit members for 15 minutes at a cabin altitude of 8000 feet.

Note : The above times are based on the use of a sealed mask, but may be shorter if the flight crewmember has a beard.

GENERAL

OIL QUANTITY

R The APU may be started and operated even if the LOW OIL LEVEL ECAM advisory is
R displayed. Maintenance action is required within next 10 hours of APU operation.

APU STARTER

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

ROTOR SPEED

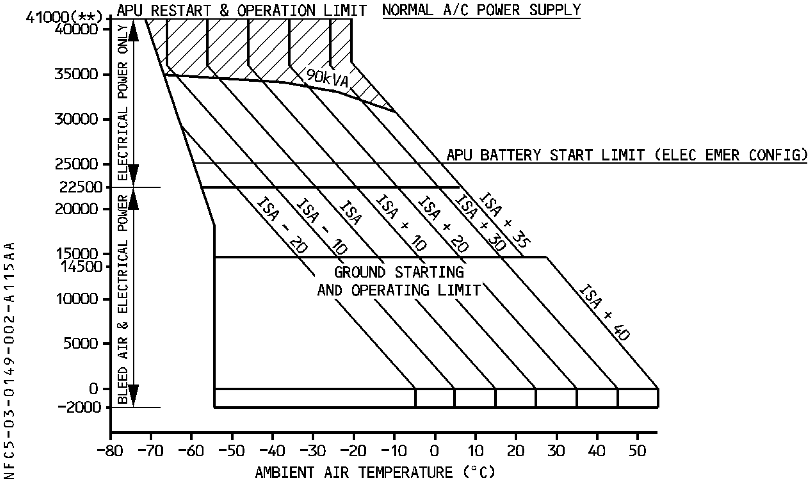
· Maximum N (ECAM display) . . . . 107 %

Note : The APU automatically shuts down at 107 % N speed, that appears on the ECAM. This corresponds to an actual N speed of 106 %.

EGT

· Maximum EGT . . . . 675 degrees C
· Maximum for start (below 35000 feet) . . . . 1090 degrees C
· Maximum for start (above 35000 feet) . . . . 1120 degrees C

ENVELOPE



R *Note : In the APU start envelope, the APU start is guaranteed within 3 consecutive start*
R *attempts.*

GENERATOR LOAD IN FLIGHT					
Altitude (ft)	ISA	ISA + 10	ISA + 20	ISA + 30	ISA + 35
25000	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)
30000	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)	98 % (88 KVA)
35000	93 % (84 KVA)	91% (82 KVA)	88 % (79 KVA)	84 % (76 KVA)	79 % (71 KVA)
39000	71 % (64 KVA)	69 % (62 KVA)	68 % (61 KVA)	63 % (57 KVA)	61 % (55 KVA)
41000**	57 % (51 KVA)	55 % (50 KVA)	55 % (50 KVA)	54 % (49 KVA)	53 % (48 KVA)

GENERATOR LOAD ON THE GROUND							
Altitude (ft)	MODE	ISA	IAS + 10	ISA + 20	ISA + 30	ISA + 35	ISA + 40
14500	ENG START	100 % (90 KVA)	100 % (90KVA)	98 % (88 KVA)	85 % (77 KVA*)	79 % (71 KVA*)	68 % (61 KVA*)
	PACKS	100 % (90 KVA)	100 % (90 KVA)	91 % (82 KVA)	78 % (70 KVA)	70 % (63 KVA)	58 % (52 KVA)
9200	ENG START	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)	91 % (82 KVA)	83 % (75 KVA)	72 % (65 KVA)
	PACKS	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)	87 % (78 KVA)	78 % (70 KVA)	67 % (60 KVA)
8000	ENG START	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)	92 % (83 KVA)	84 % (76 KVA)	74 % (67 KVA)
	PACKS	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)	89 % (80 KVA)	79 % (71 KVA)	70 % (63 KVA)
0	ENG START	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)	90 % (81 KVA)	81 % (73 KVA)
	PACKS	100 % (90 KVA)	100 % (90 KVA)	100 % (90 KVA)	91 % (82 KVA)	83 % (75 KVA)	75 % (68 KVA)

(*) : Generator load with maximum bleed performance.
(**) : Only for aircraft certified up to that flight level.

– 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	92 % (83 KVA)	64 % (58 KVA)	45 % (41 KVA)
ONE PACK UP TO 22500 ft	78 % (70 KVA)	67 % (60 KVA)	63 % (57 KVA)
TWO PACKS UP TO 15000 ft	100 % (90 KVA)	79 % (71 KVA)	64 % (58 KVA)

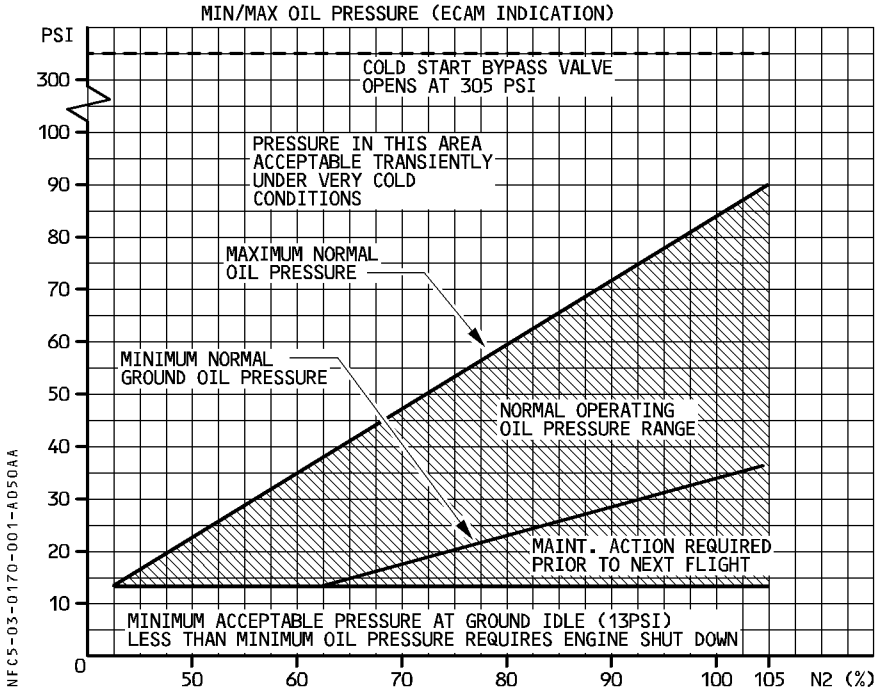
– Air bleed extraction for wing anti-icing is not permitted.

THRUST SETTING/EGT LIMITS

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

OIL

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



RPM

N1 max . . . . 104 %

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

N2 max . . . . 105 %

STARTER

- 4 consecutive cycles : Each lasts a maximum of 2 minutes.
- Pause between start attempts : 20 seconds.
- Cooling period, after 4 start attempts : 15 minutes.
- No running engagement of the starter, when N2 is above 20 %.

REVERSE THRUST

- It is not permitted to select reverse thrust in flight.
- It is not permitted to back up the aircraft with reverse thrust.
- Maximum reverse should not be used below 70 knots. (Idle reverse is permitted down to aircraft stop).

REDUCED THRUST TAKEOFF

- Takeoff at reduced thrust is only permitted, 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
R requirement, the flexible temperature must not be higher than ISA + 53 (T MAX FLEX).
- 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 permitted with any inoperative item affecting the performance, only if the associated performance shortfall has been applied to meet all performance requirements at the takeoff weight, with the operating engines at the thrust available for the flex temperature.

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02.70 POWERPLANT (CONT'D)

02.80 MISCELLANEOUS

02.90 DETAILED CABIN/COCKPIT EVAC PROC

GENERAL

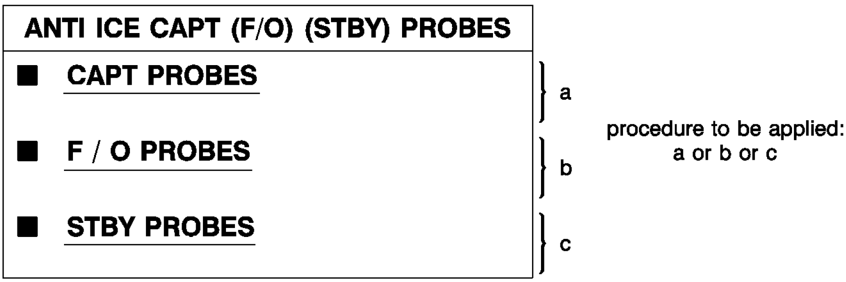
R Abnormal and Emergency procedures maintain adequate safety and help to ensure the
R conduct of the flight. The flight crew uses the “READ and DO” oral reading principle when
R performing these procedures.

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.

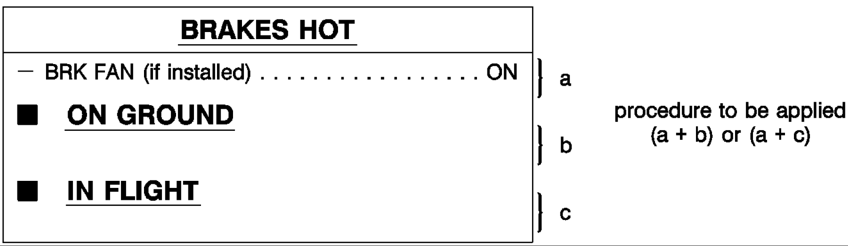
R **BLACK SQUARE**

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

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



NFC5-03-0201-001-B001AA

The ECAM does not display black squares.

R **BLACK DOT**

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

NFC5-03-0201-002-A001AA

F / CTL FLAPS FAULT

— FLAPS LEVER . . . . RECYCLE

• **If unsuccessful :**

— GPWS FLAP MODE . . . . OFF

"If unsuccessful" does not appear on ECAM

R **INDENTATION**

R Indentation is used in order to identify when an action depends on a precondition/flight
R phase/procedure.
R For example :
R

NFC5-03-0201-002-B001AA

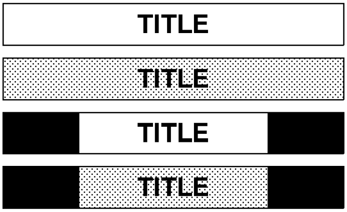
■ **IN FLIGHT**
• If Flaps locked
APPR SPEED . . . . VREF +30
— MAX SPEED . . . . 250 kt
INCREASED FUEL CONSUMP

R — The APPR SPEED is equal to VREF + 30 kt, only if the flaps are locked, because "APPR
R SPEED......VREF + 30" is indented below "• If flaps locked".
R — The MAX SPEED of 250 kt does not depend on the flaps locked condition because it is
R aligned with "• If flaps locked". Therefore, MAX SPEED has to be respected whether the
R flaps are locked or not.
R — INCREASED FUEL CONSUMP is aligned with IN FLIGHT. Therefore, this information is
R valid in flight and on ground.

PROCEDURE TITLES

Titles of the procedures appear in the following ways :

NFC5-03-0201-002AA001AA



Abnormal procedure displayed on ECAM (amber caution)

Abnormal procedure not displayed on ECAM

Emergency procedure displayed on ECAM (red warning)

Emergency procedure not displayed on ECAM

TASKSHARING

The general tasksharing shown below applies to all procedures.
The pilot flying remains the pilot flying throughout the procedure.
The PF (pilot flying), is responsible for the :
- Thrust levers
- Control of flight path and airspeed
- Aircraft configuration (request configuration change)
- Navigation
- Communications.

The PNF (pilot not flying), is responsible for :
- Monitoring and reading aloud the ECAM and checklists
- Performing required actions, or actions requested by the PF, if applicable
- Using the engine master switches, IR and guarded switches, with PF's confirmation.

MEMORY ITEMS

The following procedures are to be applied without referring to paper : Windshear ⊲ , windshear ahead ⊲ , TCAS ⊲ , EGPWS ⊲ , loss of braking, immediate actions of EMER DESCENT, immediate actions of UNRELIABLE SPEED INDICATION/ADR CHECK PROC, CREW INCAPACITATION.

USE OF AUTOPILOT

The autopilot (AP) may be used in most failure cases, when available :

- In case of engine failure, including CAT II/CAT III ILS approaches and fail-passive automatic landing.
  When performing an engine-out non precision approach, the use of the AP 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 canceling audio warnings, through the MASTER WARN light) until :

- The appropriate flight path is established, and
- 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 is a good compromise between the necessary time for stabilization, and excessive delay in procedure initiation.
In some emergency cases, provided that the appropriate flight path is established, the Pilot Flying may initiate actions before this height.
R If an emergency causes LAND ASAP to appear in red on the ECAM, the flight crew must
R land as soon as possible at the nearest suitable airport at which a safe approach and
R landing can be made.
R If an abnormal procedure causes LAND ASAP to appear in amber on the ECAM, the flight
R crew should consider landing at the nearest suitable airport.

LANDING DISTANCE

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

ECAM

Warning inhibition during takeoff

Some warnings (non-inhibited) appear when the situation that prompts them occurs. Other warnings (inhibited) do not appear immediately, when the situation that prompts them occurs during takeoff.

CREW COORDINATION

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

NO CLEAR ACTION BEFORE CROSS CONFIRMATION

Example of crew coordination and cross confirmation :

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

For standard calls, refer to 3.03.90.

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

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

INTENTIONALLY LEFT BLANK

USE OF SUMMARIES

GENERAL

The summaries consist of QRH procedures. They have been created to help the crew handle the actions to be carried out, in the event of an electrical emergency configuration or dual hydraulic failure.
In any case, the ECAM should be applied first.
This includes both the procedure and the STATUS review.
Only after announcing "ECAM ACTIONS COMPLETED", should the Pilot Not Flying (PNF) refer to the corresponding QRH summary.
R When a failure occurs, and after performing the ECAM actions, the PNF must refer to the bottom of the applicable Summary page (below the Go-Around section), in order to determine the landing distance that takes into account the failure.
R For dry and wet runways, the actual landing distance with failure is provided in the QRH.
R This actual landing distance is based on the following assumptions :
R – The approach speed is VREF + △VREF (refer to the "CRUISE" section of the Summary). The speed increment (when applicable), and corresponding landing distance penalty that are required when the A/THR is used, or in the case of ice accretion on surfaces that are not heated, is not taken into account.
R – The flight crew uses maximum reverse thrust on all operative reversers for wet runways.
R For contaminated runways, the landing distance factor that the PNF must apply to the actual landing distance with reverser, is also provided in the QRH. The PNF must refer to the applicable QRH page 4.03 and calculate the landing distance, taking into account the failure.
R Depending on the actual landing distance with failure, the PNF can decide whether or not a diversion is necessary.

APPROACH PREPARATION

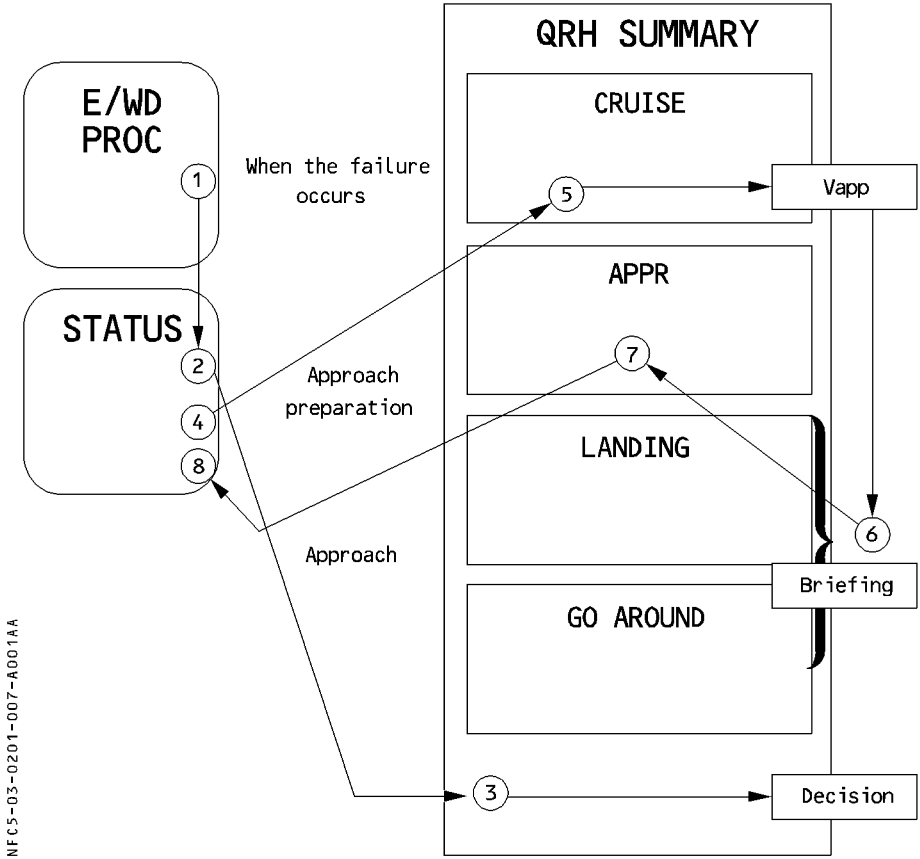
As always, approach preparation includes a review of the ECAM STATUS.
After reviewing the STATUS, the PNF should refer to the "CRUISE" portion of the summary to determine the VREF correction, and compute the VAPP.
The pilot is presumed to know the computation method, and use the VREF given on the MCDU (the destination having been previously updated).
A VREF table is provided in the summary, for failure cases leading to the loss of the MCDU.
The LANDING and GO-AROUND portions of the summary should be used for the approach briefing.

APPROACH

The APPR PROC actions should be performed by reading the APPROACH portion of the summary. This portion has primarily been added due to the flap extension procedure, which is not fully addressed on the ECAM.
As the recommendations provided in this portion of the summary are deemed sufficient, it is not necessary to refer to the "LANDING WITH FLAPS (SLATS) JAMMED" paper procedure.
After referring to the APPROACH portion of the summary, the PNF should then review the ECAM STATUS, and check that all APPR PROC actions have been completed.

SEQUENCE

R



REJECTED TAKEOFF

GENERAL

The decision to reject the takeoff and the stop action is made by the Captain.
It is therefore recommended that the Captain keeps his hand on the thrust levers until the aircraft reaches V1, whether he is Pilot Flying (PF) or Pilot Not Flying (PNF). As soon as he decides to abort, he calls "stop", takes over control of the aircraft and performs the stop actions.
It is not possible to list all the factors that could lead to the decision to reject the takeoff. However, in order to help the Captain to make a decision, the ECAM inhibits the warnings that are not essential from 80 knots to 1 500 feet (or 2 minutes after lift-off, whichever occurs first).
Experience has shown that rejected takeoffs can be hazardous even if the performance is correctly calculated, based on flight tests.
This may be due to the following factors :

- Delay in Performing the stopping procedure.
- Damaged tires.
- Brakes worn, brakes not working correctly, or higher than normal initial brakes temperature.
- The brakes not being fully applied.
- A runway friction coefficient lower than assumed in computations.
- An error in gross weight calculation.
- Runway line up not considered.

When the aircraft speed is at or above 100 knots, it may become hazardous to reject a takeoff. Therefore, when the aircraft speed approaches V1, the Captain should be "Go-minded" if none of the main failures quoted below ("Above 100 knots and below V1") have occured.

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/caution 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. At these speeds the Captain should be "go-minded" and very few situations should lead to the decision to reject the takeoff :
  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.
R 4. Any red ECAM warning.
R 5. Any amber ECAM caution listed below :
R · F/CTL SIDESTICK FAULT
R · ENG FAIL
R · ENG REVERSER FAULT
R · ENG REVERSE UNLOCKED
R Exceeding the EGT red line or nose gear vibration should not
R result in the decision to reject takeoff 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
– CALL . . . . "STOP" Simultaneously : – THRUST LEVERS . . . . IDLE – REVERSE THRUST . . . . MAX AVAIL.	– BRAKE RESPONSE . . . . . MONITOR – REVERSE . . . . CONFIRM – ANY AUDIO . . . . CANCEL
Aircraft stopped Consider positioning the aircraft to keep any possible fire away from the fuselage. – REVERSE . . . . STOWED – PARKING BRAKE . . . . APPLY *Set parking brake ON after aircraft stops.* – PA call . "ATTENTION CREW!AT STATIONS" – CALL . . . . "ECAM ACTIONS"	 – ATC . . . . INFORM – EMER EVAC checklist . . . . LOCATE – ECAM ACTIONS . . . . INITIATE
The aircraft should remain stationary while the crew evaluates the situation.	
Evacuation phase If required, refer to the EMERGENCY 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

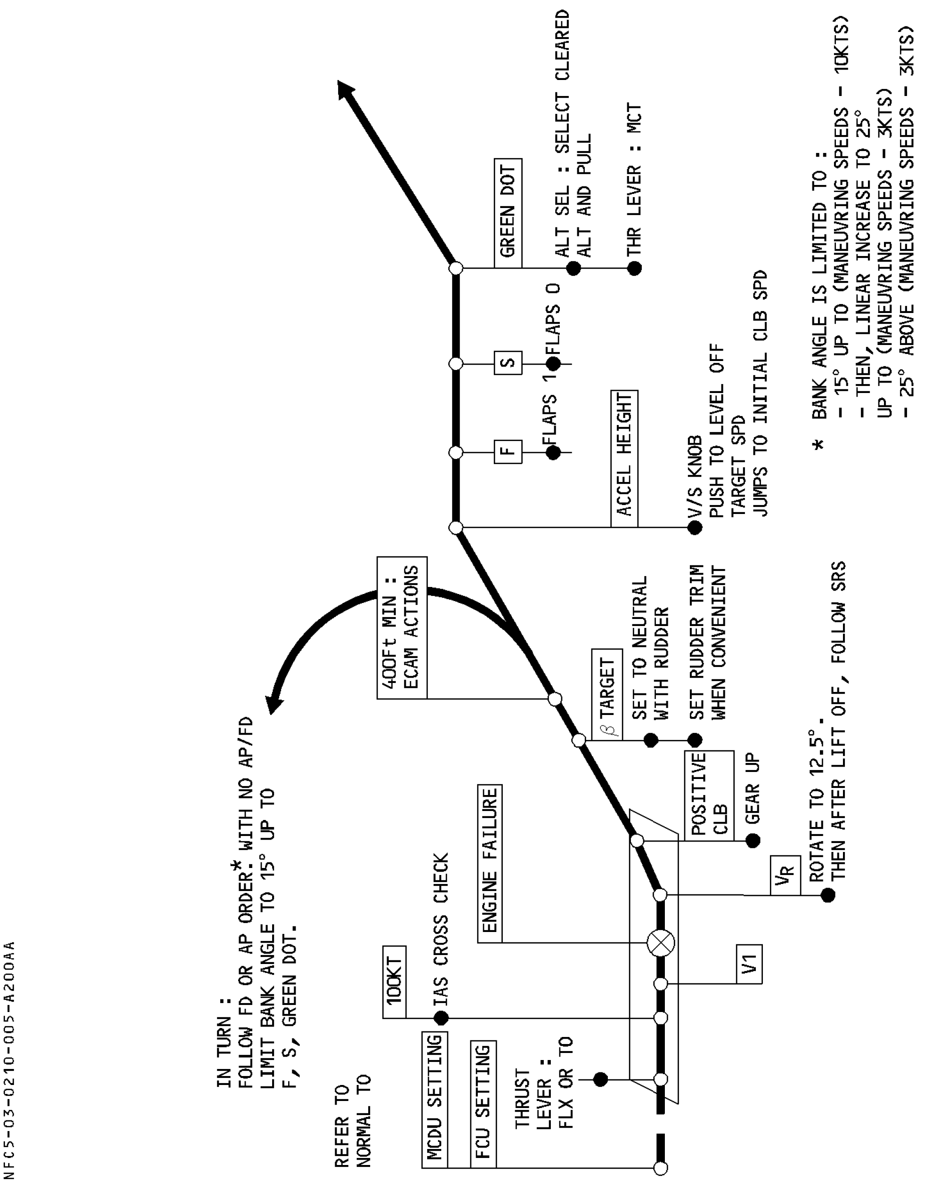
- If an engine fails after the aircraft passes V1, the takeoff must be continued.
- Use rudder conventionally to stay on the runway centerline.
- At VR, rotate the aircraft smoothly using a continuous pitch rate to a pitch attitude of 12.5 degrees. After lift-off, follow the Speed Reference System (SRS).
- 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.

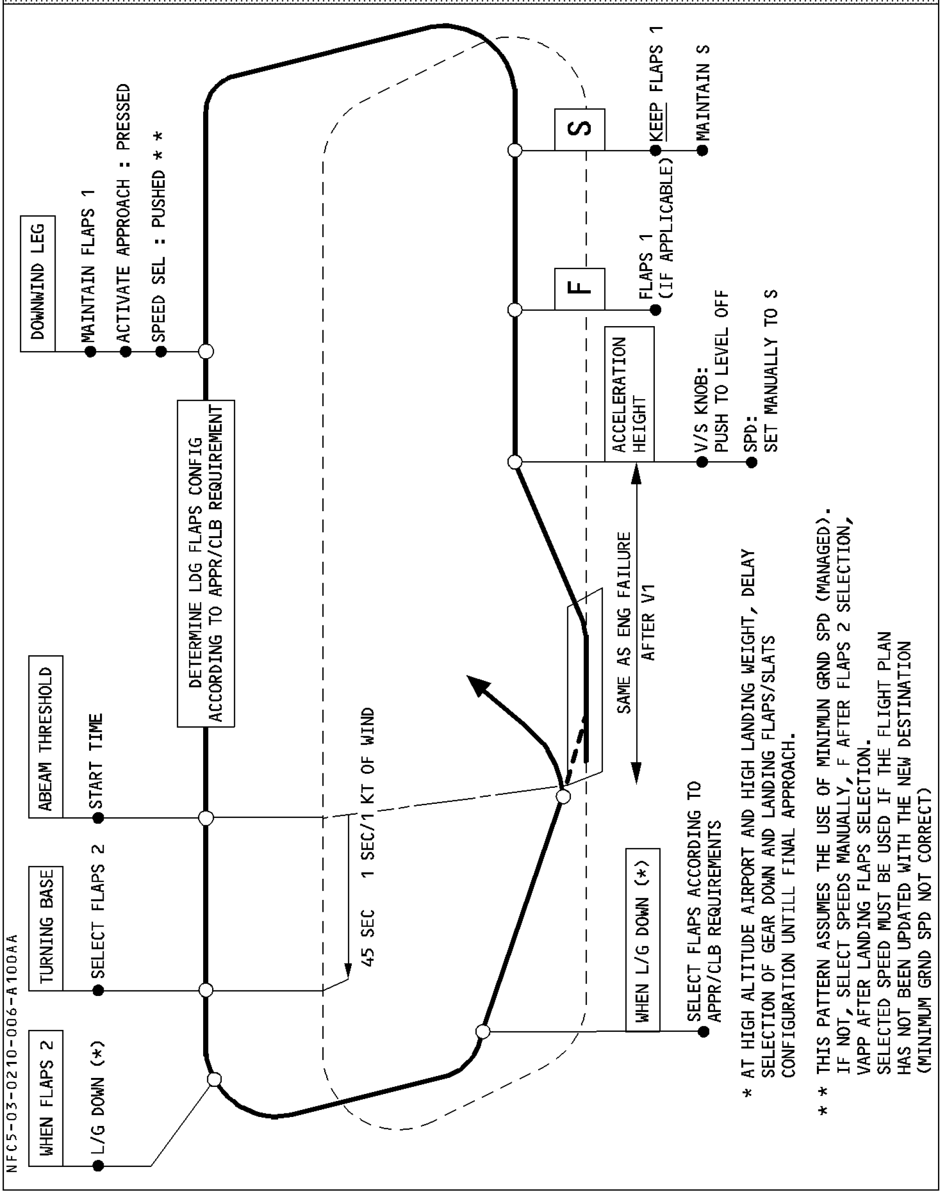
ENG FAILURE AFTER V1 – CONTINUED TAKEOFF (CONT'D)

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



R

IMMEDIATE VMC LDG FOLLOWING ENG FAILURE ON TO



STRAIGHT-IN APPROACH WITH ONE ENGINE INOPERATIVE

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

R ## CIRCLING APPROACH WITH ONE ENGINE INOPERATIVE

R – LANDING WEIGHT . . . . CHECK
R ● **If the aircraft weight is above the maximum weight for**
R **circling in CONF 3 (given in the table below) :**
R *The aircraft cannot maintain flight level with CONF 3 and the landing gear down.*
R – FOR LDG . . . . USE FLAP 3
R *Conf 3 is preferred, to minimize a configuration change in short final.*
R – GPWS LDG FLAP 3 . . . . ON
R – Delay gear extension.
R *Note : – If the approach is flown at less than 750 feet RA, the "L/G NOT DOWN"*
R *warning will be triggered. The pilot can cancel the aural warning by pressing*
R *the EMER CANC pushbutton, located on the ECAM control panel.*
R *– A "TOO LOW GEAR" warning is to be expected, if the landing gear is not*
R *downlocked at 500 feet RA.*

MAXIMUM WEIGHT FOR CIRCLING IN CONF 3 (1000 KG)

OAT (°C)	AIRPORT ELEVATION (feet)							
	0	2000	4000	6000	8000	10000	12000	14000
0	77.0	76.0	69.0	63.0	58.0	53.0	48.0	45.0
5	77.0	76.0	69.0	63.0	58.0	53.0	48.0	45.0
10	77.0	76.0	69.0	63.0	58.0	53.0	48.0	45.0
15	77.0	76.0	69.0	63.0	58.0	53.0	48.0	45.0
20	77.0	76.0	69.0	63.0	58.0	53.0	48.0	45.0
25	77.0	75.0	69.0	63.0	58.0	53.0	48.0	45.0
30	77.0	72.0	68.0	63.0	58.0	53.0	48.0	
35	74.0	70.0	66.0	63.0	56.0	51.0		
40	71.0	67.0	63.0	59.0				
45	69.0	65.0	61.0					
50	67.0	63.0						
55	64.0							

LANDING WITH SLATS OR FLAPS JAMMED

– LANDING CONF . . . . CONF 3

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

– SPEED SEL . . . . VFE NEXT – 5 KT

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

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

As speed reduces through VFE NEXT :

– FLAPS LEVER . . . . ONE STEP DOWN

● **When landing configuration is established :**

– DECELERATE TO CALCULATED APPROACH SPEED IN FINAL APPROACH

FOR GO AROUND

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

■ **IF SLATS FAULT :**

● **FOR CIRCUIT :**

– MAINTAIN SLATS/FLAPS CONFIGURATION

– Recommended speed : MAX SPEED – 10 KT

R ● **FOR DIVERSION**

R – SELECT CLEAN CONFIGURATION

R *Recommended flaps retraction speed is between MAX SPEED – 10 knots and*
R *MAX SPEED.*

R – Recommended diversion speed : MAX SPEED – 10 KT.

LANDING WITH SLATS OR FLAPS JAMMED (CONT'D)

■ IF FLAPS FAULT :

- **FOR CIRCUIT :**
  - MAINTAIN SLATS/FLAPS CONFIGURATION
  - Recommended speed : MAX SPEED – 10 KT
- **FOR DIVERSION :**
  - **If FLAPS jammed at 0**
    - SELECT CLEAN CONFIGURATION

      Note : Recommended speed for slats retraction is between MAX SPEED – 10 KT and MAX SPEED of actual slat/flap position.
    - Normal operating speeds
  - **If FLAPS jammed > 0**
    - MAINTAIN SLAT/FLAP CONFIGURATION
    - Recommended speed for diversion : MAX SPEED – 10 KT

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

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

CAUTION

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

AIR PACK 1(2) OVHT

– PACK (affected) .... OFF

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

● **WHEN PACK OVHT OUT :**

– PACK (affected) .... ON

STATUS

● **WHEN PACK OVHT OUT :**

– PACK (affected) .... ON

INOP SYS

● **If pack not recovered :**

INOP SYS
PACK 1(2)

AIR PACK 1(2) FAULT

– PACK (affected) .... OFF

STATUS

R ■ **If ACSC 1 failed**
R CKPT AT FIXED TEMP
R
R

INOP SYS
PACK 1
COND CTL 1
FWD CRG HEAT◁

R ■ **If ACSC 2 failed**
R CAB AT FIXED TEMP
R

INOP SYS
PACK 2
COND CTL 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 .... 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

– CKPT AT FIXED TEMP

– CAB AT FIXED TEMP

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

● **WHEN PACK OVHT OUT** :

– PACK (affected) .... ON

INOP SYS

PACK 1 + 2
COND CTL 1
COND CTL 2
FWD CRG HEAT◁

AIR PACK 1(2) REGUL FAULT

Crew awareness.

The temperature regulation performance is degraded.

STATUS

■ **In case of By Pass Valve or RAM Air Inlet failure**	INOP SYS PACK 1(2) REGUL
■ **In case of Flow Control Valve in backup mode :**	INOP SYS HOT AIR

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 the system is not recovered :**

CAB TEMP BY PACK ONLY

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

INOP SYS

HOT AIR

COND AFT CARGO DUCT OVHT

● **WHEN DUCT TEMP < 70 DEG C :**

– HOT AIR (on CARGO HEAT panel) . . . . OFF THEN ON

Hot air pressure regulating valve reopens.

STATUS

R INOP SYS

AFT CRG HEAT

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)
R *Basic temperature regulation by packs only (remains automatic).*

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

COND TRIM AIR SYS FAULT

■ **One trim valve failed :**

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

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

TRIM AIR HI PR

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

COND AFT CRG ISOL VALVE

Crew awareness.

STATUS

INOP SYS
AFT CRG HEAT
AFT CRG VENT

COND AFT CRG HEAT FAULT

Crew awareness.

STATUS

INOP SYS
AFT CRG HEAT

AIR AFT CRG VENT FAULT

Crew awareness.
Failure of ventilation fan.

STATUS

INOP SYS
R AFT CRG HEAT
AFT CRG VENT

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, from the cabin, is lost.
In addition, lavatory smoke detection system is inoperative.

STATUS

■ **If ACSC 2 is operative :**

CAB TEMP CKPT CTL ONLY

– *To adjust the cabin zone temperature, use the FWD CABIN and AFT CABIN zone temperature selectors (overhead panel). The selectors control the cabin duct temperature directly.*
– *Cockpit temperature regulation is normal.*

INOP SYS
GALLEY FAN
LAV DET

■ **If ACSC 2 is inoperative :**

CAB AT FIXED TEMP

– *FWD CABIN and AFT CABIN zone temperature selectors are inoperative.*
– *To adjust the cabin zone temperature, use the COCKPIT zone temperature selector (overhead panel). Cabin duct temperature is the same as cockpit duct temperature.*
– *Cockpit temperature regulation is normal.*

INOP SYS
GALLEY FAN
LAV DET
PACK 2
COND CTL 2

TOO HOT/COLD COCKPIT AND CABIN TEMP IN FLIGHT

Apply the procedure if the cockpit and cabin temperature becomes too hot or too cold with the temperature selector at its max cold or hot selection :

– PACKS OUTLET TEMP (ON ECAM BLEED PAGE) . . . . CHECK

■ **IF DIFFERENCE BETWEEN BOTH PACKS IS BELOW 10°C:**

– AIR COND HOT AIR switch . . . . OFF

A difference between both packs lower than 10°C may reflect a mixer temperature sensor failure. Switching OFF the HOT AIR results in the use of the duct temperature sensors only and no longer in the use of the mixer temperature sensors. A normal cabin and cockpit temperature will be recovered.

■ **IF DIFFERENCE BETWEEN BOTH PACKS IS AT OR ABOVE 10°C:**

– PACK (WITH THE HIGHEST OUTLET TEMP) . . . . OFF

A difference between both packs of 10°C or greater than 10°C may reflect a contamination of packs resulting in too hot cabin and cockpit air temperature. The situation may be alleviated by switching OFF the pack discharging the hottest air.

CAB PR EXCESS CAB ALT

R *Rely on the CAB PR EXCESS CAB ALT warning even if not confirmed on the CAB PRESS*
R *page. The warning can be triggered by a cabin pressure sensor different from the one used*
R *to control the pressure and display the cabin altitude on the SD.*

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

It is recommended 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 (◁).

CAB PR EXCESS CAB ALT (CONT'D)

– DESCENT . . . . INITIATE

EMER DESCENT FL 100/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. However, if structural damage is suspected use the flight controls with care and reduce speed as appropriate. Landing gear may be extended below 25 000 feet. In this case, 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 the oxygen diluter selector to the N position.

With the oxygen diluter left to 100%, oxygen quantity may not be sufficient for the entire descent profile.

Ensure that the flight crew can communicate wearing oxygen masks. Avoid the continuous use of the interphone position to minimize the interference from the noise of the oxygen mask.

● **IF CAB ALT > 14 000 FT :**

– PAX OXY MASKS . . . . MAN ON

R *Contact the cabin crew to confirm that the passenger oxygen masks are released.*

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 outlfow 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 △P to 8.6 psi.*

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 :
– MAN V/S CTL .... FULL UP

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

INOP SYS
CAB PR 1 + 2

R # CABIN OVERPRESSURE

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

– PACK 1 or 2 . . . . OFF
– BLOWER + EXTRACT . . . . OVRD
  Cabin air is extracted overboard
– △P . . . . FREQUENTLY MONITOR

● **If △P > 9 PSI**
  – PACK 1 + 2 . . . . OFF
  LAND ASAP

Before 10 minutes from landing :
– PACK 1 + 2 . . . . OFF
– BLOWER + EXTRACT . . . . AUTO

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

CAB PR LO DIFF PR

– EXPECT HI CAB RATE
– A/C V/S . . . . REDUCE
This line is not displayed in case of Emergency Descent due to Excessive Cabin Altitude.

CAB PR OFV 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 . . . . OFF
  – PACK 2 . . . . OFF

CAB PR EXCESS RESIDUAL PR

– PACK 1 . . . . OFF
– PACK 2 . . . . OFF
– CABIN CREW . . . . ALERT

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 safety valve has opened due to cabin overpressure, or negative differential pressure.

■ **IF DIFF PR ABV 8 PSI :**

- MODE SEL .... MAN
- MAN V/S CTL .... AS RQRD

  If overpressure is confirmed, reduce cabin △P.
  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

■ **IF DIFF PR BELOW 0 PSI :**

- EXPECT HI CAB RATE
- A/C V/S .... 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 :**

- MAN V/S CTL .... FULL UP

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

VENT BLOWER FAULT

- **If NO DC ESS BUS FAULT**
  - – BLOWER . . . . OVRD

    The ventilation system is in closed circuit configuration, and air from the air conditioning is added to the ventilation air.
- **If DC ESS BUS FAULT**

  LAND ASAP

STATUS

- **If DC ESS BUS FAULT**

  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 outlfow valve position.

STATUS

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

INOP SYS
AVNCS VALVE

VENT AVNCS SYS FAULT

Crew awareness.

Triggered when the AEVC is not supplied, or when the 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.

R
AIR COND CTL 1(2) - A(B) FAULT

Crew awareness

R *Informs pilots of which air conditioning system controller (1 or 2) lane (A or B) is faulty.*

STATUS

INOP SYS
R COND CTL
1(2)-A(B)

VENT GND COOL FAULT

– GND COOL . . . . OFF

Note : If the warning remains after GND COOL switching at OFF, MMEL entry is required.

STATUS

INOP SYS
GND COOL

AUTO FLT YAW DAMPER 1(2)

Crew awareness.

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 . . . . OFF THEN ON
– FAC 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 is limited, due to the loss of high-speed protections.

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

Refer to the QRH Part 2, or to the FCOM 3.02.80.

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).

INOP SYS

F/CTL PROT
YAW DAMPER
AP 1 + 2
CAT 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 .... OFF THEN ON
– FAC 2 .... OFF THEN ON

STATUS

INOP SYS
RUD TRIM
AP 1 + 2
CAT 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, to prevent damage to the aircraft structure, use the rudder with care, when the speed is greater than 160 knots.
At slats' extension, full rudder travel authority can be recovered.

– FAC 1 . . . . OFF THEN ON
– FAC 2 . . . . OFF THEN ON

● **AT LDG ROLL** :
  – DIFF BRAKING . . . . AS RQRD

STATUS

RUD WITH CARE ABV 160 KT

● **AT LDG ROLL** :
  – DIFF BRAKING : . . . . AS RQRD

CAT 3 SINGLE ONLY

Note : An autoland must not be performed with a crosswind greater than 12 knots.

INOP SYS
RUD TRV LIM
CAT 3 DUAL

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

Characteristic speeds, displayed on the two PFDs, are computed by the same FAC.

CAT 3 SINGLE ONLY

INOP SYS

CAT 3 DUAL

FAC 1(2)

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, to prevent damage to the aircraft structure, use the rudder with care, when the speed is above 160 knots.

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

– FAC 1 .... OFF THEN ON
– FAC 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
Refer to the QRH Part 2, or to the FCOM 3.02.80
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).

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

AUTO FLT FCU 1 + 2 FAULT

– PFD BARO REF : STD ONLY

If both FCU channels fail, the barometric reference on the PFD automatically changes to 1013 hPa. Use the standby altimeter, and set it to the actual barometric setting.
Do not insert the MDA (MDH) value on the MCDU PERF APPR page (because the PFD altitude is referenced to STD, and not to the correct barometric value).
The PNF must then perform the standard callouts ("HUNDRED ABOVE" and "MINIMUM"), using the STBY altimeter.
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 the PFD :*
  - *The altitude alert is inoperative*
  - *The ILS deviation scales are displayed*
  - *The flight path vector is displayed*
  - *The Mach indication is inoperative*
  - *The FMA is lost, except in LAND or GA mode.*
- *On the ND :*
  - *The ROSE NAV mode with map (80 NM range) is displayed*
  - *VOR/ADF needles :*
    Needle 1 relates to VOR1 only
    Needle 2 relates 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. Disregard the image, if it remains displayed. In all cases, the red "WXR RNG" message appears.*

STATUS

PFD BARO REF : STD 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)
GPWS TERR
CAT 2 (if not LAND or GA)

AUTO FLT FCU 1 (2) FAULT

– BARO REF .... X CHECK
One FCU channel is lost : Crosscheck barometric reference settings on the FCU and PFDs.

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

INOP SYS
(affected) AP
CAT 2 (if both AP lost)

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. If the A/THR is failed, the flight crew may recover it by engaging the other AP, and then trying to re-engage the A/THR.

Note : It the A/THR is recovered with AP 2, A/THR will be lost again at AP 2 disengagement.

– 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.

AUTO FLT REAC W/S DET FAULT

Crew awareness.

STATUS

INOP SYS
REAC W/S DET

Note : On ground, this warning may appear spuriously. This warning is cancelled 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's
R *energy goes below a threshold under which the thrust must be increased.*
R – "SPEED SPEED SPEED"
R *Increase the thrust until the warning stops and, depending on the circumstances, adjust the*
R *pitch accordingly.*

LOSS OF FMS DATA IN DESCENT/APPROACH (SEVERE RESET)

AP/FD lateral and vertical selected modes, and A/THR, are available immediately after the reset. If necessary, the pilot may perform the FCU selections for short-term navigation.
When the FMS has automatically recovered :
– The database cycle may have changed
– The FMGS does not autotune the ILS and ADF
– The FMS position bias is lost
– Lateral and vertical managed modes cannot re-engage
– The "CAB PR LDG ELEV FAULT" message is displayed on the ECAM
– A "MAP NOT AVAIL" message may be displayed on one ND.
With respect to the Auto Flight System, and depending on when the flight plan is lost, the following two procedures list the actions to be performed, in their order of priority :

■ INITIAL APPROACH OR CLOSE TO ILS INTERCEPTION

● **When the system has recovered :**
- Access the RAD NAV page, and manually tune the ILS (preferably using Ident). Enter the ILS course, if a frequency has been entered.
- Fly in selected speed.

Note : – LOC and G/S guidance modes are available.
– VLS speed is still available and displayed on the PFD.
– Missed approach trajectory is not available.

■ DESCENT or TERMINAL AREA

● **When the system has recovered :**
- Select the initial database
- Perform DIR TO a downpath waypoint. Select heading, if required.
- Perform a LAT REV at the downpath waypoint and redefine the DESTINATION in the NEW DEST field.
- Redefine the arrival and/or the approach procedure.
- Select the FUEL PRED page, and enter the GW.
- Activate the APPROACH phase.

Enter destination data on the PERF APPR page, as required.
Managed speed is available.

COM CIDS 1 + 2 FAULT

Crew awareness.

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

STATUS

INOP SYS

CIDS

◁ COM VHF 1(2)(3)/HF 1(2) EMITTING

1. *If any Push To Talk (PTT) transmission selector (sidestick radio selector, hand mike selector, or PTT switch ◁) is jammed in the transmit position, try to release it in order to remove the caution.*
R 2. *If unsuccessful, deselect the identified failed VHF/HF transmission keys on the associated*
R *Audio Control Panel (ACP) to remove the caution. This ACP should only be used in*
R *reception mode. The associated PTT transmission selectors must not be used.*

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

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

◁ COM ACARS FAULT

Crew awareness.

STATUS

INOP SYS

ACARS

◁ COM SATCOM FAULT

Crew awareness.

ACARS ◁ and telephone communications are inoperative.

STATUS

INOP SYS

SATCOM

COM SATCOM DATA FAULT

Crew awareness.

STATUS

INOP SYS

SATCOM DATA

COM VHF 3 DATA FAULT

Crew awareness.

STATUS

INOP SYS

VHF3 DATA

COM HF 1(2) DATA FAULT

Crew awareness.

Triggered to indicate the loss of the HFs' DATA mode.

STATUS

INOP SYS

HF 1(2) DATA

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 the affected GEN ON, with the applicable pushbutton.

STATUS

CAT 3 SINGLE ONLY

INOP SYS

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

ELEC APU GEN FAULT

– APU GEN . . . . OFF THEN ON

● **IF UNSUCCESSFUL :**

– APU GEN . . . . OFF

STATUS

INOP SYS

MAIN GALLEY
(when only one
gen operating)
APU GEN

ELEC BAT 1(2) FAULT

Crew awareness

Battery contactor is opened automatically by battery charge limiter.

STATUS

APU BAT START NOT AVAIL

INOP SYS

BAT 1(2)

ELEC BAT 1(2) OFF

Crew awareness

Battery is abnormally selected off.

STATUS

APU BAT START NOT AVAIL

ELEC BCL 1(2) FAULT

Crew awareness

STATUS

APU BAT START NOT AVAIL

INOP SYS

BCL 1(2)

ELEC AC BUS 1 FAULT

AC BUS 1 normally supplies the AC ESS BUS, and, via the TR1, the DC ESS BUS.
In the case of an AC BUS 1 FAULT, the AC ESS BUS and the DC ESS BUS will automatically recover, due to the fact that the AC BUS 2 will automatically supply the AC ESS BUS.
If AC BUS 2 does not automatically supply the AC ESS BUS, the flight crew can recover the AC ESS BUS and the DC ESS BUS by setting the AC ESS FEED pushbutton to ALTN, as requested by the AC ESS BUS FAULT ECAM procedure.

– 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
– LDG DIST PROC . . . . APPLY *Refer to the QRH Part 2, or to the FCOM 3.02.80.* SLATS SLOW CAT 2 ONLY	INOP SYS See below

INOP SYS displayed on ECAM

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

Other inoperative systems

Left cabin fan	Engine 1 ignition B	COND controller lane A
Radar 1	EVMU eng 1 and eng 2	Hydraulic quantity indication
Stby Pitot/AOA		Partial galley
ATSU	Printer	PVI
Brake fans 5, 6, 7 and 8 ◁		TCAS
HUD ◁		
MCDU 3 ◁		

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

INOP SYS
See below

INOP SYS displayed on ECAM

ADR 2	CTR TK PUMP 2	RUD TRV LIM 2
ILS 2	LGCIU 2	BRK SYS 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	DMC 2
R WNDW HEAT	MAIN GALLEY	RECORDER SYS
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 sub BUS failure. 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

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		ENG 1 + 2 IGN A

Other inoperative systems

RMP's lighting (RMP's still operative)	ECAM upper display	DDRMI
VOR 1	CAPT PFD	
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. As a result, 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	APU fuel pump
CAPT ND	DME 1	Passenger oxygen masks (auto + manual)
CAPT AOA heat	CVR	HF 1
R ADF 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 FAULT

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

Avionic ventilation air is supplied to the air conditioning, and exhausted overboard.

Affected systems
* AVNCS VENT
* FUEL

STATUS

R CAT 3 SINGLE ONLY

INOP SYS
See below

INOP SYS displayed on ECAM

ACP 3	CTR TK PUMP 1	BRAKES SYS 1
CAPT STAT heat	AVNCS VENT	LAV DET
R STBY STAT heat	GALLEY FAN	CAT 3 DUAL
L. WSHLD HEAT	GND COOL ◁	
L. WNDW HEAT	REVERSER 1	

Other inoperative systems

Left cab fan	VHF 3 ◁	Eng 1 oil press and qty ind.
COND controller lane A	RMP 3 ◁	TPIS ◁
Sel cal	Hot air	Brake temps ind.
CFDIU	Capt wiper	

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 BUS 2 FAULT

- AIR DATA SWTG F/O3
- 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

Refer to the QRH Part 2, or to the FCOM 3.02.80.

ENG 2 APPR IDLE ONLY
BOTH PFD ON SAME FAC
SLATS/FLAPS SLOW
CAT 3 SINGLE ONLY

INOP SYS
See below

INOP SYS displayed on ECAM

SPLR 1+2+5	CAT 3 DUAL	MAIN GALLEY
ELAC 2 (a)	FAC 2	Y ELEC PUMP (if selected ON)
SEC 2 + 3	L TK PUMP 2	BRAKES SYS 2
VHF 2	R TK PUMP 2	F/O STAT
CTR TK PUMP 2	ENG 1 LOOP B	R WSLHD HEAT
LGCIU 2	ENG 2 LOOP A	R WNDW HEAT
REVERSER 2	AP 2	CAB PR 2
FCDC 2	FCU 2	

Other inoperative systems

SFCC 2	BMC 2	Brake fan ◁
R cabin fan	Bleed X feed auto control	Eng 2 oil low press and qty ind
F/O wiper	RMP 2	R loudspeaker
F/O rain rplnt	FQI channel 2	rudder trim ind
Eng 1 and 2 fire ext btl 2	Autobrake (due to loss of 2 SECs)	CIDS 2 SMOKE DETECT
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
ACP 1 and 2 are lost. Therefore, set the AUDIO SWTG selector to CAPT 3 or F/O 3 to recover communications.
– BARO REF . . . . CHECK
Crosscheck the barometer reference settings on the FCU and the PFD.
– GPWS . . . . OFF

NAV GPWS FAULT

R – GPWS . . . . OFF

Note : To shut down the engines on ground, use the ENG FIRE pushbutton.

Affected systems
* CAB PRESS
* HYD
* F/CTL

ELEC DC ESS BUS FAULT (CONT'D)

STATUS

LDG DIST PROC .... APPLY	INOP SYS
Refer to the QRH Part 2, or to the FCOM 3.02.80.	See below
ENG 1 APPR IDLE ONLY	
ENG 2 APPR IDLE ONLY	
BOTH PFD ON SAME FAC	
SLATS/FLAPS SLOW	
CAT 2 ONLY (1)	

INOP SYS displayed on ECAM

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

Other inoperative systems

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

Note : 1. *Before arming the approach mode, the ECAM STATUS displays "CAT 3 SINGLE". However, the real landing capability is CAT 2, and is correctly displayed on the FMA when the approach mode is armed.*
2. *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 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
CAT 3 SINGLE ONLY

INOP SYS

WING A. ICE
AP 1
CAT 3 DUAL
FAC 1
VENT EXTRACT
AFT CRG HEAT◁
FWD CRG HEAT◁
AFT CRG VENT◁
FWD CRG VENT◁
FCDC 1
See below

OTHER INOP SYS

Cabin oxygen mask (auto drop out)	STBY ALTI vib	BMC 1
R X BLEED valve man ctl		CIDS 1 SMOKE DETECT
FQ1 channel 1	FMGC 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 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
Refer to the QRH Part 2, or to the FCOM 3.02.80.
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

	INOP SYS
APU BAT START NOT AVAIL	See below
R *Note : The APU battery start can be recovered by setting the*	
R *APU MASTER SW to ON.*	
CAB AT FIXED TEMP	
SLATS/FLAPS SLOW	
R CAT 3 SINGLE ONLY	

INOP SYS displayed on ECAM

R SPLR 1 + 2 + 5	CAT 3 DUAL	GND COOL ◁
ELAC 2 (a)	FAC 2	MAIN GALLEY
SEC 2 + 3		Y ELEC PUMP
VHF 2	ANTI SKID	BRAKES SYS 1
ACP 3	N.W. STEER	BRAKES SYS 2
CAPT STAT heat	LGCIU 2	APU FIRE DET
F/O STAT heat	REV 1 + 2	LAV DET
STBY STAT heat	CAB PRESS 2	ENG 1 LOOP B
WSHLD HEAT	AVNCS VENT	ENG 2 LOOP A
WNDW HEAT	L + R CAB FAN	PACK 2
AP 2	GALLEY FAN	COND CTL2
FCU 2		L TK PUMP 2
FCDC 2		R TK PUMP 2
		CTR TK PUMPS

Other inoperative systems

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

(a) Lost after 30 seconds, but is 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 EMER CONFIG

LAND ASAP

MIN RAT SPEED . . . . 140 KT

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

– GEN 1 + 2 . . . . OFF THEN ON

● **IF UNSUCCESSFUL :**

- – BUS TIE . . . . OFF

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

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

  Engines are fed by gravity only.
- R – VHF1/HF1 ◁ /ATC1/ . . . . USE

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

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

ELEC EMER CONFIG (CONT'D)

FUEL GRVTY FEED

Engines are fed by gravity only. Avoid negative Gs.

PROC : GRVTY FUEL FEEDING

Apply the GRVTY FUEL FEEDING procedure (3.02.28).

– FAC 1 . . . . OFF THEN ON

The rudder trim is recovered, although no indication is available.

– BUS TIE . . . . AUTO

R R *Setting BUS TIE pushbutton to AUTO enables the APU to take an available electrical channel.*

– 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 via 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 + 10/140 kt

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

LDG DIST PROC . . . . APPLY

Refer to the QRH Part 2, or to the FCOM 3.02.80.

ALTN LAW : PROT LOST

WHEN L/G DN : DIRECT LAW

CTR TK FUEL UNUSABLE

SLATS/FLAPS SLOW

INOP SYS

See below

INOP SYS displayed on ECAM

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

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

ELEC ESS BUSES ON BAT

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

LAND ASAP

– MIN RAT SPD .... 140 KT

Displayed, if the RAT is extended.

– EMER ELEC PWR .... MAN ON

ESS BUSES are supplied by the emergency generator.

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
	AFT CRG HEAT	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
	HF 1	Norm	Inop	Inop
	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.

R (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.

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
	ABCU	Norm	Norm	Norm
LIGHTS	EMER CKPT	Norm	Norm	Norm
	EMER CAB	Norm	Norm	Norm
NAV	IR	N°1 only (2)	N°1 only (2)	N°1 only (2)
	ADR	N°1 only	N°1 only	N°1 only
	ADF ◁	N°1 only	Inop	Inop
	VOR/MMR	N°1 only	N°1 only	N°1 only (1)
	DME	N°1 only	Inop	Inop
	VOR/DDRMI	Norm	Norm	Norm (1)
	ATC	N°1 only	Inop	Inop
	ISIS	Norm	Norm	Norm

(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

– GALY/CAB .... OFF

STATUS

INOP SYS
GALY/CAB

ELEC TR 1(2) or ESS TR FAULT

R Crew awareness.

STATUS

R CAT 3 SINGLE ONLY (if TR1 or TR2 FAULT)

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

ELEC DC BAT BUS FAULT

Crew awareness.

STATUS

APU BAT START NOT AVAIL
ECB is no longer supplied

INOP SYS
APU FIRE DET
See below

OTHER INOP SYS

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

Note : The warning may be caused by a sub BUS failure. 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

The 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 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
* HYD
* FUEL
* AIR COND
* BRAKES
* WHEEL
* F/CTL

STATUS

MIN RAT SPEED . . . . 140 KT
PROC : GRVTY FUEL FEEDING
MAX BRK PR . . . . 1000 PSI
FUEL GRVTY FEED
LDG DIST PROC . . . . APPLY
Refer to the QRH Part 2, or to the FCOM 3.02.80.
ENG 1 APPR IDLE ONLY
ENG 2 APPR IDLE ONLY

ELEC DC EMER CONFIG (CONT'D)

STATUS

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

ELEC DC EMER CONFIG (CONT'D)

STATUS

INOP SYS
See below

INOP SYS displayed on ECAM

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
ANTI SKID	ACP 3	N.W. STEER
Y ELEC PUMP	CAPT STAT	LGCIU 2
BRAKES SYS 1	F/O STAT	REVERSER 2
BRAKES SYS 2	STBY STAT	CAB PRESS 2
APU FIRE DET	WSHLD HEAT	AVNCS VENT
LAV DET	WNDW HEAT	VENT BLOWER
ENG 1 LOOP B	PACK 1	ENG 2 LOOP A
L+R CAB FAN	PACK 2	AP2
FCDC 2	COND CTL 1	COND CTL 2

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

ELEC STAT INV FAULT

Crew awareness.

ELEC EMER GEN 1 LINE OFF

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

Crew awareness.

Set the GEN 1 LINE pushbutton to ON.

C/B TRIPPED

R Crew awareness.

R *If one green circuit breaker (C/B) is tripped, one of the following messages appears after one*
R *minute, depending on the location of the affected C/B :*

C/B TRIPPED ON OVHD PNL
C/B TRIPPED ON L(R) ELEC BAY
C/B TRIPPED REAR PNL J-M or N-R or S-V or W-Z

R *Note : Do not reengage a C/B that has tripped by itself, unless the Captain judges it*
R *necessary to do so for the safe continuation of the flight. This procedure should be*
R *adopted only as a last resort, and only one reengagement should be attempted.*
R *On ground, do not reengage the C/B of the fuel pump(s) of any tank. For all other*
R *C/Bs, if the flight crew coordinates the action with maintenance, the flight crew may*
R *reengage a tripped C/B, provided that the cause of the tripped C/B is identified.*

COCKPIT DOOR FAULT

This procedure should be applied, if the Cockpit Door Locking System (CDLS) fails. This failure is indicated when the FAULT light on the center pedestal's COCKPIT DOOR panel comes on.
In the case of a DC BUS 2 fault, no FAULT indication appears on the center pedestal's COCKPIT DOOR panel. The CDLS is not electrically-supplied, and is inoperative.

– CKPT DOOR CONT panel . . . . CHECK
This panel is located on the overhead panel. It is used to identify the faulty CDLS item, and to verify the status of the pressure sensors and the three electrical latches (referred to as strikes).

● **If two or more electrical latches (strikes) are faulty :**
The cockpit door is not intrusion-proof.
The system may be recovered by performing the following steps:
– Cockpit door . . . . OPEN
– COCKPIT DOOR toggle switch . . . . SET to UNLOCK
After 10 seconds :
– COCKPIT DOOR toggle switch . . . . SET to NORM

● **If two pressure sensors are faulty :**
Automatic latch release is not available, in case of cockpit decompression.

● **If no LED on the CKPT DOOR CONT panel is on :**
The CDLS control unit is faulty, therefore, the cockpit door might unlock automatically. If it does not, consider using the mechanical override system to unlock the door.

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

No crew action required in flight.

STATUS

INOP SYS

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

ENG 1(2)/APU FIRE DET FAULT

Loss of both fire detection loops.

Crew awareness.

STATUS

INOP SYS

FIRE DET 1(2)
or APU FIRE DET

ENG 1(2) FIRE (on ground)

- THR LEVERS . . . . IDLE

  Full reverse may be used to stop the aircraft.

● **WHEN A/C IS STOPPED :**

- PARKING BRK . . . . ON
- 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
- 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.
- AGENT 1 + 2 . . . . DISCH
- EMER EVAC PROC . . . . APPLY

  Refer to the EMERGENCY EVACUATION procedure in FCOM 3.02.80 or in QRH 7.00

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 AFTER 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 AFTER 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/FUMES/AVNCS SMOKE

This paper procedure includes all the steps of the AVIONICS SMOKE ECAM procedure.
Apply this paper procedure when :
- *The flight (cabin) crew suspect that smoke is coming from the avionics, and/or the air conditioning, and/or the cabin equipment.*
- *Requested by the AVIONICS SMOKE ECAM procedure.*
- *There is a smell of smoke/fumes in the cockpit :*
  - *If the smell is similar to that of orange peels, suspect a toxic leak of rain repellent fluid.*
  - *If the smell is similar to that of pine needles, suspect a non-toxic leak.*

If any other ECAM SMOKE alert triggers (CARGO, ...), the crew must first apply the ECAM procedure, then consider applying this paper procedure.
Note that these ECAM alerts may be caused by another source, that should usually first be detected by the flight crew/cabin crew/avionics smoke detectors.
The following explains the layout of this paper procedure :
- *The procedure lines above the text boxes indicate the actions that the flight crew must immediately perform, if smoke is detected (with or without ECAM activation and regardless of the smoke source). These immediate actions correspond to the most common steps to be taken in smoke cases. In all cases, the flight crew must also be prepared to immediately perform a diversion. However, this diversion may be avoided if the smoke source is obvious, accessible and extinguishable or confirmed isolated (after completion of the immediate actions).*
- *The text boxes indicate the actions that the flight crew must consider, if at any time during the remainder of the procedure but always after the initial steps :*
  - *Smoke/fumes become the greatest threat and smoke/fumes removal is required, and/or*
  - *The situation becomes critical and can no longer be controlled.*
- *The procedure lines below the text boxes indicate the actions that the flight crew must perform, as soon as they suspect a source of smoke. The actions will depend on whether the smoke is coming from the avionics, and/or air conditioning, and/or cabin equipment.*

LAND ASAP

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

If smoke is confirmed, the following procedure must be applied.

- BLOWER . . . . OVRD
- EXTRACT . . . . OVRD

  Avionics ventilation air is extracted overboard.
- CAB FANS . . . . OFF

  To prevent smoke from entering the cockpit and cabin.
- GALY & CAB . . . . OFF
- SIGNS . . . . ON

SMOKE/FUMES/AVNCS SMOKE (CONT'D)

– CKPT/CABIN COM . . . . ESTABLISH

Communication must be established with the cabin crew in order to follow up on the smoke origin and dissipation.

● **If required**

– 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.

● **If smoke source immediately obvious, accessible, and extinguishable :**

– FAULTY EQPT . . . . ISOLATE

● **If smoke source not immediately isolated :**

– DIVERSION . . . . INITIATE
– DESCENT (FL 100, or MEA, or minimum obstacle clearance altitude) . . . . INITIATE

R

● At ANY TIME of the remainder of the procedure, if smoke/fumes becomes the GREATEST THREAT:

- SMOKE FUMES REMOVAL...CONSIDER
- ELEC EMER CONFIG... CONSIDER
  Refer to the end of the procedure to set ELEC EMER CONFIG

● At ANY TIME of the procedure, if situation becomes critical and can no longer be controlled :

- IMMEDIATE LANDING...CONSIDER

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Guidelines to determine smoke source :

– If smoke initially comes out of the ventilation outlets, the crew may suspect AIR COND SMOKE. In addition, very shortly thereafter, several SMOKE warnings (cargo, lavatory, avionics) will be triggered. The displayed ECAM procedures must be applied.
– After an ENG or APU failure, smoke may come from the faulty item via the bleed system and be perceived in the cockpit and/or cabin. In such a case, it will be recirculated throughout the aircraft, until it completely disappears from the air conditioning system.
– If only the AVIONICS SMOKE warning is triggered, the crew may suspect avionics smoke.
– If the smoke is detected 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.

SMOKE/FUMES/AVNCS SMOKE (CONT'D)

● **IF AIR COND SMOKE SUSPECTED :**

- APU BLEED . . . . OFF
- BLOWER and EXTRACT . . . . AUTO

  Note : *When both BLOWER and EXTRACT are in the OVRD position, a single pack may not be able to maintain the cabin pressure.*
- CARGO AFT ISOL VALVE . . . . OFF

  To prevent a cargo smoke warning from being triggered due to cabin smoke.
- PACK 1 . . . . OFF

● **If smoke continues :**
- PACK 1 . . . . ON
- PACK 2 . . . . OFF

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

  Restore normal configuration if PACK 2 is not suspected to cause smoke.
- BLOWER and EXTRACT . . . . OVRD

- SMOKE/FUMES REMOVAL . . . . CONSIDER

● **IF CABIN EQUIPMENT SMOKE SUSPECTED :**

● **If smoke continues :**
- EMER EXIT LIGHT . . . . ON
- COMMERCIAL . . . . OFF
- SMOKE DISSIPATION . . . . CHECK
- FAULTY EQPT . . . . SEARCH/ISOLATE

  Once the cabin has been secured, try to find the smoke source and isolate it. Cabin lights, reading lights, passenger systems, galleys have dedicated control C/B in the cabin or cockpit.

● **If smoke still continues or if faulty equipment confirmed isolated :**
- COMMERCIAL . . . . NORM

- SMOKE/FUMES REMOVAL . . . . CONSIDER

  At any time of the procedure, considered applying the SMOKE/FUMES REMOVAL procedure.

SMOKE/FUMES/AVNCS SMOKE (CONT'D)

R ● **IF SMOKE SOURCE CANNOT BE DETERMINED AND STILL CONTINUES OR AVNCS/ELECTRICAL SMOKE SUSPECTED :**

– ELEC EMER CONFIG . . . . CONSIDER

R *As a last attempt, the flight crew can set the electrical emergency configuration to*
R *possibly isolate or minimize the smoke source.*

● **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

R *Two different procedures can be displayed on the ECAM, depending on whether the*
R *AVIONICS SMOKE ECAM caution is triggered or not before the flight crew sets the*
R *electrical emergency configuration.*

R ● **If AVIONICS SMOKE is not triggered**

R *The ECAM displays the ELEC EMER CONFIG procedure described in FCOM 3.02.24.*
R *The flight crew must apply the ECAM without performing the GEN 1+2 reset.*

R ● **BEFORE L/G EXTENSION :**

R *Restore all generators only few minutes before landing to minimize the possible*
R *reactivation of a smoke source.*

R – GEN 2 . . . . ON

R – EMER ELEC GEN 1 LINE . . . . ON

R ● **WHEN A/C IS STOPPED :**

R – ALL GEN . . . . OFF

R ● **If AVIONICS SMOKE is triggered**

R *The ECAM displays a specific ELEC EMER CONFIG procedure. The flight crew must*
R *apply the following ECAM procedure.*

SMOKE/FUMES/AVNCS SMOKE (CONT'D)

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/HF 1/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/FUMES/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**

R *Restore all generators only a few minutes before landing, to minimize possible*
R *smoke source reactivation.*

– GEN 2 . . . . ON
– EMER ELEC GEN 1 LIN . . . . ON

<u>F/CTL</u> 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/FUMES/AVNCS SMOKE (CONT'D)

STATUS

– FOR LDG . . . . USE FLAPS 3
– GPWS LDG FLAP 3 . . . . ON
APPR SPD . . . . VREF + 10 KT
LDG DIST PROC . . . . APPLY
Refer to the QRH Part 2, or to the FCOM 3.02.80
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
<u>APPR PROC</u>

- **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
  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
  Refer to the QRH Part 2, or to the FCOM 3.02.80
  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).

<u>INOP SYS</u>

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

SMOKE/FUMES REMOVAL

R *Apply the SMOKE/FUMES REMOVAL paper procedure, if smoke/fumes become the greatest*
R *threat when applying the SMOKE/FUMES/AVNICS SMOKE paper procedure.*

– EMER EXIT LIGHT . . . . ON

● **If fuel vapors :**

– CAB FANS . . . . ON

The recirculating air ventilates the air mixer bay and other fuselage area. This prevents fuel vapors from accumulating and the risk of explosion. Passenger health is not affected.

– PACK 1+2 . . . . OFF

● **If no fuel vapors :**

– 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

The most effective means of smoke removal is use of ram air. Therefore, descent is initiated to FL100, or the MEA, or the minimum obstacle clearance altitude, while the cabin altitude is increased to 10 000 feet or the 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/FUMES/AVNCS SMOKE PROC . . . . CONTINUE

While descending, continue applying the appropriate steps of the SMOKE/FUMES/AVNCS SMOKE procedure depending on the suspected smoke source.

SMOKE/FUMES REMOVAL (CONT'D)

● **At FL100, or MEA** :

R ● **If electrical emergency configuration** :

R – APU MASTER SW . . . . ON

R *In electrical emergency configuration, when the APU MASTER switch is ON, the*
R *battery contactors will automatically close for a maximum of 3 minutes. This will*
R *enable the flight crew to manually control the outflow valves that are powered by*
R *the DC BAT BUS.*

– PACKS 1 + 2 . . . . OFF

R *In electrical emergency configuration, PACK 2 isolation valve is not powered.*

– 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 △P is 1 psi or below. Opening the RAM AIR enables flying with both packs OFF.

R – APU MASTER SW . . . . OFF

● **If smoke persists, open CKPT window** :

If there is smoke in the cockpit, open the cockpit (CKPT) window to evacuate the smoke.

MAX SPEED . . . . 200 KT

– COCKPIT DOOR . . . . OPEN

– HEADSETS . . . . ON

– PNF COCKPIT WINDOW . . . . OPEN

● **When window is open** :

– NON-AFFECTED PACK(s) . . . . ON

– VISUAL WARNINGS (noisy CKPT) . . . . MONITOR

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

– SMOKE/FUMES/AVNCS SMOKE PROC . . . CONTINUE

Continue applying the appropriate steps of the SMOKE/FUMES/AVNCS SMOKE paper procedure depending on the suspected smoke source.

SMOKE FWD (AFT) CARGO SMOKE

LAND ASAP

R – AFT ISOL VALVE (if not automatically closed and AFT affected)
R .... OFF

– CAB FANS .... OFF

● **IF FWD (AFT) CRG CLOSED (displayed on ground only)**

Order the ground crew not to open the door of the affected cargo compartment, unless the passengers have disembarked and fire services are present. Also ensure that the FWD (AFT) cargo door is closed before discharging the extinguishing agent.

– AGENT .... DISCH

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.

R *Note : If the warning has been displayed temporarily, and agent has not been discharged,*
R *normal cargo ventilation may be recovered when ventilation is required for livestock*
R *transportation :*
R *C/B of CARGO VENT controller (S20 on 122VU, or C7 on 49VU, as installed) ....*
R *PULL then PUSH*

STATUS

INOP SYS
AFT CRG VENT
AFT CRG HEAT ◁
(if aft affected)

SMOKE FWD (AFT) CRG BTL (1)(2◁) FAULT

Crew awareness.

If bottle 1 is lost, fire extinguishing capability is lost in the FWD (AFT) cargo compartment.
If bottle 2 is lost, agent concentration will not be ensured after fire extinguishing.

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

R ● **IF NO LIVE STOCK :**
– AFT ISOL VALVE . . . . OFF

STATUS

INOP SYS
R SMOKE DET

SMOKE LAVATORY SMOKE

– CKPT/CAB COM . . . . ESTABLISH
Communication must be established with the cabin crew in order to follow up on the smoke origin and dissipation.
Consider applying the SMOKE/FUMES/AVNCS SMOKE paper procedure.

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	INOP SYS
– 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 . . . . APPLY *Refer to the QRH Part 2, or to the FCOM 3.02.80.* 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)	FLAPS AP 1+2 (a) A/THR (a) Moreover, both FDs are lost (a) CAT 2 (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 : If there is a SLATS FAULT after both slat channels fail, alternate law becomes active (see associated procedure).

● **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 . . . . APPLY
Refer to the QRH Part 2, or to the FCOM 3.02.80.
CTR TK FEED : MAN ONLY
● **If both slat channels fail** :
ALTN LAW : PROT LOST
WHEN L/G DN : DIRECT LAW
INCREASED FUEL CONSUMP (see page 3)

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

(a) If both slat channels fail.

R

FLAPS/SLATS FAULT/LOCKED

<table>
<tr><th colspan="6">MAX SPEED</th></tr>
<tr><th>Flaps (1)
Slats (1)</th><th>F = 0</th><th>0 < F ≤ 1</th><th>1 < F ≤ 2</th><th>2 < F ≤ 3</th><th>F > 3</th></tr>
<tr><td>S = 0</td><td>NO LIMITATION</td><td rowspan="3">215 kt</td><td rowspan="4">200 kt</td><td rowspan="4">185 kt</td><td rowspan="2">Not allowed
(177 kt)</td></tr>
<tr><td>0 < S < 1</td><td rowspan="2">230 kt</td></tr>
<tr><td>S = 1</td><td rowspan="2"></td></tr>
<tr><td>1 < S ≤ 3</td><td colspan="2">200 kt</td></tr>
<tr><td>S > 3</td><td colspan="5">177 kt</td></tr>
</table>

<table>
<tr><th colspan="6">APPR SPD</th></tr>
<tr><th>Flaps (1)
Slats (1)</th><th>F = 0</th><th>0 < F < 1</th><th>1 ≤ F < 2</th><th>2 ≤ F < 3</th><th>F ≥ 3</th></tr>
<tr><td>S = 0</td><td>VREF + 60 (Appr)
VREF + 50
(Touch Down)</td><td></td><td rowspan="2">VREF + 30</td><td rowspan="2">VREF + 25</td><td rowspan="2">(FLAPS > 3
not
allowed)
VREF + 25</td></tr>
<tr><td>0 < S < 1</td><td colspan="2">VREF + 45</td></tr>
<tr><td>1 ≤ S ≤ 3</td><td colspan="2" rowspan="2">VREF + 25</td><td rowspan="2">VREF + 15</td><td rowspan="2">VREF + 10</td><td>VREF + 10</td></tr>
<tr><td>S > 3</td><td>VREF + 5</td></tr>
</table>

(1) Slats/Flaps position displayed on the upper ECAM display.

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), 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.

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

● **If both slat channels fail :**
MAX SPEED . . . . 320 KT
ALTN LAW : PROT LOST
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 :**
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
Refer to the QRH Part 2 or, to the FCOM 3.02.80.
ENG 1 APPR IDLE ONLY (b)
ENG 2 APPR IDLE ONLY (b)

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

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

F/CTL SLAT SYS 1(2) FAULT

Crew awareness

STATUS

SLATS SLOW

F/CTL FLAP SYS 1(2) FAULT

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

STATUS

ENG 1(2) APPR IDLE ONLY
FLAPS SLOW

F/CTL SLAT (FLAP) TIP BRK FAULT

Failure of one slat or flap wingtip brake.
Crew awareness

F/CTL L (R) SIDESTICK FAULT

Crew awareness

F/CTL FLAP ATTACH SENSOR

Failure of flap attachment failure detection sensor.
Crew awareness

R ## CONFIG SLATS (FLAPS) NOT IN T.O CONFIG

R 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 cases of sidestick transducer failure, ELAC 1(2) FAULT is triggered without the procedure, and the FAULT light on the associated pushbutton does not come on.
R *2. If the ELAC 1 computer is reset on ground, the pitch trim returns to the*
R *ground setting position (0°).*

● **IF UNSUCCESSFUL :**

– ELAC (affected) . . . . OFF

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

STATUS

CAT 3 SINGLE ONLY

INOP SYS
ELAC 1(2)
CAT 3 DUAL

■ Both computers failed :

– ELAC 1 . . . . OFF THEN ON

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

– ELAC 2 . . . . OFF THEN ON

● **If both ELAC FAULT remain :**

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

F/CTL ALTN LAW

(PROT LOST)

Pitch and roll normal laws are lost : Refer to the 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
Refer to the QRH Part 2, or to the FCOM 3.02.80.
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 the DIRECT LAW procedure).

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

F/CTL ELAC 1(2) PITCH FAULT

Crew awareness
Pitch function is achieved by the other ELAC.

STATUS

CAT 3 SINGLE ONLY

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

CONFIG SPD BRK NOT RETRACTED

Crew awareness.

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

– SEC (affected) .... OFF THEN ON

● **IF UNSUCCESSFUL :**

– SEC (affected) .... OFF

Associated spoilers are lost. If SEC 1 or 2 fails, LAF is degraded (A320 with LAF only). 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 (c)

(PROT LOST) (c)

STATUS

– SPD BRK .... DO NOT USE

(If SEC 1 is affected).

– FOR LDG .... USE FLAP 3 (c)

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

LDG DIST PROC .... APPLY

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

Refer to the QRH Part 2, or to the FCOM 3.02.80.

ALTN LAW : PROT LOST (c)

R ● **If no AP engaged : (c)**

R WHEN L/G DN : DIRECT LAW (d)

R ● **If AP engaged : (c)**

R WHEN L/G DN AND AP OFF : DIRECT LAW (d)

INOP SYS

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

(a) If at least 2 SECs fail.
(b) If SEC 1 + 2 fail, reverser 1 is not available for landing.
If SEC 1 + 3 fail, reverser 2 is not available for landing.
(c) If SEC 1 + 2 + 3 fail.
R (d) If SEC 1 + 2 + 3 fail. In such a case, the LGCIU information can no
R longer be sent to the ELAC. For the activation of DIRECT law, the ELAC
R uses the condition “slats and flaps in CONF 2”, instead of “landing gear down”.

F/CTL DIRECT LAW

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

(PROT LOST)

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

MAX SPEED 320/.77

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

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

Automatic trim is inoperative in direct law.

MANEUVER WITH CARE

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
R *Refer to the QRH Part 2, or to the FCOM 3.02.80.*
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 the FCOM 3.04.27 for flight characteristics.
With the autopilot engaged, the FMGC (AP mode) controls the aircraft.

(PROT LOST)

All protections, except maneuver protections, are lost.
Depending on the failure, static stability may be introduced.
Note : In case of GPWS (EGPWS ◁) alerts, since protections are lost, respect stall warnings when applying the GPWS (EGPWS ◁) procedure.

MAX SPEED . . . . 320 KT

(320/.77, if dual hydraulic system low pressure).
Speed is limited to 320/.82 or 320/.77 for dual hydraulic failure, due to the loss of high-speed protection.

– SPD BRK (if L or R elevator fault) . . . . DO NOT USE

STATUS

MAX SPEED . . . . 320 KT
(320/.77, if dual hydraulic system low pressure).
– SPD BRK (if L or R elevator fault) . . . DO NOT USE

APPR PROC
- – FOR LDG . . . . USE FLAP 3
- – GPWS LDG FLAP 3 . . . . ON

APPR SPD . . . . VREF + 10
LDG DIST PROC . . . . APPLY
R *Refer to the QRH Part 2, or to FCOM 3.02.80.*

● **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 the DIRECT LAW procedure.

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

See the DIRECT LAW procedure.

ALTN LAW : PROT LOST

INOP SYS
F/CTL PROT

CONFIG RUD TRIM NOT IN T.O RANGE

Crew awareness.

F/CTL FCDC FAULT

■ **FCDC 1(2) FAULT :**

Crew awareness

STATUS

INOP SYS
FCDC 1(2)

■ **FCDC 1 + 2 FAULT :**

– MONITOR F/CTL OVHD PNL

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

STATUS

F/CTL INDICATIONS LOST

INOP SYS
FCDC 1 + 2

F/CTL AIL SERVO FAULT

Crew awareness
LAF is degraded (A320 only).

F/CTL L (R) AIL FAULT

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

STATUS

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

INOP SYS
L (R) AIL

F/CTL L + R ELEV FAULT

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

STATUS

MAX SPEED 320/.77
SPD BRK .... DO NOT USE
APPR PROC
– 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.
– MAN PITCH TRIM .... USE
APPR SPD .... VREF + 10
LDG DIST PROC .... APPLY
Refer to the QRH Part 2, or to the FCOM 3.02.80.
PITCH MECH BACK UP
ROLL DIRECT LAW

INOP SYS
L + R ELEV
ELAC PITCH
LAF (A320 with LAF only)
AP 1 + 2
CAT 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, due to 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 + 10 KT
LDG DIST PROC .... APPLY
Refer to the QRH part 2, or to the FCOM 3.02.80.
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.

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

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

R *Refer to the QRH Part 2, or to the FCOM 3.02.80.*

INOP SYS

GND SPLR (affected)

F/CTL SPD BRK DISAGREE

■ **Surfaces 3 + 4 affected**

Surfaces' position not in agreement with the 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 the 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 the speedbrake lever transducer(s). In addition, associated ground spoilers are only available through reverse selection.

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

Do not use speedbrakes, since it is not efficient to use only Surface n° 2, and would activate the SPD BRK DISAGREE caution.

STATUS

R – SPD BRK . . . . DO NOT USE

(if SPD BRK 3 + 4 affected)

LDG DIST PROC . . . . APPLY

R *If reversers are not used, refer to the QRH Part 2, or to the*
R *FCOM 3.02.80.*

<u>INOP SYS</u>

SPD BRK (affected)

F/CTL SIDESTICK PRIORITY

A failure is detected in the sidestick priority logic circuit.

– CHECK PRIORITY LOGIC

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

– ELAC 1 . . . . OFF THEN ON

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

– ELAC 2 . . . . OFF THEN ON

● **If the warning disappears :**

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

Check that the :

– Aural "priority left" message is activated.

– F/O red arrow light is on.

– CAPT TAKE OVER pb . . . . RELEASE

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

Check that the :

– Aural "priority right" message is activated

– CAPT red arrow light is on.

– F/O TAKE OVER pb . . . . RELEASE

– Check that the warning does not reappear.

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

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

Maintenance action is due.

F/CTL STABILIZER JAM

When the Flight Control Computers detect a loss of electrical control of the stabilizer, pitch control law reverts to alternate law. Depending on the type of failure, the MAN PITCH TRIM may still be available.

– 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

MAX SPEED . . . . 320 KT
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

Refer to the QRH Part 2, or to the FCOM 3.02.80.

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.

INOP SYS
F/CTL PROT
STABILIZER
ELAC PITCH
AP 1 + 2
CAT 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

R CAT 2 INOP

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 for LDG 15 KT
R – AUTO BRK . . . . DO NOT USE
R *Do not use the autobrake, so as not to delay the application of differential braking at*
R *landing roll.*
– FOR LDG . . . . USE NORMAL CONF
– SPEED AND TRAJECTORY . . . . STABILIZE ASAP
R – LDG DIST PROC . . . . APPLY
R *Refer to the QRH Part 2, or to the FCOM 3.02.80.*

ON GROUND

– DIFFERENTIAL BRAKING . . . . USE ASAP
Do not use asymmetric reverse thrust.
Use nosewheel steering handle below 70 knots.

F/CTL SPD BRK STILL OUT

Crew awareness.

Speedbrakes are out, with at least one engine not at idle.

R

ACTIVE CONTROL LAW

ACTIVE LAW ▶	PITCH		ROLL	YAW
SYS FAILED ▼	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 (2)
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	NO	DIRECT	ALTN
HYD Y + B	NORM	NORM	NORM	NORM
on BATTERIES	ALTN	REDUCED	DIRECT	MECH
on EMER GEN	ALTN	REDUCED	DIRECT	MECH – – – – – ALTN (3)

(1) In case of AOA disagree
(2) After the faulty IR is selected OFF
(3) After FAC 1 is reset
(4) When landing gear down (or CONF 2, if both LGCIUs faulty)
(5) Depending where the failure is, control law may revert to alternate law

ELEVATORS AND STABILIZER CONTROL AFTER FAILURE

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

R

	LEFT ELEVATOR		THS	RIGHT ELEVATOR	
	BLUE	GREEN	GREEN AND YELLOW	YELLOW	BLUE
<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	SEC2	Damped	
+ B		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	

SIDESTICK/RUDDER PEDALS STIFF

Even if the autopilot is disengaged, the sidestick and/or the rudder pedals may be stiff. This may affect either :

- *Both sidesticks (CAPT and F/O) at the same time, but not the rudder pedals, or*
- *One sidestick and the rudder pedals at the same time.*

The piloting technique remains the same : The aircraft remains responsive.

However, the flight crew should keep in mind that they may need to use extra force on the sidesticks and/or the rudder pedals.

The extra force required to move the controls out of the neutral position is moderate.

This extra force does not significantly affect the handling of the aircraft.

If sidesticks and/or rudder pedals are stiff after autopilot disengagement, apply the following procedure :

- AP DISENGAGEMENT .... CONFIRM

  Confirm autopilot disengagement by checking that either :
  - *The FMA no longer displays the AP1(2) indication, or*
  - *The AP lights on the FCU are off, or*
  - *The ECAM displays the AP1(2) OFF red message, or*
  - *The cavalry charge audio alert has triggered.*
- CONSIDER TRANSFERRING CONTROL TO PNF

  If the PNF's sidestick is not affected.

■ **FOR DECRAB, ROLLOUT, OR ENGINE FAILURE**

  - BE PREPARED TO APPLY EXTRA FORCE ON RUDDER PEDAL

    Not applicable if both sidesticks are stiff.

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 enable the center tank pumps to run.
– TK PUMP 1 (affected) . . . . OFF
– TK PUMP 2 (affected) . . . . OFF

● **WHEN TK (affected) FUEL RQRD :**
Apply the 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 :**

● **IF NO FUEL LEAK :**
– FUEL X FEED (if above FL150) . . . . ON
– ENG MODE SEL . . . . IGN
The selection of continuous relight protects against flameout, caused by possible fuel supply surging.
– TK PUMP 1 (affected) . . . . OFF
– TK PUMP 2 (affected) . . . . OFF

● **If FUEL X FEED off :**
As long as the fuel crossfeed valve is closed, the associated engine is fed by gravity only.
– PROC : GRVTY FUEL FEEDING
Apply the GRVTY FUEL FEEDING procedure.
AVOID NEGATIVE G FACTOR
Avoiding negative g factors will prevent fuel surging and, therefore, reduce the risk of engine malfunction.

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

- **WHEN TK (affected) FUEL RQRD :**
  - TK (affected) FEED . . . . GRVTY ONLY

    Apply the 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)

- **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

- **If center tank not empty :**
  - FUEL MODE SEL . . . . MAN
- **IF NO FUEL LEAK AND FUEL IMBALANCE :**
  - 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 the center tank and in wing tanks will run.
- FUEL X FEED . . . . OFF

FUEL L (R) XFR VALVE CLOSED

Note : When fuel quantity in affected wing reaches low level, corresponding WING TK LO LVL warning is triggered.

OUTER TK UNUSABLE (affected side)

STATUS

OUTER TK UNUSABLE (affected side)

FUEL L (R) XFR VALVE OPEN

Crew awareness

STATUS

INOP SYS
L (R) CELL VALVE

FUEL X FEED VALVE FAULT

Crew awareness

If valve failed open, maintain fuel balance with selective use of pumps.

If valve failed closed and if unable to maintain an acceptable balance, land as soon as possible.

STATUS

INOP SYS

FUEL X FEED

FUEL L (R) OUTER TK LO TEMP

R ■ **on the ground before takeoff :**

– DELAY T.O

Do not takeoff until temperatures are within limits.

■ **in flight**

Crew awareness

Consider descending to a lower altitude and/or increasing Mach to increase TAT.

FUEL L (R) INNER TK LO TEMP

R ■ **on the ground before takeoff :**

– DELAY T.O

Do not takeoff until temperatures are within limits.

■ **in flight**

Crew awareness

Consider descending to a lower altitude and/or increasing Mach to increase TAT.

FUEL L (R) OUTER (INNER) TK HI TEMP

R *This caution may spuriously trigger due to interference from communication equipment.*
R *Therefore, the flight crew should wait two minutes while the fuel temperature measurement*
R *is updated. After two minutes, if the ECAM caution has not disappeared, the flight crew must*
R *apply the following procedure :*

– 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

- **IF NO FUEL LEAK :**
  - FUEL X FEED .... ON
- CTR TK PUMP (affected) .... OFF

R *A fuel imbalance may occur, if the performance of the pumps of one wing is different from*
R *that of the other wing, and the CTR TK PUMP that is not affected stops automatically*
R *because :*
R *– The R(L) INR TK is full, or*
R *– The CTR TK is empty.*
R *In this case, apply the FUEL IMBALANCE procedure, as required. When the CTR TK is*
R *empty, the X FEED may be turned off, to avoid a possible fuel imbalance.*

STATUS

INOP SYS
CTR TK PUMP 1(2)

FUEL CTR TK PUMPS LO PR

R *Set FUEL MODE SEL to MAN, to avoid the possible triggering of the "FUEL CTR TK PUMPS*
R *OFF" ECAM caution.*

- CTR TK PUMP 1 .... OFF
- CTR TK PUMP 2 .... OFF
- CTR TK UNUSABLE

Gravity feeding from the center tank is not possible (no bypass valve fitted on the center tank pumps).

STATUS

CTR TK FUEL UNUSABLE

INOP SYS
CTR TK PUMPS

FUEL AUTO FEED FAULT

– FUEL MODE SEL .... MAN

The center tank pumps will run and feed the engines.

■ **Fuel in one wing tank < 5000 kg (11000 lb) and in center tank > 250 kg (550 lb) :**

– CTR TK PUMP 1 .... ON
– CTR TK PUMP 2 .... ON

When the center tank is empty, CTR TK PUMP LO PR warning will come on.

■ **CTR TK PUMPS running after slat extension, or LO LVL in center tank**

– CTR TK PUMP 1 .... OFF
– CTR TK PUMP 2 .... OFF

STATUS

CTR TK FEED : MAN ONLY | I

FUEL F. USED/FOB DISAGREE

This caution is triggered, if the difference between the initial FOB and the (actual FOB + fuel used) data is significant.

– FUEL LEAK PROC .... APPLY

FUEL LEAK

R *A fuel leak may be detected, if :*
R *· The sum of FOB and FU significantly less than FOB at engine start or is decreasing, or*
R *· A passenger observes fuel spray from engine/pylon or wing tip, or*
R *· The total fuel quantity is decreasing at an abnormal rate, or*
R *· A fuel imbalance is developing, or*
R *· Fuel quantity in a tank is decreasing too fast (leak from engine/pylon, or hole in a tank), or*
R *· The Fuel flow is excessive (leak from engine), or*
R *· Fuel is smelt in the cabin.*
R *If visibility permits, leak source may be identified by a visual check from the cabin.*

WHEN A LEAK IS CONFIRMED

LAND ASAP

R ■ **LEAK FROM ENGINE/PYLON CONFIRMED:**

R *Engine fuel leak can be confirmed by excessive fuel flow indication, or a visual check.*

– THR LEVER (of affected engine) .... IDLE
– ENG MASTER (of affected engine) .... OFF
– FUEL X FEED .... USE AS RQRD

R *If the leak stops, the crossfeed valve can now be opened to re-balance fuel quantity,*
R *or to enable use of fuel from both wings. Do not restart the engine.*

R ■ **LEAK FROM ENGINE/PYLON NOT CONFIRMED or LEAK NOT**
R **LOCATED:**

R *Stop any fuel transfer, and then monitor the depletion rate of each inner tank, to*
R *determine if the leak is from an engine or a wing (case 1), or from the Center tank, or*
R *the APU feeding line (case 2).*

– FUEL X FEED .... MAINTAIN CLOSED

The crossfeed valve must remain closed to prevent the leak from affecting both sides.

R – CTR TK PUMP 1+2 .... OFF
R *Each engine is fed via its associated inner tank only.*
R – INNER TANK FUEL QUANTITIES .... MONITOR
R *Monitor the depletion rate of each inner tank.*

FUEL LEAK (CONT'D)

- **CASE 1: IF ONE INNER TANK DEPLETES FASTER THAN THE OTHER BY AT LEAST 300 kg (660 lb) IN LESS THAN 30 MINUTES:**

  An engine leak may still be suspected. Therefore :
  - THR LEVER (engine on leaking side) .... IDLE
  - ENG MASTER (engine on leaking side) .... OFF
  - CTR TK PUMP 1+2 .... ON
  - FUEL LEAK .... MONITOR

  - **If leak stops:**

    If the inner tank fuel quantity of the affected side stops decreasing, the engine leak is confirmed and stopped.
    - FUEL X FEED .... USE AS RQRD

      The crossfeed valves can now be opened to re-balance fuel quantity, or to enable use of fuel from both wings. Do not restart the engine.

  - **If leak continues (after engine shutdown):**

    The inner tank fuel quantity of the affected side continues to decrease. If the leak has not stopped after engine shut down, a leak from the wing may be suspected.
    - ENGINE RESTART .... CONSIDER

  CAUTION
  > Do not apply the FUEL IMBALANCE procedure. Approach and landing can be done, even with one full wing/one empty wing.

- **CASE 2: IF BOTH INNER TANKS DEPLETE AT A SIMILAR RATE:**

  A leak from the Center tank or the APU feeding line may be suspected.

  - **If fuel smell in the cabin:**
    - APU (if ON) .... OFF

      This prevents additional fuel loss through the APU feeding line.

  - **When fuel quantity in one inner tank is less than 3 tons (6600 lb):**
    - CTR TK PUMP 1+2 .... ON

R **FOR LANDING**

CAUTION
R Do not use reversers.

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** :

R Consult the following table to determine the flight altitude
R limitation.

Flight conditions at time of gravity feeding	Gravity feed ceiling
Flight time above FL300 more than 30 minutes (Fuel deaerated)	Current FL*
Flight time above FL300 less 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 IMBALANCE 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

Refer to the QRH Part 2, or to the FCOM 3.02.80.

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

Refer to the QRH Part 2, or to the FCOM 3.02.80.

SLATS SLOW

CAT 3 SINGLE ONLY

INOP SYS

BLUE HYD
SPLR 3
CAT 3 DUAL
B ELEC PUMP

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

STATUS

■ **Sys lost by RSVR LO LVL :**

LDG DIST PROC . . . . APPLY

Refer to the QRH Part 2, or to the FCOM 3.02.80.

SLATS SLOW

CAT 3 SINGLE ONLY

INOP SYS

BLUE HYD
SPLR 3
CAT 3 DUAL
EMER GEN
B ELEC PUMP

HYD G RSVR LO AIR PR/OVHT/LO LVL

■ **RSVR OVHT or LO LVL :**

– PTU . . . . OFF
– GREEN ENG 1 PUMP . . . . OFF

■ **RSVR LO AIR PR :**

● **IF PRESS FLUCTUATES :**

– PTU . . . . OFF
– GREEN ENG 1 PUMP . . . . OFF

G ENG 1 PUMP LO PR

G SYS LO PR

Affected systems

*WHEEL
*F/CTL

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

● **IF HYD NOT RECOVERED :**

– L/G .... GRVTY EXTN

Refer to 3.02.32.

LDG DIST PROC .... APPLY

Refer to the QRH Part 2, or to the FCOM 3.02.80.

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

● **IF HYD NOT RECOVERED :**

– L/G .... GRVTY EXTN

Refer to 3.02.32.

LDG DIST PROC .... APPLY

Refer to the QRH Part 2, or to the FCOM 3.02.80.

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

Refer to the QRH Part 2, or to the FCOM 3.02.80.

SLATS/FLAPS SLOW

CAT 3 SINGLE ONLY

INOP SYS

GREEN HYD
SPLR 1 + 5
CAT 3 DUAL
AUTO BRK
NORM BRK
L/G RETRACT
REVERSER 1
YAW DAMPER 1

HYD Y RSVR LO AIR PR/OVHT/LO LVL

- **RSVR OVHT**
  - 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
- **RSVR LO LVL**
  - PTU . . . . OFF
  - YELLOW ENG 2 PUMP . . . . OFF
R
  - YELLOW ELEC 2 PUMP . . . . OFF

BRK Y ACCU PR MONITOR

This check is recommended to cover the case of a pipe rupture, which could lead to the simultaneous loss of the hydraulic system and the accumulator fluid. If this occurs, the loss of the accumulator should be observed on the indicator within 10 minutes. In that case : The only remaining braking means is normal braking, using green pressure. The parking brake should not be used since, it is not available. And, the chocks should be in place before Engine 1 shutdown.

Y ENG 2 PUMP LO PR.

R
Y SYS LO PR

Affected systems
*F/CTL

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

STATUS

■ **Sys lost by RSVR LO AIR PR :**

The probability of cavitation increases with altitude. Therefore, it may be possible to restore the system after descending to a lower altitude.

APPR PROC HYD LO PR

– YELLOW ENG 2 PUMP . . . . ON

● **If sys not recovered :**

LDG DIST PROC . . . . APPLY

Refer to the QRH Part 2, or to the FCOM 3.02.80.

FLAPS SLOW

CAT 3 SINGLE

■ **Sys lost by RSVR OVHT :**

APPR PROC HYD LO PR

● **IF YELLOW OVHT OUT**

– YELLOW ENG 2 PUMP . . . . ON

● **If not recovered :**

LDG DIST PROC . . . . APPLY

Refer to the QRH Part 2, or to the FCOM 3.02.80.

FLAPS SLOW

CAT 3 SINGLE

■ **Sys lost by RSVR LO LVL :**

LDG DIST PROC . . . . APPLY

Refer to the QRH Part 2, or to the FCOM 3.02.80.

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
N/W STRG
ALTN BRK
REVERSER 2
CARGO DOOR (if LO LVL)
YAW DAMPER 2

HYD G + B SYS LO PR

Note : If green system has been lost because of fluid low level or overheat, "HYD PTU FAULT" should appear demanding that the flight crew switches the PTU OFF.

LAND ASAP

● **if blue sys lost by ELEC PUMP LO PR**

– RAT .... MAN ON

MIN RAT SPD .... 140 KT

– Affected PUMPS .... OFF

– MANEUVER WITH CARE

F/CTL ALTN LAW

(PROT LOST)

The flight control normal laws and associated protections are lost. Only load factor limitation is furnished (alternate law without protection).

MAX SPEED 320/.77

Speed is limited due to loss of high speed protection.

– SPD BRK .... DO NOT USE

■ **if blue sys recovered :**

See procedure for single failure

■ **if blue sys not recovered :**

(Refer to 3.02.10) LANDING WITH SLATS OR FLAPS JAMMED.

Affected systems

R * WHEEL

R * F/CTL

HYD G + B SYS LO PR (CONT'D)

STATUS

MIN RAT SPD (if RAT out) . . . . 140 KT
(if B PUMP LO PR)
MAX SPEED 320/.77
MANEUVER WITH CARE
– 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
- **if sys lost by RSVR OVHT** :
  - **IF BLUE OVHT OUT** :
    – BLUE ELEC PUMP . . . . AUTO
  - **IF GREEN OVHT OUT** :
    – GREEN ENG 1 PUMP . . . . . . ON

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 FCOM 3.02.32.
      Extend landing gear at 200 knots, for improved controllability, when on a single elevator.

APPR SPD . . . . VREF + 25 KT
Approach speed must be increased due to loss of ailerons and slats.

LDG DIST PROC . . . . APPLY
Refer to the QRH Part 2, or to the FCOM 3.02.80.

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

INOP SYS

G + B HYD
F/CTL PROT
L ELEV
L + R AIL
SPLR 1+3+5
SLATS
AP 1 + 2
AUTO BRK
NORM BRK
L/G RETRACT
REVERSER 1
EMER GEN
(if B RSVR LO LVL)
B ELEC PUMP
YAW DAMPER 1
CAT 2

HYD G + Y SYS LO PR

LAND ASAP

– Affected PUMPS .... OFF

● **if yellow sys lost by ENG 2 PUMP LO PR**

R – YELLOW ELEC PUMP .... ON

MANEUVER WITH CARE

F/CTL ALTN LAW
(PROT LOST)

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

MAX SPEED 320/.77

Speed is limited due to loss of high speed protection.

■ **if yellow sys recovered :**

Refer to procedure for single failure

■ **if yellow sys not recovered**

R *Refer to 3.02.10 LANDING WITH SLATS OR FLAPS JAMMED.*

Affected systems
* F/CTL
* WHEEL

<u>HYD</u> G + Y SYS LO PR (CONT'D)

STATUS

MAX SPEED 320/.77
MAX BRK PR . . . . 1000 PSI
MANEUVER WITH CARE
<u>APPR PROC</u> DUAL HYD LO PR (line not displayed for a double LO LVL)

- **if sys lost by RSVR LO AIR PR** :
  - related PUMP . . . . ON
- **if sys lost by RSVR OVHT** :
  - **IF GREEN OVHT OUT** :
    - GREEN ENG 1 PUMP . . . . . . ON
  - **IF YELLOW OVHT OUT** :
    - YELLOW ENG 2 PUMP . . . . . ON
- **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
  Refer to the QRH Part 2, or to the FCOM 3.02.80.

  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).

  BRK Y ACCU PR ONLY
  7 full brake applications are available.

  SLATS SLOW
  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)
CAT 2

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**
  In approach, system lost by RSVR LO AIR PR may be recovered at low altitude.
  – Related PUMP .... ON
- **If sys lost by RSVR OVHT**
  In approach, system lost by RSVR OVHT may be recovered if OVHT indication disappears.
  - **IF BLUE OVHT OUT**
    R – BLUE ELEC PUMP .... AUTO
  - **IF YELLOW OVHT OUT**
    – YELLOW ENG 2 PUMP ..... ON
- **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
Refer to the QRH Part 2, or to the FCOM 3.02.80.
R SLATS/FLAPS SLOW

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
N/W STRG
ALTN BRK
CARGO DOOR
(if Y RSVR LO LVL)
REVERSER 2
B ELEC PUMP
EMER GEN
(if B RSVR LO LVL)
YAW DAMPER 2
CAT 2

HYD Y ELEC PUMP LO PR or OVHT

If the ELEC PUMP overheats, or if Y ELEC PUMP fails, while the Y ENG PUMP and the PTU are inoperative :

– YELLOW ELEC PUMP . . . . OFF

Y SYS LO PR

BRK Y ACCU PR MONITOR

This check is recommended to cover the case of a pipe rupture, which could lead to the simultaneous loss of the hydraulic system and the accumulator fluid. If this occurs, the loss of the accumulator should be observed on the indicator within 10 minutes. In that case : The only remaining braking means is the normal braking using the green pressure ; the parking brake should not be used, since it is not available, and the chocks should be in place before engine 1 shutdown.

Affected systems
*F/CTL

STATUS

APPR PROC HYD LO PR
R ● **IF YELLOW OVHT OUT**
– YELLOW ENG 2 PUMP . . . . ON
– PTU . . . . AUTO
The above two lines are only displayed, in case of an electrical pump overheat.
LDG DIST PROC . . . . APPLY
R *Refer to the QRH Part 2, or to the FCOM 3.02.80.*
FLAPS SLOW
CAT 3 SINGLE ONLY

INOP SYS
YELLOW HYD
SPLR 2 + 4
CAT 3 DUAL
N.W. STEER
ALTN BRK
REVERSER 2
Y ELEC PUMP
YAW DAMPER 2

HYD G (Y) ENG 1(2) PUMP LO PR

– ENG PUMP (affected) . . . . OFF

■ **PTU operative :**

STATUS

INOP SYS
G (Y) ENG 1(2)
PUMP

■ **PTU inoperative :**

G (Y) SYS LO PR

Note : If the 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
R *Refer to the QRH Part 2, or to the FCOM 3.02.80.*
SLATS/FLAPS SLOW
CAT 3 SINGLE

INOP SYS
GREEN HYD
SPLR 1 + 5
CAT 3 DUAL
AUTO BRK
NORM BRK
L/G RETRACT
REVERSER 1
PTU
G ENG 1 PUMP
YAW DAMPER 1

● **Y sys lost :**

LDG DIST PROC . . . . APPLY
R *Refer to the QRH Part 2, or to the FCOM 3.02.80.*
FLAPS SLOW
CAT 3 SINGLE

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

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

HYD PTU FAULT

Note : This warning is triggered, if the second engine is started within 40 seconds, following the end of the cargo doors operation. In this case, reset the warning by switching the yellow elec pump ON, then OFF.

● **If green or yellow reservoir low level and system low press:**
– PTU .... OFF

STATUS

INOP SYS
PTU

HYD RAT FAULT

Crew awareness.

STATUS

INOP SYS
RAT

HYD B ELEC PUMP LO PR or OVHT

– BLUE ELEC PUMP .... OFF

B SYS LO PR

Affected systems
*F/CTL

STATUS

APPR PROC HYD LO PR
● **IF BLUE OVHT OUT**
– BLUE ELEC PUMP .... AUTO
LDG DIST PROC .... APPLY
R *Refer to the QRH Part 2, or to the FCOM 3.02.80.*
SLATS SLOW
CAT 3 SINGLE ONLY

INOP SYS
BLUE HYD
SPLR 3
CAT 3 DUAL
B ELEC PUMP

ANTI ICE L (R) WINDSHIELD (WINDOW)

R Crew awareness.

STATUS

INOP SYS
L (R) WSHLD
(WNDW) HEAT

ANTI ICE L + R WINDSHIELD

R Crew awareness.

STATUS

INOP SYS
WSHLD HEAT

ANTI ICE CAPT PITOT or L (R) STAT or AOA

Failure of probe heating.

– AIR DATA SWTG . . . . CAPT 3

ADR 3 supplies data to PFD 1 and ND 1.

When ADR 3 is selected on the captain's side, deicing of the pitot associated with ADR 1 is lost.

Note : AIR DATA SWTG should not be set to CAPT 3, if ADR 3 is not available.

STATUS

INOP SYS
CAPT PITOT/
L STAT/
R STAT
CAPT AOA

ANTI ICE F/O PITOT or L (R) STAT or AOA

Failure of probe heating.

– AIR DATA SWTG . . . . F/O 3

ADR 3 supplies data to PFD 2 and ND 2.

Note : AIR DATA SWTG should not be set to F/O 3, if ADR 3 is not available.

STATUS

INOP SYS
F/O PITOT/
L STAT/
R STAT
F/O AOA

ANTI ICE CAPT (F/O) TAT

Crew awareness.

STATUS

INOP SYS
CAPT (F/O) TAT

ANTI ICE STBY PITOT or L (R) STAT or AOA

Crew awareness.

When using standby instruments, monitor air data information.

STATUS

INOP SYS
STBY PITOT/
L(R) STAT/
AOA

R
DOUBLE AOA HEAT FAILURE

R *In case of double failure of the alpha probe heaters in icing conditions, the choice made by the computers among the three ADR values may be erroneous.*

● **If icing conditions cannot be avoided :**
- One of the affected ADRs . . . . OFF
  There will be a disagreement between the two remaining ADRs, which will trigger the F/CTL ADR DISAGREE ECAM caution.

ANTI ICE CAPT (F/O) (STBY) PROBES

■ CAPT PROBES fault :

– AIR DATA SWTG . . . . CAPT 3

Note : AIR DATA SWTG should not be set to CAPT 3, if ADR 3 is not available.

STATUS

INOP SYS
CAPT PROBES

■ F/O PROBES fault :

– AIR DATA SWTG . . . . F/O 3

Note : AIR DATA SWTG should not be set to F/O 3, if ADR 3 is not available.

STATUS

INOP SYS
F/O PROBES

■ STBY PROBES fault :

Crew awareness

STATUS

INOP SYS
STBY PROBES

ANTI ICE ENG 1 (2) VALVE CLSD

AVOID ICING CONDITIONS

STATUS

AVOID ICING CONDITIONS

INOP SYS
ENG 1 (2) A. ICE

ANTI ICE ENG 1 (2) VALVE OPEN

THRUST LIM PENALTY

STATUS

THRUST LIM PENALTY

WING ANTI ICE L (R) VALVE OPEN

■ **Failure detected on ground :**

- WING ANTI ICE .... OFF
- ENG BLEED (affected side) .... OFF
- X BLEED (if not closed) .... SHUT
- APU BLEED (if left wing affected and if APU running) .. OFF

WAI AVAIL IN FLT

STATUS

WAI AVAIL IN FLT

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

● **After takeoff when above 1500 feet (automatic recall) :**

WAI AVAIL IN FLT

- ENG BLEED .... ON
- WING ANTI ICE .... AS RQRD

Wing anti ice is available if needed and anyway is continually on, on failed side.

- THRUST LIM PENALTY

STATUS

R THRUST LIM PENALTY

● **After landing (automatic recall) :**

- WING ANTI ICE .... OFF
- ENG BLEED (affected side) .... OFF
- X BLEED (if not closed) .... SHUT
- APU BLEED (if left wing affected) .... OFF

STATUS

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

WING ANTI ICE L (R) VALVE OPEN (CONT'D)

■ **Failure detected in flight :**

WAI AVAIL IN FLT

– WING ANTI ICE . . . . AS RQRD

Wing anti-ice is available if needed and anyway is continually on on failed side.

– THRUST LIM PENALTY

STATUS

THRUST LIM PENALTY
WAI AVAIL IN FLT

● **After landing (automatic recall) :**

– ENG BLEED (affected side) . . . . OFF
– X BLEED (if not closed) . . . . SHUT
– APU BLEED (if left wing affected) . . . . OFF
– WING ANTI ICE . . . . OFF

STATUS

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

WING ANTI ICE OPEN ON GND

Following ground test the valves are still open after 35 seconds.

– WING ANTI ICE .... OFF

STATUS

WAI AVAIL IN FLT

WING ANTI ICE SYS FAULT

- **If one wing valve remains closed when the wing anti-ice is turned on :**

  – WING ANTI ICE .... OFF

  AVOID ICING CONDITIONS

  Note : If ice accretion, the speed must not be lower than :
  - *VLS + 15 knots when in CONF 0.*
  - *VLS + 10 knots when in other configurations*
  - *For landing distance determination, refer to QRH part 2 or to FCOM 3.02.80*

STATUS

AVOID ICING CONDITIONS	INOP SYS
R *Note : In the case of severe ice accretion, with wing anti-ice failed, the Angle-of-Attack (AOA) protections remain efficient. However, if full backstick is maintained while at maximum AOA, a divergent roll oscillation may occur. Slightly release the backstick to stop this oscillation.*	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

ANTI ICE CAPT + F/O PITOT

Capt and F/O pitot heating is lost. In case of simultaneous pitot icing, and in the same amount, ADR 1 and ADR 2 speeds will be in agreement, but incorrect. Therefore, flight controls will consider the remaining correct source as being faulty, and will reject the only correct source. The following ECAM procedure avoids that the flight controls use two erroneous, but coherent, sources.

■ **If ADR 3 operative and ON**

– ADR 1 (2) . . . . OFF

Depending on the status of the static, AOA, and TAT heating, the ECAM requires that either ADR 1 or 2 be switched OFF.

Note : In case of subsequent, significant, speed discrepancy between the two remaining ADRs, the "ADR DISAGREE" ECAM caution will be triggered.

■ **If ADR 3 failed or OFF**

No action is required, as long as there are no icing conditions, in order to keep two independent speed sources.

● **IF ICING EXPECTED :**

– ADR 1 (2) . . . . OFF

Depending on the status of the static, AOA, and TAT heating, the ECAM requires that either ADR 1 or 2 be switched OFF.

– UNREL SPD PROC . . . . APPLY

Only one ADR is available, and the corresponding pitot probe may be affected by
R *ice accretion. Be prepared to use the UNRELIABLE SPEED INDICATION/ADR*
R *CHECK PROC procedure.*

NAV ADR FAULT

■ **If ADR 3 failed or OFF**

● **IF ICING EXPECTED :**

– ADR 1 (2) . . . . OFF

– UNREL SPD PROC . . . . APPLY

STATUS

INOP SYS

CAPT PITOT
F/O PITOT
CAPT PROBES
(If all CAPT PROBES heating is lost)
F/O PROBES
(If all F/O PROBES heating is lost)

ANTI ICE CAPT + STBY PITOT

Capt and STBY pitot heating is lost. In case of simultaneous pitot icing, and in the same amount, ADR 1 and ADR 3 speeds will be in agreement, but incorrect. Flight controls will consider the remaining correct source as being faulty, and will reject the only correct source. The following ECAM procedure avoids that the flight controls use two erroneous, but coherent, sources.

■ **If ADR 2 operative and ON**

– ADR 1 (3) . . . . OFF

Depending on the status of the static, AOA, and TAT heating, the ECAM requires that either ADR 1 or 3 be switched OFF.

Note : In case of subsequent, significant, speed discrepancy between the two remaining ADRs, the "ADR DISAGREE" ECAM caution will be triggered.

■ **If ADR 2 failed or OFF**

No action is required, as long as there are no icing conditions, in order to keep two independent speed sources.

● **IF ICING EXPECTED :**

– ADR 1 (3) . . . . OFF

Depending on the status of the static, AOA, and TAT heating, the ECAM requires that either ADR 1 or 3 be switched OFF.

– UNREL SPD PROC . . . . APPLY

Only one ADR is available, and the corresponding pitot probe may be affected by
R *ice accretion. Be prepared to use the UNRELIABLE SPEED INDICATION/ADR*
R *CHECK PROC procedure.*

NAV ADR FAULT

	STATUS
■ **If ADR 2 failed or OFF** ● **IF ICING EXPECTED :** – ADR 1 (3) . . . . OFF – UNREL SPD PROC . . . . APPLY	INOP SYS CAPT PITOT STBY PITOT CAPT PROBES (If all CAPT PROBES heating is lost) STBY PROBES (If all STBY PROBES heating is lost)

ANTI ICE F/O + STBY PITOT

F/O and STBY pitot heating is lost. In case of a simultaneous pitot icing, and in the same amount, ADR 2 and ADR 3 speeds will be in agreement, but incorrect. Therefore, flight controls will consider the remaining correct source as being faulty, and will reject the only correct source. The following ECAM procedure avoids that the flight controls use two erroneous, but coherent, sources.

■ **If ADR 1 operative and ON**

– ADR 2 (3) . . . . OFF

Depending on the status of the static, AOA, and TAT heating, the ECAM requires that either ADR 2 or 3 be switched OFF.

Note : In case of subsequent, significant, speed discrepancy between the two remaining ADRs, the "ADR DISAGREE" ECAM caution will be triggered.

■ **If ADR 1 failed or OFF**

No action is required, as long as there are no icing conditions, in order to keep two independent speed sources.

● **IF ICING EXPECTED :**

– ADR 2 (3) . . . . OFF

Depending on the status of the static, AOA, and TAT heating, the ECAM requires that either ADR 2 or 3 be switched OFF.

– UNREL SPD PROC . . . . APPLY

Only one ADR is available, and the corresponding pitot probe may be affected by
R *ice accretion. Be prepared to use the UNRELIABLE SPEED INDICATION/ADR*
R *CHECK PROC procedure.*

NAV ADR FAULT

■ **If ADR 1 failed or OFF**

● **IF ICING EXPECTED :**

– ADR 2 (3) . . . . OFF

– UNREL SPD PROC . . . . APPLY

STATUS

INOP SYS

F/O PITOT
STBY PITOT
F/O PROBES
(If all F/O PROBES heating is lost)
STBY PROBES
(If all STBY PROBES heating is lost)

ANTI ICE ALL PITOT

Capt, F/O and STBY pitot heating is lost. In case of a simultaneous pitot icing, and in the same amount, ADR 1, ADR 2, and ADR 3 speeds will be in agreement, but incorrect. The following ECAM procedure avoids that the flight controls use erroneous, but coherent, sources.

– ADR 1 (2) (3) . . . . OFF

Depending on the status of the static, AOA, and TAT heating, the ECAM requires that either ADR 1, 2 or 3 be switched OFF.

Note : In case of subsequent, significant, speed discrepancy between the two remaining ADRs, the "ADR DISAGREE" ECAM caution will be triggered.

● **IF ICING EXPECTED :**

– ADR 2 (3) . . . . OFF

Depending on the status of the static, AOA, and TAT heating, the ECAM requires that either ADR 2 or 3 be switched OFF.

– UNREL SPD PROC . . . . APPLY

Only one ADR is available, and the corresponding pitot probe may be affected by ice
R *accretion. Be prepared to use the UNRELIABLE SPEED INDICATION/ADR CHECK PROC*
R *procedure.*

NAV ADR FAULT

Single ADR FAULT or double ADR FAULT ECAM cautions may be triggered, depending on the number of ADRs switched OFF.

F/CTL ALTN LAW (PROT LOST)

Alternate law becomes active, if :

– One ADR has already been switched OFF, and the two remaining ADRs are not in agreement, or

– Two ADRs have been switched OFF.

ANTI ICE ALL PITOT (CONT'D)

STATUS

- **IF ICING EXPECTED :**
  - ADR 2 (3) . . . . OFF
  - UNREL SPD PROC . . . . APPLY

INOP SYS

CAPT PITOT
F/O PITOT
STBY PITOT
CAPT PROBES
(If all CAPT PROBES heating is lost)
F/O PROBES
(If all F/O PROBES heating is lost)
STBY PROBES
(If all STBY PROBES heating is lost)

RECORDER DFDR FAULT

Crew awareness.

STATUS

INOP SYS
DFDR

RECORDER SYS FAULT

Crew awareness.

STATUS

INOP SYS
RECORDER SYS

FWS OEB/FWC DISCREPANCY

– OEB DATABASE . . . . XCHECK

This action is normally performed by maintenance.

FWS SDAC 1(2) FAULT

Crew awareness

STATUS

R *Note : Although the ECAM may display some symbols and/or*
R *parameters in amber, this does not always signify that*
R *additional systems are failed.*

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

EIS DMC 1(2)(3) FAULT

■ **DMC 1**

– EIS DMC SWITCH .... CAPT 3

DMC 3 replaces DMC 1.

■ **DMC 2**

– EIS DMC SWITCH .... F/O 3

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

R CAT 1 ONLY (not displayed on the ECAM)

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

R ■ **The DU is blank (with or without a large letter "F" in amber), or the display is distorted :**

- DU (affected) . . . . AS RQRD
  The DU can be switched off.
- ECAM/ND XFR (if the ECAM DUs are affected) . . . . . . USE
  Transfer SD to F/O or CAPT ND.
- PFD/ND XFR (if the EFIS DUs are affected) . . . . USE

■ **INVALID DISPLAY UNIT message is displayed :**

This may be caused by a DU failure.

- FOR AUTOMATIC DU RECOVERY .. WAIT MORE THAN 40s

● **IF DU IS AUTOMATICALLY RECOVERED :**
No crew action is required.

● **IF DU IS NOT RECOVERED :**
- Non-recovered DU . . . . AS RQRD
  The DU can be switched off.

■ **The INVALID DATA message appears (not on all DUs) :**

This failure may be because of 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 : The ND display may disappear, if 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.

■ **The INVALID DATA message appears on all DUs :**

The autopilot, autothrust and MCDU navigation data are still available, and may be used.

- FOR AUTOMATIC DUs RECOVERY . WAIT MORE THAN 40S

● **IF ALL DUs ARE AUTOMATICALLY RECOVERED :**
No crew action is required.

● **IF ONE OR MORE DUs ARE NOT RECOVERED :**
- Non-recovered DUs . . . . OFF FOR 40S
- Non-recovered DUs . . . . BACK ON sequentially

● **If the initial failure re-occurs (the INVALID DATA message appears on all DUs), when switching a given DU back ON :**
Apply the entire procedure again, from the beginning. Leave this specific DU permanently OFF.

DISPLAY UNIT FAILURE (CONT'D)

■ **INVERSION OF THE EWD AND THE 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. There is no SD on the other DUs.

■ **To call a SYS page :**

– PRESS AND MAINTAIN the SYS page key on the ECP.

■ **OVERFLOW ON THE STATUS page :**

– PRESS AND MAINTAIN the STS KEY ON the ECP

The first page of STATUS appears.

– RELEASE IT, THEN PRESS AGAIN WITHIN 2 SECONDS

The second page of STATUS appears.

– CONTINUE UNTIL THE OVERFLOW ARROW DISAPPEARS.

When the STS key is released for more than 2 seconds, the EWD reappears.

L/G SHOCK ABSORBER FAULT

■ **Shock absorber not extended after liftoff :**

MAX SPEED 280/.67
– L/G . . . . KEEP DOWN

STATUS

MAX SPEED 280/.67	INOP SYS
– L/G . . . . KEEP DOWN	L/G RETRACT
INCREASED FUEL CONSUMP	

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

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

■ **Shock absorber extended on the ground :**

Crew awareness.

L/G GEAR NOT UPLOCKED

This warning appears if the landing gear sequence is not completed after 30 seconds.

■ **L/G doors closed :**

AVOID EXCESS G FACTOR

Because the gear rests on the doors, avoid excessive load factors in order not to damage door structure.

L/G GEAR NOT UPLOCKED (CONT'D)

■ **L/G doors not closed :**

MAX SPEED 220/.54
– L/G .... RECYCLE

● **IF UNSUCCESSFUL :**
– L/G .... DOWN
MAX SPEED 280/.67

STATUS

MAX SPEED 280/.67	INOP SYS
INCREASED FUEL CONSUMP	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.*
R
– *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	INOP SYS
CAT 3 SINGLE ONLY	CAT 3 DUAL
If gravity extension is unsuccessful, see "LDG WITH ABNORMAL L/G" procedure.	

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 extinguish 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 free-fall 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 SYS 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.*

■ **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.
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 the L/G lever is UP :**
  - **WHEN SPD < 220/.54**
    - – 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 kept 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 the 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 GEAR NOT DOWN

R *This warning appears in approach at 750 feet RA, if the landing gear is not set to DOWN,*
R *and the system has not failed. When this warning appears, the red arrow on the instrument*
R *panel comes on.*
R Crew awareness.

L/G LGCIU 1(2) FAULT

■ **One LGCIU is faulty the:**

– GPWS (if LGCIU 1 affected) . . . . OFF

If LGCIU 1 is lost, the 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

	INOP SYS
ENG 1(2) APPR IDLE ONLY *When idle is selected on ground with slats extended, only approach idle is available.*	LGCIU 1(2) REV 1(2) GPWS (if LGCIU 1 fault)

■ **Both LGCIUs are 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, the 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

	INOP SYS
– L/G . . . . GRVTY EXTN L/G CONTROL NOT AVAIL ENG 1 APPR IDLE ONLY ENG 2 APPR IDLE ONLY	REVERSER 1 + 2 AP 1 + 2 (except in LAND mode) A/THR LGCIU 1 and 2 GPWS CAT 2 (except in LAND mode)

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 the wheel speed greater than 72 knots.*
2. *Depending on the LGCIU failure, only a part of the above systems may be lost.*

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 moves the CG roughly 4 % aft*
· *10 passengers from mid to rear moves the CG roughly 2.5 aft.*

● **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
– SIGNS .... ON
– CABIN and COCKPIT .... PREPARE
Secure loose equipment, prepare survival equipment, and lock belts and shoulder harnesses.

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.
– 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).

LDG WITH ABNORMAL L/G (CONT'D)

– EMER EXIT LT . . . . ON
– CABIN REPORT . . . . OBTAIN
– A/SKID & N/W 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. As a result, 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.

● **If one or both MAIN L/G abnormal**
– 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

● **If the external light condition is poor at landing** :
– DOME LT . . . . DIM
Set the dome light to DIM to ensure that there is a light source after both engines are shut down after landing, in order to see and read the BRAKE PRESS indicator.

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 in order to prevent :
– The engine(s) from touching the ground during rollout
– Ground spoilers extension, in the case of abnormal main landing gear.

● **if NOSE L/G abnormal**
– NOSE . . . . MAINTAIN UP
After touchdown, keep the nose off the runway by the use of the elevator. Then, lower the nose on to the runway before elevator control is lost.
– BRAKES (compatible with elevator efficiency) . . . APPLY
– ENG MASTERS . . . . OFF
Shutdown the engines before nose impact.

LDG WITH ABNORMAL L/G (CONT'D)

● **If one MAIN L/G abnormal**

– ENG MASTERS . . . . OFF
At touchdown, shut down both engines.

– FAILURE SIDE WING . . . . MAINTAIN UP
Use roll control, as necessary, to maintain the unsupported wing up as long as possible.

– DIRECTIONAL CONTROL . . . . MAINTAIN
Use rudder and brakes (maximum 1000 psi) to maintain the runway axis as long as possible.

● **If both MAIN L/G abnormal**

– ENG MASTERS . . . . OFF
Shut down the engines in the flare, before touchdown.

– PITCH ATTITUDE (at touchdown) . . NOT LESS THAN 6°

WHEN A/C STOPPED

– ENG (all) and APU FIRE pushbutton . . . . PUSH
Pressing the ENG FIRE pushbutton shuts off the related hydraulic pressure within a short time.

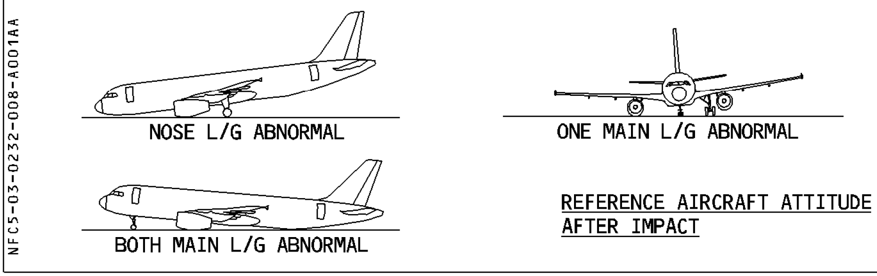
– ALL ENG and APU AGENT . . . . DISCH

R ■ **<u>If Evacuation required :</u>**

R – EVACUATION . . . . INITIATE
R · *All emergency and passenger doors may be used to evacuate the aircraft.*
R · *Announce an appropriate command such as "PASSENGER*
R *EVACUATION-EVACUATE THROUGH LH or RH DOORS" using the Passenger*
R *Address (PA) system, and press the EVAC COMMAND pushbutton, if installed.*

R ■ **<u>If Evacuation not required :</u>**

R – CABIN CREW and PASSENGERS (PA) . . . . NOTIFY
R *Ensure that all the landing gears are secured before initiating the disembarkation*
R *(before switching OFF the seat belts signs).*



CONFIG PARK BRK 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 STRG FAULT

STATUS

CAT 3 SINGLE ONLY

R *Note : 1. 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 nose wheel touchdown as long as possible.*

2. As specified in the QRH 5.04, automatic rollout is not permitted.

INOP SYS

CAT 3 DUAL
N/W STRG

R
BRAKES A/SKID N/WS FAULT or A/SKID N/WS OFF

Either both BSCU channels are failed, or the A/SKID & N/W STRG 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

Refer to the QRH Part 2, or to the FCOM 3.02.80

● **If Y SYS LO PR**
BRK Y ACCU PR ONLY

CAT 3 SINGLE ONLY

Note : As specified in the QRH 5.04, automatic rollout is not permitted.

INOP SYS

CAT 3 DUAL
ANTI SKID
N/W STRG
NORM BRK
AUTO BRK

BRAKES SYS 1(2) FAULT

Crew awareness.

STATUS

INOP SYS

BRK SYS 1(2)

BRAKES HOT

■ **On ground :**

– PARK BRK : PREFER CHOCKS

· *If the BRAKES HOT message is still on when the aircraft is parked, the flight crew should not set the PARKING BRK ON.*

– BRK FAN (if installed) . . . . ON

R *Note : Before selecting the brake fans at the gate, the flight crew should first warn*
R *the ground personnel in order to avoid blowing carbon brake dust on them.*

– 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.*

■ **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.

● **For L/G RETRACTION :**

MAX SPEED 220/.52

Reduce speed 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

Crew awareness
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

Refer to the QRH Part 2, or to the FCOM 3.02.80.

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 the 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.
- R R *On ground, do not tow the aircraft with the yellow hydraulic system pressurized : If the steering selector valve is failed open, nosewheel steering remains pressurized, and so towing may either break the towbar shear pin, or the nose gear (if towbarless towing).*
- R *If the steering selector valve is failed open, setting A/SKID & N/W STRG to OFF 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.

WHEEL TYRE LO PR

Crew awareness.

RESIDUAL BRAKING PROC

■ **IN FLIGHT :**

– BRAKE PEDALS . . . . APPLY SEVERAL TIMES

Press the brake pedals several times. This could zero a residual pressure on the alternate system.

● **IF RESIDUAL PRESSURE REMAINS :**

– A/SKID & N/W STRG selector . . . . KEEP ON

■ **IF AUTOBRAKE IS AVAILABLE :**

– FOR LANDING . . . . AUTO/BRK MED

Using MED mode gives immediate priority to normal braking upon landing gear touchdown, which cancels residual alternate pressure.

■ **IF AUTOBRAKE IS NOT AVAILABLE :**

– JUST AFTER TOUCHDOWN . . . . APPLY BRAKING

Pressing the brake pedals gives immediate priority to normal braking, which cancels residual alternate pressure.

– Beware of possible braking asymmetry after touchdown, which can be controlled by using the pedals.

R *Note : In case of taxi with deflated or damaged tires, refer to the TAXI WITH DEFLATED TIRES procedure (FCOM 3.01.32).*

BRAKES PRK BRK ON

Parking brake is selected in flight.

– PARK BRK . . . . OFF

BRAKES NORM + ALTN FAULT

Normal and alternate braking functions are lost.

PARK BRK ONLY

STATUS

PARK BRK ONLY LDG DIST PROC .... APPLY *Refer to the QRH Part 2, or to the FCOM 3.02.80.* CAT 2 ONLY	INOP SYS CAT 3 ANTI SKID N/W STRG NORM BRK AUTO BRK ALTN BRK

BRAKES NORM BRK FAULT

Crew awareness.

Normal braking function is lost.

STATUS

LDG DIST PROC .... APPLY *Refer to the QRH Part 2, or to the FCOM 3.02.80.* ALTN Y BRK WITH A/SKID CAT 2 ONLY	INOP SYS CAT 3 NORM BRK AUTO BRK

BRAKES RELEASED

Crew awareness

At least one wheel is released.

STATUS

LDG DIST PROC .... APPLY *Refer to the QRH Part 2, or to the FCOM 3.02.80.*	INOP SYS AUTO BRK

BRAKES – N/WS MINOR FAULT

Crew awareness.

BRAKES ALTN BRK FAULT

Crew awareness.
Alternate braking function is lost.

STATUS

INOP SYS
ALTN BRK

BRAKES ALTN L(R) RELEASED

R As long as the normal braking system is available, braking is normal.
R In alternate braking mode, braking of all wheels on one gear is lost.
R ● **If normal braking is lost :**
R – ASYM BRK PROC . . . . APPLY

STATUS

● **If normal braking is lost :**
LDG DIST PROC . . . . APPLY
R *Refer to the QRH Part 2, or to the FCOM 3.02.80.*

INOP SYS
ALTN L(R) BRK

R
ASYMMETRIC BRAKING

R Normal braking is faulty, or the green hydraulic system is in low
R pressure, and one gear is released.
R – Progressively apply brake on the available side. Counter swing
R with the rudder.
R – Avoid crosswind in excess of 10 knots from the side of available
R brake.
R ● **IF ONLY ONE REVERSE IS AVAILABLE**
R – Do not use Reverse on the side of available brake
R – LDG DIST PROC . . . . APPLY
R *Refer to the QRH Part 2, or to the FCOM 3.02.80.*

BRAKES BRK Y ACCU LO PR

The yellow electrical pump can be used to pressurize the accumulator. If the accumulator pressure is still low, chocks are required before Engine 1 shut down.

■ **On ground :**

● **BEFORE ENG SHUT DOWN :**
– CHOCKS CONSIDER

STATUS

● **If Y SYS LO PR**
NORM BRK ONLY

INOP SYS
BRK Y ACCU

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 BARO REF DISCREPANCY

– BARO REF . . . . X CHECK
Crosscheck the barometric reference selection, captain side versus first officer side.

NAV ADR FAULT

Note : In the case of a simultaneous failure of ADR and IR (same ADIRU), apply ADR FAULT procedure prior to IR FAULT procedure.

■ ADR 1 FAULT :

– AIR DATA SWTG . . . . CAPT 3

Select ADR 3 (if available) to the Captain's side.
The GPWS TERR amber FAULT light comes on because the predictive functions of the GPWS are inhibited. So, 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 3

Select ADR 3 (if available) to the First Officer's side.

– ADR 2 . . . . OFF

– BARO REF . . . . CHECK

If ADR 2 fails, both baro reference channels are driven by the same FCU channel. As a result, the flight crew must check the baro reference displays.

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 3

Set ADR 3 (if available) to the Captain's side.

– ADR (affected) .... OFF

The GPWS TERR amber FAULT light comes on, because the predictive functions of the GPWS are inhibited. So, 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 the 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 the case of an ADR 1 + 3 FAULT, the GPWS TERR amber FAULT light comes on, when the predictive functions of the GPWS are inhibited. So, 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

– FOR LDG .... USE FLAP 3

Do not select CONF FULL to not degrade handling qualities.

– GPWS LDG FLAP 3 .... ON

Appears when CONF 3 is selected.

● **If ADR 1+3 FAULT**

– L/G .... GRVTY EXTN

(Refer to 3.02.32).

APPR SPD .... VREF + 10 KT

LDG DIST PROC .... APPLY

Refer to the QRH Part 2, or to the FCOM 3.02.80.

ALTN LAW : PROT LOST

– WHEN L/G DN : DIRECT LAW

At L/G extension, control reverts to direct law in pitch and roll (Ref. DIRECT LAW proc. 3.02.27).

● **ADR 1 + 3 (or 2 + 3) FAULT** :

BOTH PFD ON THE SAME FAC

In the case of an ADR 1 + 3 FAULT, the GPWS TERR amber FAULT light comes on, because the enhanced EGPWS functions are inhibited. So, 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)
YAM DAMPER 1(2)(a)
CAT 2

(a) 1, in the case of an ADR 1 + 3 FAULT
2, in the case of an ADR 2 + 3 FAULT

ADR 1 + 2 + 3 FAULT

The ECAM does not display this procedure. In the case of a triple ADR failure, the ECAM only displays dual ADR warnings.

– ADR (all) .... OFF

– STBY INST (ALT + ASI) .... USE

Note : Disregard ECAM actions for AIR DATA SWTG and ATC, because these have no effect in the case of a total loss of ADRs.

ADR 1 + 2 + 3 FAULT (CONT'D)

F/CTL ALTN LAW

(PROT 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 moment when the failure occurs. Therefore, to prevent damage to the aircraft structure, use the rudder with care, when the speed is above 160 knots. 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.

R APPR SPD . . . . VREF + 10 KT

ADR 1 + 2 + 3 FAULT (CONT'D)

STATUS

● **DURING FINAL APPR**
- V/S CTL . . . . FULL UP
- LDG DIST PROC . . . . APPLY

Refer to the QRH part 2, or to the FCOM 3.02.80.

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
R Check that the outflow valve is fully open and
R that cabin altitude is at airfield elevation before
R opening the doors.

INOP SYS
See below

INOP SYS displayed on ECAM

F/CTL PROT	ADR 1+2+3	A/THR
WINDSHEAR DET	AP 1 + 2	RUD TRV LIM 1+2
GPWS		CAB PR 1 + 2

Other inoperative systems

	ATC ALTI MODE	TCAS ◁
		L/G RETRACT

RAT automatic extension.

NAV IR FAULT

Note : In the case of a simultaneous ADR and IR (same ADIRU) failure, apply the ADR FAULT procedure before the IR FAULT procedure.

■ IR 1 FAULT :

R – ATT HDG SWTG .... CAPT 3

STATUS

IR MAY BE AVAIL IN ATT	INOP SYS
Refer to the IR ALIGNMENT IN ATT MODE procedure.	IR 1
CAT 3 SINGLE ONLY	CAT 3 DUAL
	GPWS TERR
R	TCAS (*)

Note : (*) In case of an IR 1 fault, the TCAS may be inoperative (depending on the TCAS manufacturer). If the IR 1 is available in ATT mode, the TCAS can be recovered by entering the aircraft magnetic heading into the CDU, as per IR ALIGNMENT IN ATT MODE procedure.

■ IR 2 FAULT :

– ATT HDG SWTG .... F/O 3

STATUS

IR MAY BE AVAIL IN ATT	INOP SYS
Refer to the IR ALIGNMENT IN ATT MODE procedure.	IR 2
CAT 3 SINGLE ONLY	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	INOP SYS
Refer to the IR ALIGNMENT IN ATT MODE procedure.	IR 3
CAT 3 SINGLE ONLY	CAT 3 DUAL

NAV IR FAULT (CONT'D)

■ **Two IR FAULT :**

● **If IR 1 + 2 FAULT :**

– ATT HDG SWTG . . . . CAPT 3

Set IR 3 (if available) to the Captain's side.
Attitude information on F/O PFD is lost.

● **If IR 1 + 3 (or 2 + 3) FAULT :**

– ATT HDG SWTG . . . . NORM

Attitude information is lost on one side (Captain or First Officer).

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 due to the loss of high-speed protections.

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 appear, when CONF 3 is selected.

APPR SPD : VREF + 10 KT
LDG DIST PROC .... APPLY
Refer to the QRH part 2, or to the FCOM 3.02.80.
ALTN LAW : PROT LOST
WHEN L/G DN : DIRECT LAW
R *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
R *Refer to the IR ALIGNMENT IN ATT MODE procedure.*

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)
GPWS TERR (if IR 1 Fault)
TCAS (*)
CAT 2

(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). If the IR 1 is available in ATT mode, the TCAS can be recovered by entering the aircraft magnetic heading into the CDU, as per IR ALIGNMENT IN ATT MODE procedure.*

NAV IR NOT ALIGNED

This caution is available in Phase 2 (after first engine start, until takeoff)

■ **POSITION DISAGREE**

■ **POSITION MISSING**
- PRESENT POS .... INSERT

■ **EXCESS MOTION**

■ **IR 1 (2) (3) (1+2) (2+3) (1+2+3) IN ALIGN**

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

■ **MCDU INITIALIZATION :**

- DATA (MCDU KEY) .... PRESS
  The DATA INDEX page is displayed.
- IRS MONITOR (2L KEY) .... PRESS
  The IRS MONITOR page is displayed.
- A/C HEADING .... ENTER
  The heading must be entered in the SET HDG field (5R KEY).

■ **CDU INITIALIZATION :**

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 the aircraft's magnetic heading on the CDU keyboard.
  Then, press the ENT key to enter data.
  Example : To enter heading of 320°, dial 3, 2, 0, 0 then press ENT.
  Heading will be displayed on the associated ND.
  "HDG–ATT MODE" will be displayed on the CDU.
  Due to IR drift, the magnetic heading has to be periodically crosschecked and updated with standby compass, if required.

NAV PRED W/S DET FAULT

The predictive windshear function is lost.

Crew awareness

STATUS

INOP SYS

PRED W/S DET

NAV 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

R *Refer to the QRH part 2, or to the FCOM 3.02.80.*

ALTN LAW : PROT LOST

WHEN L/G DN : DIRECT LAW

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

INOP SYS

F/CTL PROT

NAV RA 1(2) FAULT

Crew awareness.

STATUS

■ **One RA FAULT :**

CAT 2 ONLY

INOP SYS
RA 1(2)
CAT 3
GPWS (if RA 1 fault)

■ **Both RA FAULT :**

WHEN L/G DN : DIRECT LAW

At landing gear extension, flight controls revert to direct law in pitch, as well as in roll (see DIRECT LAW procedure 3.02.27).

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
CAT 2 (when landing gear is down)

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

The FMS and GPS positions differ by more than :
– A longitude threshold that depends on the latitude :
· 0.5 minutes for latitudes below 55 degrees
· 0.9 minutes for latitudes at, or above, 55 degrees, and below 70 degrees
– A latitude threshold of 0.5 minutes, regardless of the latitude.

– A/C POS . . . . CHECK

R The following procedure is not displayed on the ECAM :

● **If the message occurs during ILS/LOC approach (LOC green)**:
– DISREGARD it.

● **If the message occurs during 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.
– Consider switching off the GPWS terrain functions.

– When possible, compare the FM position with 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.

R
NAV ILS 1(2) (1 + 2) FAULT

Crew awareness.

STATUS

R ■ **One ILS fault :**

INOP SYS
ILS 1 (2)
CAT 2
R GPWS (if ILS 1 fault on ground)

R ■ **Both ILS fault :**

INOP SYS
R ILS 1 + 2
R GPWS

NAV GPWS FAULT

– GPWS . . . . OFF

This line remains displayed, even after the GPWS pushbutton has been switched OFF.

STATUS

INOP SYS
GPWS

GPWS 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 stops, or a safe trajectory is ensured.

■ "AVOID TERRAIN"

Simultaneously :

- AP .... OFF
- PITCH .... PULL UP

R *Pull to full backstick and maintain in that position.*

- THRUST LEVERS .... TOGA
- SPEEDBRAKES lever .... CHECK RETRACTED
- BANK .... WINGS LEVEL or ADJUST

At least one "TERRAIN AHEAD PULL UP" aural alert generates before the "AVOID TERRAIN" aural alert. The PULL UP maneuver must be performed before the turn towards the safe direction, as climbing helps in clearing the terrain.
Best climb performance is obtained when close to wings level. Then depending on the situation, a turn will be performed :

- *If the alert generates when the wings are level, the "AVOID TERRAIN" aural alert indicates that the obstacles are probably ahead, and that a turn is required in order to clear the obstacles. In this case, initiate the pull-up, and then turn the aircraft in the appropriate direction.*
- *If the alert occurs while the aircraft is turning, the "AVOID TERRAIN" aural alert indicates that the obstacles are most probably within the turn trajectory, and that stopping the turn should enable the aircraft to avoid the obstacles. In this case, initiate the PULL UP, while leveling the wings, and then ADJUST bank, as necessary.*

● **When flight path is safe, and the warning stops :**
Decrease pitch attitude and accelerate.

● **When speed is above VLS, and vertical speed is positive :**
Clean up aircraft, as required.

GPWS ALERTS (CONT'D)

■ **"PULL UP" - "TERRAIN TERRAIN PULL UP" - "TERRAIN AHEAD PULL UP"**

Simultaneously :
- AP . . . . OFF
- PITCH . . . . PULL UP

R *Pull to full backstick and maintain in that position.*
- THRUST LEVERS . . . . TOGA
- SPEEDBRAKE lever . . . . CHECK RETRACTED
- BANK . . . . WINGS LEVEL or ADJUST

Best climb performance is obtained when close to wings level. Then, for "TERRAIN AHEAD PULL UP" only, and if the flight crew concludes that turning is the safest way of action, a turning maneuver can be initiated.

● **When flight path is safe, and the warning stops :**
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 an 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" :**

Perform a go-around.

■ **"GLIDE SLOPE" :**

Establish the aircraft on the glide slope, or switch OFF the G/S mode pushbutton, if flight below the glide slope is intentional (Non Precision Approach (NPA)).

NAV GPWS TERR DET FAULT

The predictive functions of the GPWS 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 on.

TCAS WARNINGS

■ Traffic advisory : "TRAFFIC" messages

Do not maneuver based on a TA alone.
Attempt to see the reported traffic.

■ Resolution advisory : All "CLIMB" and "DESCEND" or "MAINTAIN VERTICAL SPEED MAINTAIN" or "ADJUST VERTICAL SPEED ADJUST" or "MONITOR VERTICAL SPEED" type messages

- AP (if engaged) . . . . OFF
- BOTH FDs . . . . OFF
- Respond promptly and smoothly to an RA by adjusting or maintaining the vertical speed, as required, to reach the green area and/or avoid the red area of the vertical speed scale.

  Note : *Avoid excessive maneuvers while aiming to keep the vertical speed just outside the red area of the VSI, and within the green area. If necessary, use the full speed range between Vαmax and Vmax.*
- Respect stall, GPWS, or windshear warning.
- Notify ATC.
- When "CLEAR OF CONFLICT" is announced :
  - *Resume normal navigation in accordance with ATC clearance.*
  - *AP/FD can be re-engaged as desired.*

● **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.*

NAV 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 :**

R – ADR CHECK PROC . . . . APPLY

Refer to the ADR CHECK PROC paper procedure to determine the faulty ADR.

■ **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

R *Refer to the QRH part 2, or to the FCOM 3.02.80.*

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

NAV IAS DISCREPANCY

– AIR SPD .... X CHECK
– AIR DATA SWTG .... AS RQRD

STATUS

CAT 3 SINGLE ONLY	INOP SYS
	CAT 3 DUAL

R

UNRELIABLE SPEED INDIC/ADR CHECK PROC

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. If all ADRs provide unreliable data, keep one ADR on to keep the stall warning protection. 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/steady 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.

R
UNRELIABLE SPEED INDIC/ADR CHECK PROC (CONT'D)

● **If the safe conduct of the flight is impacted :**

MEMORY ITEMS :
- AP/FD..OFF
- A/THR..OFF
- PITCH/THRUST :
  - Below THRUST RED ALT.........................15°/TOGA
  - Above THRUST RED ALT and Below FL 100.........10°/CLB
  - Above THRUST RED ALT and Above FL 100.........5°/CLB
- FLAPS..........................Maintain current CONFIG
- SPEEDBRAKES...........................Check retracted
- L/G..UP

When at, or above MSA or Circuit Altitude: level off for troubleshooting

NFC5-03-0234-021-A253AA

- GPS ALTITUDE .... Display on MCDU

● **To level off for troubleshooting :**

R – AP/FD .... OFF
R – A/THR .... OFF

Note : Check the actual slat/flap config. on ECAM, as flap auto-retraction may occur.

PITCH/THRUST FOR INITIAL LEVEL OFF

SLATS/FLAPS EXTENDED				
		Above 67 t	67 t – 57 t	Below 57 t
CONF	Speed	Pitch (°)/Thrust (% N1)		
3	F	7.0/62.4	7.0/58.4	7.0/53.0
2	F	8.5/62.3	8.5/58.3	8.5/53.0
1 + F	S	4.5/61.3	4.5/57.2	4.5/52.3
1	S	7.5/60.2	7.5/55.8	7.5/51.0
CLEAN				
FL	Speed	Pitch (°)/Thrust (% N1)		
Below FL 200	250 kts	3.5/64.7	3.0/62.3	2.0/60.3
FL 200 - FL 320	275 kts	2.5/78.7	2.0/76.8	1.0/75.3
Above FL 320	M 0.76	3.0/84.6	2.5/83.3	2.0/80.8

R

UNRELIABLE SPEED INDIC/ADR CHECK PROC (CONT'D)

Flying technique to stabilize speed :

- Adjust pitch in order to fly the required flight path.
- When target pitch is reached, flying intended flight path, adjust thrust to target.
  - If the aircraft pitch tends to increase, aircraft is slow, then increase thrust ;
  - If the aircraft pitch tends to decrease, aircraft is fast, then decrease thrust.

WHEN FLIGHT PATH IS STABILIZED

- PROBE/WINDOW HEAT . . . . ON

Technical recommendations :

- Respect Stall Warning.
- To monitor speed, refer to IRS Ground Speed or GPS Ground Speed variations.

● **If remaining altitude indication is unreliable** :

- Do not use FPV and/or V/S, which are affected.
- ATC altitude is affected. Notify the ATC.
- Refer to GPS altitude : altitude variations may be used to control level flight, and is an altitude cue.
- Refer to Radio altimeter.

CAUTION

If the failure is due to radome destruction, the drag will increase and therefore N1 must be increased by 5 %. Fuel flow will increase by about 27 %.

UNRELIABLE SPEED INDIC/ADR CHECK PROC (CONT'D)

Affected ADR identification :

– Crosscheck all speed indications and refer to QRH 4.01 (for F, S speeds) or 5.01 (for speed in clean CONF):

■ **If at least one ADR is reliable :**

– Faulty ADR(s) . . . . OFF
– REMAINING AIR DATA . . . . CONFIRM

Alternate sources may be used to evaluate the air data :
– GPS altitude
– GPS and IRS ground speeds, taking into account altitude and wind effect.

■ **If affected ADR(s) cannot be identified, or if all ADRs are affected :**

– ONE ADR . . . . KEEP ON

Keep one ADR ON to maintain the STALL WARNING protection.

– TWO ADRS . . . . OFF

This prevents flight control laws from using two coherent but unreliable ADR data.

– LDG CONF . . . . USE FLAP 3
– APP SPD . . . . VLS + 10
– LDG DIST PROC . . . . APPLY

Refer to the QRH Part 2, or to the FCOM 3.02.80.

■ **To return to departure airport :**

Keep takeoff configuration preferably.
Refer to initial and intermediate approach, and final approach tables.

■ **To accelerate and clean up after takeoff :**

Accelerate and clean up the aircraft in level flight :

– THRUST . . . . CLB
– FLAPS . . . . RETRACT

Retract from 3 or 2 to 1, once CLB thrust is set.
Retract from 1 to 0, when the aircraft pitch is lower than the pitch for S speed (refer to the "Pitch/Thrust for initial level off" table).
Once in clean configuration, refer to climb, cruise, descent, approach tables for flight continuation.

■ **Other cases :**

– Refer to climb, cruise, descent, approach tables for flight continuation.

R

UNRELIABLE SPEED INDIC/ADR CHECK PROC (CONT'D)

CLIMB

Set the thrust to CL.

CLEAN				
		Above 67 t	67 t - 57 t	Below 57 t
FL	Speed	Pitch (°)/Thrust (% N1)		
Below FL 50	250 kts	10.5/CLB	11.0/CLB	12.5/CLB
FL 50 - FL 100		10.5/CLB	10.0/CLB	11.0/CLB
FL 100 - FL 150		8.0/CLB	8.5/CLB	9.5/CLB
FL 150 - FL 200		7.0/CLB	7.0/CLB	7.5/CLB
FL 200 - FL 250	275 kts	5.0/CLB	5.0/CLB	5.0/CLB
FL 250 - FL 320		3.5/CLB	3.5/CLB	3.5/CLB
Above FL 320	M 0.76	3.5/CLB	3.5/CLB	3.5/CLB

CRUISE

Adjust N1 to maintain approximate level flight with pitch attitude held constant. When time permits, refer to FCOM 3.04.91 (SEVERE TURBULENCE) and adjust pitch to maintain level flight.

CLEAN				
		Above 67 t	67 t - 57 t	Below 57 t
FL	Speed	Pitch (°)/Thrust (% N1)		
Below FL 200	250 kts	3.5/64.7	3.0/62.3	2.0/60.3
FL 200 - FL 320	275 kts	2.5/78.7	2.0/76.8	1.0/75.3
Above FL 320	M 0.76	3.0/84.6	2.5/83.3	2.0/80.8

DESCENT

Set the thrust to IDLE

CLEAN				
		Above 67 t	67 t - 57 t	Below 57 t
FL	Speed	Pitch (°)/Thrust (% N1)		
Above FL 320	M 0.76	-0.5/IDLE	-1.0/IDLE	-2.0/IDLE
FL 320 - FL 200	275 kts	-0.5/IDLE	-1.0/IDLE	-2.0/IDLE
FL 200 - FL 100	250 kts	1.0/IDLE	0.0/IDLE	-1.0/IDLE
Below FL 100	250 kts	0.5/IDLE	-0.5/IDLE	-2.0/IDLE
Below FL 100	G-DOT	1.5/IDLE	2.0/IDLE	2.0/IDLE

R

UNRELIABLE SPEED INDIC/ADR CHECK PROC (CONT'D)

INITIAL AND INTERMEDIATE APPROACH IN LEVEL FLIGHT

R
R

The approach phase between Green Dot speed (clean configuration) and the landing configuration (CONF 3), is flown in level flight.

LANDING GEAR UP IN LEVEL FLIGHT				
		Above 67 t	67 t - 57 t	Below 57 t
CONF	Speed (kts)	Pitch (°)/Thrust (% N1)		
0	G-DOT	5.0/58.7	5.0/54.4	5.5/50.0
1	S	7.5/60.3	7.5/56.0	7.5/51.2
1+F (a)	S	4.5/61.3	4.5/57.2	4.5/52.3
2	F	8.5/62.2	8.5/58.4	8.5/53.0
LANDING GEAR DOWN IN LEVEL FLIGHT (EXPECT GRVTY EXTENSION)				
3	F	7.0/67.7	7.0/63.3	7.5/58.6

(a) Due to the fact that the speed is unreliable, the SFCC may select the 1+F configuration in approach, instead of 1.

FINAL APPROACH AT STANDARD - 3° DESCENT FLIGHT PATH

LANDING GEAR DOWN				
		Above 67 t	67 t - 57 t	Below 57 t
CONF	Speed (kts)	Pitch (°)/Thrust (% N1)		
3	VLS + 10	4.0/49.7	4.0/45.8	4.0/42.1

Flying technique to stabilize speed :

– Adjust pitch in order to fly the required flight path.
– When target pitch is reached, flying intended flight path, adjust thrust to target.
  · If the aircraft pitch tends to increase, aircraft is slow, then increase thrust ;
  · If the aircraft pitch tends to decrease, aircraft is fast, then decrease thrust.

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)

<u>AIR</u> 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.* R

● **If wing anti-ice is on and both packs are on :**

– PACK affected .... OFF

One pack must be closed when the pilot is using wing anti-ice because of precooler perfomance.

– X BLEED .... OPEN

STATUS

ONE PACK ONLY IF WAI ON

<u>INOP SYS</u>
ENG 1(2) BLEED
PACK 1(2)
(if closed)

AIR DUAL BLEED FAULT

■ **If ENG 1 BLEED was lost due to a :**

LEAK on side 1
ENG 1 FIRE
Start Air Valve 1 failed open.

– DESCENT TO FL100/MEA .... INITIATE

Descend rapidly to FL100/MEA, to prevent excessive cabin altitude.

AVOID ICING CONDITIONS

■ **If ENG 2 BLEED was lost due to a :**

LEAK on side 2
ENG 2 FIRE
Start Air Valve 2 failed open.

– X BLEED .... CHECK CLOSED
– DESCENT TO FL225/MEA .... INITIATE

Descend rapidly to FL225, to recover the bleed supply from the APU.

– APU .... START

Start the APU during the descent.

● **AT, OR BELOW, FL225 :**

– WING A.ICE .... OFF

APU BLEED must not be used for wing anti-ice.

– APU BLEED .... ON

MAX FL225
AVOID ICING CONDITIONS

■ **In all other cases :**

– DESCENT .... INITIATE

Descend rapidly to FL225, so that the bleed supply may be supplied by the APU, if the bleed system recovery is not successful.

● **If both packs are available :**

If both packs are operative, it can be suspected that the second bleed system failed due to excessive demand. Recovery of the second failed engine bleed may be attempted.

■ **If ENG 1 BLEED is lost first :**

– PACK 1 .... OFF
– ENGINE 2 BLEED .... ON

■ **If ENG 2 BLEED is lost first :**

– PACK 2 .... OFF
– ENGINE 1 BLEED .... ON

⇩

AIR DUAL BLEED FAULT (CONT'D)

● **If engine bleed recovery was not successful, or if one pack is inoperative :**

– X BLEED .... CHECK OPEN
– DESCENT TO FL225/MEA .... CONTINUE
Descend rapidly to FL225, to recover the bleed supply from the APU.
– APU .... START
Start the APU during the descent.

● **AT, OR BELOW, FL225 :**

– WING A.ICE .... OFF
APU BLEED must not be used for wing anti-ice.
– APU BLEED .... ON

MAX FL225
AVOID ICING CONDITIONS

AIR L (R) WING or ENG 1(2) BLEED 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 off when the overheat disappears.*

R ● **If left wing or engine 1 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

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

AIR X BLEED FAULT

– X BLEED . . . . MAN CTL

Select OPEN, when the APU BLEED pushbutton is ON, or for engine start, or when WING
R *ANTI-ICE is ON and one bleed is inoperative.*
Select SHUT in other cases.

● **If manual opening inoperative, and only one bleed available:**

– WING ANTI ICE . . . . OFF

AVOID ICING CONDITIONS

● **If manual opening inoperative :**

AVOID ICING CONDITIONS

R X BLEED MAN CTL

STATUS

INOP SYS

X BLEED

WING A. ICE

AIR APU BLEED LEAK

– 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.

STATUS

INOP SYS

APU BLEED
(if valve closed)

AIR ENG 1(2) HP VALVE FAULT

Crew awareness.

STATUS

AIR PRESS LOW AT IDLE

AIR ENG 1(2) LEAK DET FAULT

Crew awareness.

STATUS

INOP SYS
ENG 1 (2) LK DET

AIR L (R) WNG LEAK DET FAULT

Crew awareness.

STATUS

INOP SYS
L(R) WNG LK DET

BLEED MONIT SYS 1(2) FAULT

Crew awareness.

STATUS

INOP SYS
BMC 1 (2)

BLEED MONITORING FAULT

Crew awareness.

STATUS

INOP SYS
BMC 1 + 2

AIR ENG 1(2) BLEED LO TEMP

In flight, engine bleed temperature is too low for correct wing de-icing.

– A/THR . . . . OFF
– THR LEVER (affected engine) . . . . ADVANCE

The thrust lever of the affected engine must be advanced, with the autothrust OFF.
Low bleed temperature may be due to low outside air temperature. Therefore, increasing engine thrust may increase bleed temperature and clear the ECAM caution.

● **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

AIR ENG 1 + 2 BLEED LO TEMP

– A/THR .... OFF
– THR LEVERS .... ADVANCE

The thrust lever of the affected engine must be advanced, with the autothrust OFF. Low bleed temperature may be due to low outside air temperature. Therefore, increasing engine thrust may increase bleed temperature and clear the ECAM caution.

● **IF UNSUCCESSFUL** :
– WING A. ICE .... OFF
AVOID ICING CONDITIONS

STATUS

AVOID ICING CONDITIONS | I

R

DATALINK ATSU FAULT

Crew awareness.

ATSU INIT FAULT

Displayed, in case of failure upon ATSU initialization. Refer to 3.04.46, for ATSU initialization.

STATUS

INOP SYS

ATSU
DATA COMPANY

DATALINK COMPANY FAULT

Crew awareness.

STATUS

INOP SYS

DATA COMPANY

APU AUTO (EMER) SHUT DOWN

APU EMER SHUT DOWN is triggered if :
- *an APU fire is detected on ground, or*
- *the ground crew shuts down the APU manually by pushing the APU SHUT OFF pushbutton on the nose gear interphone panel, or*
- *the flight crew presses the APU FIRE pushbutton in the cockpit.*

– MASTER SW . . . . OFF

STATUS

INOP SYS

APU

DOORS (L/R/FWD/AFT) AVIONICS

■ **On the ground**

Crew awareness.

■ **In flight**

No crew action required as long as cabin pressure is normal.

● **IF ABN CAB V/S :**

– MAX FL 100/MEA

Limit maximum flight level to FL100 or MEA or minimum obstacle clearance altitude.

Avionics doors are of plug type. Therefore full depressurization is not recommended.

STATUS

MAX FL 100/MEA

DOORS CABIN/EMER EXIT/CARGO

Crew may confirm a cabin door warning by checking the visual indicator on the door.

■ **On the ground**

Crew awareness.

Crew may confirm a cargo door warning by removing the detachable inspection panel on the base of cargo door.

■ **In flight**

No crew action required as long as cabin pressure is normal.

● **IF ABN CAB V/S :**

– MAX FL 100/MEA

Limit maximum flight level to FL100 or MEA or minimum obstacle clearance altitude.

If door warning is accompanied by abnormal increase of cabin altitude, flight crew must reduce cabin ΔP and altitude by descending.

STATUS

MAX FL 100/MEA

ENG 1(2) FUEL FILTER CLOG

Crew awareness.
Maintenance action is due.

ENG 1(2) REVERSER FAULT

LAND ASAP

- **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.

■ **In flight**

– THR LEVER 1(2) .... IDLE
If flight conditions permit, reduce the thrust of the affected engine to IDLE as a precautionary measure.

■ **On ground**

THR LVR 1(2) NOT ABOVE IDLE

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.

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

ENG 1(2) N1/N2/EGT OVERLIMIT

■ **Max pointer indication :**

EGT between 915 and 950°C (except during takeoff, alpha floor activation, or reverse selected), or 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 the next landing.
Report in the 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 shutdown, land ASAP, using the minimum thrust required to sustain safe flight.

ENG 1(2) **SHUT DOWN**

Apply the after ENG SHUT DOWN procedure.

R

ENG REV SET

Reverse thrust has been selected in flight.

– THR LEVER (affected engine) . . . . FWD THR

ENG 1(2) REVERSE UNLOCKED

One or more reverser doors are not stowed.
If N1 is above 70%, the auto-restow function is inhibited in flight and on ground.

■ **On ground :**

ENG 1(2) AT IDLE

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

– THR LEVER (affected engine) . . . . IDLE
– ENG MASTER (affected engine) . . . . OFF

■ **In flight :**

R LAND ASAP

ENG 1(2) AT IDLE

Only displayed, if the engine is automatically set at idle.

– THR LEVER (affected engine) . . . . IDLE
MAX SPEED 300/.78

● **IF BUFFET :**

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

MAX SPEED . . . . 240 KT
– ENG MASTER (affected engine) . . . . OFF

● **If reverser is actually deployed :**

– RUD TRIM . . . . FULL R (L)
– CONTROL HDG WITH ROLL

ENG 1(2) **SHUT DOWN**

Apply the 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) REV SWITCH FAULT

Crew awareness.

ENG 1(2) START FAULT

■ ENG 1(2) IGNITION FAULT

(No light up within the 18 seconds following ignition start).

- **In flight :**
  - ENG MASTER (affected) . . . . OFF

    Wait 30 seconds before attempting a new start (to drain the engine).
- **On the ground (auto start) :**

  R *In case of no light up, the FADEC can perform one additional start attempt. After each unsuccessful start attempt, a dry crank phase is automatically performed.*

  R *The following message will be displayed on the ECAM :*

  R – NEW START IN PROGRESS
  - **When the final dry cranking process is finished :**
    - ENG MASTER (affected) . . . . OFF

      Following starter cooldown, the pilot must decide whether to attempt auto or manual start, or to report the nostart condition for appropriate maintenance action.
- **On the ground (manual start) :**

  R – MAN START (affected) . . . . OFF

  R – ENG MASTER (affected) . . . . OFF

  – MODE SEL . . . . CRANK

  R – MAN START (affected) . . . . ON

  Note : The last two lines are not displayed on the ECAM.
  Dry crank the engine for 30 seconds. The start valve automatically reopens when N2 is below 20 %.
  The pilot must decide whether to attempt a new start, or to report the no start condition for appropriate maintenance action.

ENG 1(2) START FAULT (CONT'D)

■ ENG 1(2) STALL, ENG 1(2) EGT OVERLIMIT :

● **In flight :**

– ENG MASTER (affected) . . . . OFF

Wait 30 seconds before attempting a new start (to drain the engine).

● **On ground (autostart) :**

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 message is displayed on the ECAM :

– 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 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 :**

– THR LEVER (affected) . . . . IDLE
– ENG MASTER (affected) . . . . OFF

ENG 1(2) N1 or N2 or EGT or FF DISCREPANCY

There is discrepancy between the value displayed on the ECAM and the real value. The upper ECAM upper displays 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, crosscheck with the opposite parameter.

ENG 1(2) FADEC ALTERNATOR

Loss of electrical auto supply of either FADEC channel.

Crew awareness.

ENG RELIGHT (in flight)

MAX ALTITUDE . . . . See below
- ENG MASTER (affected) . . . . OFF
- R THR LEVER (affected) . . . . Check IDLE
- ENG MODE SEL . . . . IGN
- X BLEED . . . . OPEN

  If outside the windmilling start envelope, the FADEC will open the starter valve.
- WING A. ICE (for starter assist) . . . . OFF
- ENG MASTER (affected) . . . . ON

  Be aware that, unlike the procedure for auto start on the ground, the crew must take appropriate action in case of abnormal start.

  Engine light-up must be achieved within 30 seconds after the 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 is 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 to the TA position.
- Affected SYS . . . . RESTORE

  Restore affected systems, and set the X BLEED selector to AUTO.

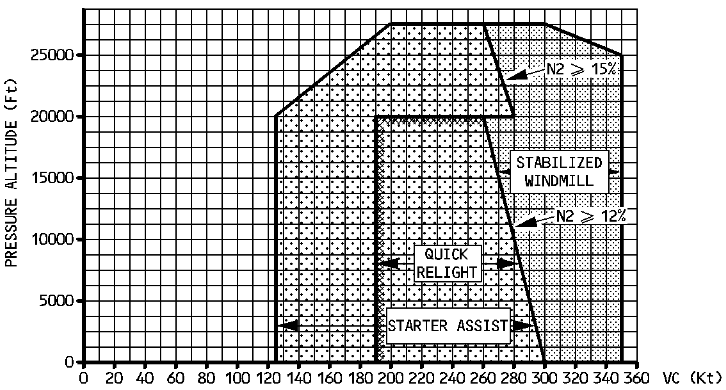
■ **If no relight :**

- ENG MASTER (affected) . . . . OFF

  Wait 30 seconds before attempting a new start (to drain the engine).

R

IN FLIGHT ENGINE RELIGHT ENVELOPE



NFC5-03-0270-010-A060AA

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
R – ENG MASTER (affected engine) . . . . OFF

● **IF DAMAGE**

R – ENG FIRE P/B (affected engine) . . . . PUSH
– 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 . . . . CONSIDER

If no damage, a new start sequence may be initiated.

ENG 1(2) **SHUT DOWN**

Apply the After ENG SHUT DOWN procedure, if damage or if engine relight is unsuccessful.

ENG 1(2) FAIL (CONT'D)

■ **In flight :**

– ENG MODE SEL . . . . IGN

Selection of continuous ignition confirms the immediate relight attempt made by the FADEC.

– THR LEVER (affected engine) . . . . IDLE

Note : In case of GPWS (EGPWS ⊲) alerts, reduce speed with care below VLS, with flaps extended (at light weights VMC may be reached before αMax), when applying the GPWS (EGPWS ⊲) procedure.

● **IF NO ENG RELIGHT AFTER 30 S**

– ENG MASTER (affected engine) . . . . OFF

● **IF DAMAGE**

R – ENG FIRE P/B (affected engine) . . . . PUSH

– AGENT 1 AFTER 10 s . . . . DISCH

ENG 1(2) SHUT DOWN

Apply the After ENG SHUT DOWN procedure, if damage, or if engine relight unsuccessful.

If high vibration occurs and continues after engine shutdown, reduce airspeed and descend to a safe altitude.

Attempt to determine and use a pratical airspeed and altitude for minimum vibrations.

● **IF NO DAMAGE**

– ENG (affected) RELIGHT . . . . CONSIDER

If there is no damage, an engine relight can be considered. To restart the engine, apply the 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 is ON :**
  - **If Elec Emer Config :**
    - PACK 1 . . . . OFF
      In Emer ELEC, only Pack 1 can be controlled off.
  - **If not Elec Emer Config :**
    - 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.
- **IF NO FUEL LEAK :**
  - IMBALANCE . . . . MONITOR
- TCAS MODE SEL (if installed) . . . . TA
- **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 REV unlocked :**
  MAX SPEED 300/.78
  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 :**
      – L/G .... DOWN
    - **AT 800 FT AGL :**
      – TARGET SPD . . . VREF + 40 KT
      LDG DIST PROC .... APPLY
      See QRH part 2, or FCOM 3.02.80.
  - **1, 2, or 3 doors not stowed (CFM), or reverse detected unlocked (IAE) :**
    - **IF BUFFET :**
      – FOR LDG .... USE FLAP 3
      – GPWS LDG FLAP 3 .... ON
      – APPR SPD ...... VREF + 10 kt
      – LDG DIST PROC .... APPLY
      See QRH part 2, or FCOM 3.02.80.
- **If WING A/ICE off and ENG 1(2) FIRE pushbutton not pressed :**
  - **IF PERF PERMITS**
    – X BLEED .... OPEN
    If no obstacle constraint exists, the XBLEED should be selected OPEN, and the 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)

● IF NO ENG 1(2) DAMAGE :
R CONSIDER ENG 1(2) RELIGHT
R CAT 3 SINGLE ONLY
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 the X BLEED selector is set at SHUT.
- *After landing, the Fuel Used value of the engine, shutdown in flight, becomes incorrect.*

STATUS

INOP SYS
CAT 3 DUAL
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 1(2) THR LEVER DISAGREE

LAND ASAP

Both Thrust Lever Angle (TLA) sensors not in agreement on one engine.

■ **On ground (if both TLA not at TOGA or FLX/MCT or if only one TLA is at TOGA or FLX/MCT and the other is below IDLE) :**

ENG (affected) IDLE POWER ONLY.

In that situation, the FADEC automatically selects IDLE

– THR LEVER (affected) . . . . IDLE

■ **During take-off (if both TLA are above IDLE) :**

ENG (affected) TO, FLX, or DRT TO ◁

If both TLA are above IDLE, the FADEC automatically selects TO, FLX TO, or DRT TO ◁ thrust until thrust reduction, after which the maximum available thrust is CLB.

■ **In cruise (with slats retracted) :**

AVAIL MAX POWER : CLB

In flight, if the failure occurs while the thrust lever is between idle and MCT, and if the slats are not extended, (or when MN > 0.55, if the onside EIU is failed) the FADEC selects the larger TLA limited to CLB.

– 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.

■ **In approach (with slats extended) :**

ENG (affected) AT IDLE (when slats are extended for approach).

If TLA at, or below, MCT with slats extended for approach (or when MN < 0.47, if the onside EIU is failed).

– THR LEVER (affected) . . . . IDLE

ENG 1(2) THR LEVER DISAGREE (CONT'D)

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.

ENG (affected) AVAIL MAX PWR : CLB
ON GND ENG (affected) MAX PWR : IDLE.

INOP SYS
ENG 1(2) THR

ENG 1(2) THR LEVER FAULT

No validated thrust lever angle for one engine thrust lever.

LAND ASAP

■ **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
R *it will select CLB thrust.*
Between IDLE and MCT : in manual thrust setting mode, engine rating increases and
R *freezes at CLB 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*
R *selected, autothrust mode will manage thrust between idle and CLB.*

– 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.

● **On ground :**
- THR LEVER (affected) .... IDLE
- ENG MASTER (affected) .... OFF

– AVOID RAPID THR CHANGES or

If the A/THR is engaged, adjust the thrust lever (of the affected engine) to align the thrust lever command with actual N1 and disconnect A/THR.

ENG (affected) SLOW RESPONSE

Depending on the type of failure, one of the above two messages is displayed.

STATUS

AVOID RAPID THR CHANGES, or
ENG (affected) SLOW RESPONSE

ENG COMPRESSOR VANE

Engine 1 and 2 VBV or VSV motor fault detected on the standby ECU channel.

Crew awareness.

ENG 1(2) FUEL CTL FAULT

Failure of Fuel Metering Valve.

● **On ground :**
- THR LEVER (affected) .... IDLE
- ENG MASTER (affected) .... OFF

– AVOID RAPID THR CHANGES, or

ENG (affected) SLOW RESPONSE

Depending on the type of failure, one of the above two messages is displayed.

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) CTL VALVE FAULT

Failure of Burner staging valve, or HP Turbine clearance system, or RACC system.

MAX N2 . . . . 96 %

Retard associated thrust lever to limit N2 to 96 %.

STATUS

MAX ENG (affected) N2 . . . . 96 %

ENG 1(2) SENSOR FAULT

PS3, T25, T3, N1, N2 data not available on both ECU channels.

■ **On ground :**

– THR LEVER (affected) . . . . IDLE
– ENG MASTER (affected) . . . . OFF

■ **In flight :**

AVOID RAPID THR CHANGES.

STATUS

AVOID RAPID THR CHANGES.

ENG 1(2) PROBES FAULT

P0, PT2, T12 data not available on both ECU channels.

Crew awareness.

ENG 1(2) FUEL RETURN VALVE

■ **VALVE NOT OPEN**

The valve is failed closed.

Crew awareness.

■ **VALVE NOT CLOSED**

The valve is failed open.

Crew awareness.

ENG DUAL FAILURE

This warning inhibits the EMER ELEC CONFIG warning, and provides the flight crew with the immediate actions to take in the case of a dual engine failure. This procedure then directs the flight crew to apply the applicable QRH procedure, depending on if there is fuel or not. When applying the QRH ENG DUAL FAILURE paper procedure :

- *If one or more engines are recovered, apply the corresponding ECAM procedure instead*
- *If no engines are recovered, continue to apply the QRH ENG DUAL FAILURE paper procedure. If time permits, clear ECAM alerts, and check the ECAM STATUS page.*

LAND ASAP

- EMER ELEC PWR (if EMER GEN not in line) . . . . MAN ON

  Pressing EMER ELEC PWR MAN ON pushbutton allows extension of RAT and emergency generator coupling.
- THR LEVERS . . . . IDLE
- FAC 1 . . . . OFF THEN ON

  Resetting FAC 1 enables the recovery of characteristics speed displayed on the PFD. Resetting FAC 1 also enables rudder trim recovery, even if no indication is available. When the hydraulic power is lost, the right aileron is lost, and is in the upfloat position. Rudder trim may be used to compensate for this upfloating aileron.

● **IF NO FUEL**

OPT SPD . . . . 220 KT/GREEN DOT

If there is no fuel remaining, the optimum speed is the green dot speed. Initially fly 220 knots then refer to the paper procedure to get the accurate green dot speed.

- ENG/NO FUEL PROC . . . . APPLY

  Refer to the ENG DUAL FAILURE – NO FUEL REMAINING in FCOM 3.02.70 or to the QRH 1.20.

ENG DUAL FAILURE (CONT'D)

● IF FUEL REMAINS

– ENG MODE SEL . . . . IGN

OPT RELIGHT SPD . . . . 300 KT

If there is fuel remaining, the optimum speed is the optimum relight speed.
The ECAM provides reference to an envelope speed. In case of speed indication failure (volcanic ash), pitch attitude for optimum relight is provided in the paper procedure.

– ENG/FUEL PROC . . . . APPLY

Refer to the ENG DUAL FAILURE – FUEL REMAINING in FCOM 3.02.70 or in QRH 1.16.

ENG DUAL FAILURE (CONT'D)

STATUS

MIN RAT SPEED . . . . 140 KT
MAX SPEED 320/.77
MAX BRK PR . . . . 1000 PSI
MANEUVER WITH CARE
FUEL GRVTY FEED
AVOID NEGATIVE G FACTOR
APPR PROC :

- **IF HYD NOT RECOVERED**
  - FOR LDG . . . . USE FLAP 3
- **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

  Refer to the QRH Part 2, or to the FCOM 3.02.80.

  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).

  BRK Y ACCU PR ONLY

  7 full brake applications are available.

  SLATS SLOW

INOP SYS

G+Y HYD
F/CTL PROT
STABILIZER
R AIL
REVERSER 1+2
ADR 2+3
IR 2+3
RA 1+2
SPLR 1+2+4+5
ELAC 2
SEC 2+3
FLAPS
YAW DAMPER
A/CALL OUT
AP 1+2
A/THR
FUEL PUMPS
ANTI SKID
N/W. STEER
AUTO BRK
L/G RETRACT
CAB PR 1+2
PACK 1+2

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/Bs 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

■ **On ground**

- THR LVR (affected) NOT ABOVE IDLE
- ENG (affected) PARAMETERS .... CHECK

  Since engine indications are lost, other system pages such as HYD ELEC or BLEED must be used to confirm engine status

● **IF ABN ENG OPERATION**
- ENG MASTER (affected) .... OFF

■ **In flight**

- THR LEVER (affected) .... IDLE
- ENG (affected) PARAMETERS .... CHECK

  Since engine indications are lost, other system pages such as HYD ELEC or BLEED must be used to confirm engine status

● **IF ABN ENG OPERATION**
- THR LEVER (affected) .... IDLE
- ENG MASTER (affected) .... OFF

ENG 1(2) **SHUT DOWN**

Apply the after ENG SHUT DOWN procedure.

ENG 1(2) FADEC HI TEMP

● **If the ECU temp is above 105°C :**
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.

■ **On ground :**
- THR LEVER (affected) . . . . IDLE
- ENG MASTER (associated engine) . . . . OFF
- ENG MODE SEL . . . . NORM
- FADEC GND PWR . . . . Check OFF

■ **In flight :**
- ENG (affected) PARAMETERS . . . . CHECK

● **IF ABN ENG OPERATION :**
- THR LEVER (affected) . . . . IDLE
- ENG MASTER (affected) . . . . OFF

ENG 1(2) **SHUT DOWN**

Apply the after ENG SHUT DOWN procedure.

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 the EGT may fail to decrease after the MASTER switch is turned OFF.

CAUTION
External fire agents can cause severe corrosive damage and should, therefore, only be considered after having applied the following procedure :

– MAN START (if manual start performed) . . . . OFF
– ENG MASTER (affected) . . . . OFF

Note : Do not press the engine fire pushbutton, since this would cut off the FADEC power supply, which would prevent motoring sequence.

– AIR BLEED PRESS . . . . ESTABLISH

· Select the APU, or opposite BLEED, to motor the engine.
· If APU BLEED is not available, and the opposite engine is shut down, connect external pneumatic power (if readily available).

R – BEACON . . . . ON
– ENG MODE SEL . . . . CRANK
– MAN START . . . . ON

The start valve automatically reopens, when N2 is below 20 %.

● **When burning has stopped :**
– MAN START . . . . OFF
– ENG MODE SEL . . . . NORM
– Maintenance action is due.

HIGH ENGINE VIBRATION

The VIB advisory on ECAM (N1 ≥ 6 units, N2 ≥ 4.3 units) is mainly a guideline to induce the crew to monitor engine parameters more closely.

VIB detection alone does not require engine shut down.

Note : 1. High engine vibrations may be accompanied by cockpit and cabin smoke and/or the smell of burning. This may be due only to compressor blade tip contact with associated abradable seals.

2. High N1 vibrations are generally accompanied by perceivable airframe vibrations. High N2 vibrations can occur without perceivable airframe vibrations.

■ **If no icing conditions :**

– ENG PARAMETERS . . . . CHECK

Check engine parameters and especially EGT ; crosscheck with other engine. Report in maintenance log.

● **If rapid increase above the advisory :**

– THRUST LEVER (affected engine) . . . . RETARD

Flight conditions permitting reduce N1 to maintain vibration level below advisory threshold.

Note : If the VIB indication does not decrease following thrust reduction, this may indicate other problems on the engine. Apply adequate procedure.

■ **If icing conditions :**

An increase of engine vibration in icing conditions with or without engine anti-ice may be due to fan blades and/or spinner icing.

– ATHR . . . . OFF

– ENGINE ANTI ICE . . . . CHECK

If ENG ANTI ICE is off, switch it ON at idle fan speed, one engine after the other with approximately 30 seconds interval.

– THRUST LEVER (one engine at a time) . INCREASE THRUST

Increase thrust to a setting compatible with the flight phase. VIB level will come back to normal after ice shed despite a slight increase during acceleration.

Resume normal operation.

Note : If possible, shut the engine down after landing for taxiing, when vibrations above the advisory level have been experienced during the flight.

ENG 1(2) BLEED STATUS FAULT

Status of bleed valves, pack valves, wing and engine anti ice valves, X bleed valve is not received by the FADEC active channel.

■ **on ground :**

– HI GND IDLE

FADEC increases minimum idle as if valves were opened.

● **If ENG ANTI ICE on :**

– ENG MODE SEL . . . . IGN

When eng anti ice is on, there is no automatic selection of continuous relight since FADEC does not know position of engine anti ice valves position.

● **BEFORE T.O. :**

– PACK (associated side) . . . . OFF

Associated pack must be closed to reduce risk of excessive EGT.

STATUS

ENG 1(2) HI GND IDLE

■ **In flight**

● **If ENG ANTI ICE on**

– ENG MODE SEL . . . . IGN

STATUS

ENG 1(2) HI GND IDLE

ENG 1(2) THR LEVER ABV IDLE

This alert is triggered at landing when one thrust lever is in the reverse detent while the other lever is above IDLE.

– THR LEVER (affected engine) . . . . IDLE

ENG THR LEVERS NOT SET

R *This caution is triggered at takeoff, if the position of the thrust levers is not in accordance*
R *with the thrust mode selected by the FADECs.*

R ● **If no FLEX temp is set, and if the thrust levers are at CLB,**
R **MCT/FLX or between CLB and MCT/FLX positions :**

– THR LEVERS . . . . TOGA

R ● **If FLEX temp is set, and thrust levers are at CLB or between**
R **CLB and MCT/FLX positions :**

– THR LEVERS . . . . MCT/FLX

ENG DUAL FAILURE – FUEL REMAINING

As long as none of the engines recover, the flight crew must apply this paper procedure when required by the ECAM ENG DUAL FAILURE procedure. If time permits, clear ECAM alerts, and check the ECAM STATUS page.

LAND ASAP

– OPTIMUM RELIGHT SPD .... 300 KT

In the case of a speed indication failure (volcanic ash), Pitch attitude for optimum relight speed is :

WEIGHT	Pitch (°)
At or below 50 000 kg/110 000 lb	– 4.5
60 000 kg/132 000 lb	– 3.5
70 000 kg/154 000 lb	– 2.5

At 300 knots, the aircraft can fly up to about 2 NM per 1000 feet (with no wind).

– LANDING STRATEGY .... DETERMINE

Determine whether a runway can be reached, or the most appropriate place for a forced landing/ditching.

– VHF1/HF1 (⧏)/ATC1 .... USE

Notify air traffic control of the nature of the emergency, and state intentions. 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.

– ATC .... NOTIFY

<u>ENG</u> DUAL FAILURE – FUEL REMAINING (CONT'D)

● **IF NO RELIGHT AFTER 30 SEC :**

– ENG MASTERS . . . . OFF 30 S/ON

Unassisted start attempts can be repeated until successful, or until APU bleed is available.

● **IF UNSUCCESSFUL :**

– CREW OXY MASKS (Above FL 100) . . . . ON

Cabin altitude will increase, due to the lack of engine bleed : The EXCESS CAB ALT ECAM warning could be triggered. Depending on the situation, to gain gliding distance, the flight crew may disregard the ECAM emergency descent requirement, because passengers will be provided with oxygen for a sufficient period of time.

– APU (IF AVAIL) . . . . START

If APU is available, it may be started when below FL 250, and the APU BLEED may be used for engine start below FL 200.

– WING ANTI ICE . . . . OFF

– APU BLEED . . . . ON

R ● **IN SEQUENCE**

R – ENG MASTERS (all non running engines) . . . . OFF

R After 30 seconds :

R – ENG MASTERS (one at a time) . . . . ON

ENG DUAL FAILURE – FUEL REMAINING (CONT'D)

● **When APU bleed is available or if engine restart is definitively considered impossible :**
– OPTIMUM SPEED . . . . REFER TO TABLE BELOW

GREEN DOT SPEED WITH ALL ENGINES INOPERATIVE (KNOTS)			
Weight (1000 kg)	At or below FL 200	FL 300	FL 400
78	241	251	261
76	237	247	257
72	229	239	249
68	221	231	241
64	213	223	233
60	205	215	225
56	197	207	217
52	189	199	209
48	181	191	201
44	173	183	193
40	165	175	185

At green dot speed, the aircraft can fly up to approximately 2.5 NM per 1000 feet (with no wind). Average rate of descent is approximately 1600 feet/min.

– CABIN AND COCKPIT . . . . PREPARE
  – *Loose equipment secured.*
  – *Survival equipments prepared.*
  – *Belts and shoulder harnesses locked.*
– CABIN SIGNS . . . . ON
– COMMERCIAL . . . . OFF
– USE RUDDER WITH CARE
  As hydraulic power is only available from the RAT, avoid large and rapid rudder deflection.

● **WHEN BELOW FL 150**
– RAM AIR . . . . ON

ENG DUAL FAILURE – FUEL REMAINING (CONT'D)

APPROACH PREPARATION

Note : Final descent slope, when configured (CONF 3 ; L/G DOWN) will be approximately 800 feet/NM (with no wind).

– BARO . . . . SET
– CREW MASKS/OXY SUPPLY (below FL 100) . . . . OFF

■ **IF FORCED LANDING ANTICIPATED**

APPROACH

– FOR LDG . . . . USE FLAP 3
Only slats extend, and slowly.
– MIN APPR SPEED . . . . 150 KT
– VAPP . . . . DETERMINE
Vapp is the maximum between Vref + 25 knots/150 knots :

Weight (1000 kg)	40	44	48	52	56	60	64	68	72	76	78
Vapp	150	150	150	150	150	155	159	163	167	171	173

● **At a suitable altitude (not below 3000 feet AGL), configure the aircraft for landing (CONF 3 ; L/G DOWN) :**

● **When in CONF 3 and VAPP :**

– GRAVITY GEAR EXTN handcrank . . . . PULL AND TURN
Flight controls revert to direct law at landing gear extension. Wait for CONF 3 and VAPP before extending the landing gear to enable the aircraft to be trimmed for approach. Disregard "USE MAN PITCH TRIM" on the PFD, because the stabilizer is frozen in the position where it was at, when the windmilling was insufficient to provide hydraulic power.

● **When L/G downlocked**

– L/G lever . . . . DOWN
– APPROACH SPEED . . . . ADJUST
Adjust the speed to the determined Vapp. Nevertheless, to reach the landing field/runway, the approach speed may be adjusted up to 200 knots (max speed with slats extended).

– GND SPLR . . . . ARM
– MAX BRK PR . . . . 1000 PSI

⇩

ENG DUAL FAILURE – FUEL REMAINING (CONT'D)

AT 2000 FEET AGL

– CABIN . . . . NOTIFY FOR LANDING

AT 500 FEET AGL

– BRACE FOR IMPACT . . . . ORDER

AT TOUCHDOWN

– ENG MASTERS . . . . OFF
– APU MASTER SW . . . . OFF
– BRAKES ON ACCU ONLY

AFTER LANDING

● **When the aircraft has stopped** :
– PARKING BRK . . . . ON
– ATC . . . . NOTIFY
– FIRE pushbutton (ENG and APU) . . . . PUSH
– AGENTS (ENG and APU) . . . . DISCH
Engine Agent 2 is not available.

R ■ **If Evacuation required :**
R – EVACUATION . . . . INITIATE
R *Announce an appropriate command such as "PASSENGER*
R *EVACUATION-EVACUATE THROUGH LH or RH DOORS" using the Passenger*
R *Address (PA) system, and press the EVAC COMMAND pushbutton, if installed.*
– ELT ◁ . . . . CHECK EMITTING
If not, switch on the transmitter.

R ■ **If Evacuation not required :**
R – CABIN CREW and PASSENGERS (PA) . . . . NOTIFY

ENG DUAL FAILURE – FUEL REMAINING (CONT'D)

■ IF DITCHING ANTICIPATED

APPROACH

– FOR LDG .... USE FLAP 3
Only slats extend, and slowly.
– MIN APPR SPEED .... 150 KT
– VAPP .... DETERMINE
VAPP is the maximum between Vref + 25 knots/150 knots :

Weight (1000 kg)	40	44	48	52	56	60	64	68	72	76	78
Vapp	150	150	150	150	150	155	159	163	167	171	173

● **At a suitable altitude (not below 3000 feet AGL), configure the aircraft for ditching (CONF 3 ; L/G UP)**
– L/G lever .... CHECK UP

AT 2000 FEET AGL

– CABIN .... NOTIFY FOR DITCHING
– DITCHING pushbutton .... ON
In case of strong crosswind, ditch face to the wind.
In the absence of strong crosswind, prefer ditching parallel to the swell. Touchdown with approximately 11 degrees of pitch and minimum aircraft vertical speed.

AT 500 FEET AGL

– BRACE FOR IMPACT .... ORDER

AT TOUCHDOWN

– ENG MASTERS .... OFF
– APU MASTER SW .... OFF

AFTER DITCHING

– ATC (VHF 1) .... NOTIFY
– FIRE pushbutton (ENG and APU) .... PUSH
– AGENT (ENG and APU) .... DISCH
Engine Agent 2 is not available.
– EVACUATION .... INITIATE
– ELT ◁ .... CHECK EMITTING
If not, switch on the transmitter

ENG DUAL FAILURE – NO FUEL REMAINING

The flight crew must apply this paper procedure when required by the ECAM ENG DUAL FAILURE procedure. If time permits, clear ECAM alerts, and check the ECAM STATUS page.

– OPTIMUM SPEED . . . . 220 KT/GREEN DOT

Initially, fly 220 knots, because the PFD may not display the correct green dot speed. Then fly the green dot speed according to the following table :

GREEN DOT SPEED WITH ALL ENGINES INOPERATIVE (KNOTS)			
Weight (1000 kg)	At or below FL 200	FL 300	FL 400
68	221	231	241
64	213	223	233
60	205	215	225
56	197	207	217
52	189	199	209
48	181	191	201
44	173	183	193
40	165	175	185

At green dot speed, the aircraft can fly up to approximately 2.5 NM per 1000 feet (with no wind). Average rate of descent is approximately 1600 feet/min.

– LANDING STRATEGY . . . . DETERMINE

Determine whether a runway can be reached or the most appropriate place for a forced landing/ditching.

– VHF1/HF1 (if installed)/ATC1 . . . . USE

Notify air traffic control of the nature of the emergency, and state intentions. 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.

– ATC . . . . NOTIFY

ENG DUAL FAILURE – NO FUEL REMAINING (CONT'D)

– CREW OXY MASKS (Above FL 100) . . . . ON

Cabin altitude will increase due to the lack of engine bleed : The EXCESS CAB ALT ECAM warning could be triggered. Depending on the situation, to gain gliding distance, the flight crew may disregard the ECAM emergency descent requirement, because passengers will be provided with oxygen for a sufficient period of time.

– CABIN AND COCKPIT . . . . PREPARE

– Loose equipment secured.
– Survival equipments prepared.
– Belts and shoulder harnesses locked.

– SIGNS . . . . ON

– COMMERCIAL . . . . OFF

– USE RUDDER WITH CARE

As hydraulic power is only available from the RAT, avoid large and rapid rudder deflection.

● **WHEN BELOW FL 150**

– RAM AIR . . . . ON

Switch ON the RAM AIR to ensure complete depressurization.

APPROACH PREPARATION

Note : Final descent slope, when configured (CONF 3/L/G DOWN), will be approximately 800 feet/NM (with no wind).

– BARO . . . . SET

– CREW MASKS/OXY SUPPLY (below FL 100) . . . . OFF

ENG DUAL FAILURE – NO FUEL REMAINING (CONT'D)

■ IF FORCED LANDING ANTICIPATED

APPROACH

– FOR LDG . . . . USE FLAP 3
Only slats extend, and slowly.
– MIN APPR SPEED . . . . 150 KT
– VAPP . . . . DETERMINE
Vapp is the maximum between Vref+25 knots/150 knots.

Weight (1000 kg)	40	44	48	52	56	60	64	68	72	76	78
Vapp	150	150	150	150	150	155	159	163	167	171	173

● **At a suitable altitude (not below 3000 feet AGL), configure the aircraft for landing (CONF 3 ; L/G DOWN)**

● **When in CONF 3 and VAPP**

– GRAVITY GEAR EXTN handcrank . . . . PULL AND TURN
Flight controls revert to direct law at landing gear extension. Wait for CONF 3 and VAPP before extending the landing gear to enable the aircraft to be trimmed for approach. Disregard "USE MAN PITCH TRIM" on the PFD, because the stabilizer is frozen in the position where it was at, when the windmilling was insufficient to provide hydraulic power.

● **When L/G downlocked**

– L/G lever . . . . DOWN
– APPROACH SPEED . . . . ADJUST
Adjust the speed to the determined Vapp. Nevertheless, to reach the landing field/runway, the approach speed may be adjusted up to 200 knots (max speed with slats extended).

– GND SPLR . . . . ARM
– MAX BRK PR . . . . 1000 PSI

AT 2000 FEET AGL

– CABIN . . . . NOTIFY FOR LANDING

AT 500 FEET AGL

– BRACE FOR IMPACT . . . . ORDER

AT TOUCHDOWN

– ENG MASTERS . . . . OFF
– BRAKES ON ACCU ONLY

ENG DUAL FAILURE – NO FUEL REMAINING (CONT'D)

AFTER LANDING

- **When the aircraft has stopped :**
  - PARKING BRK . . . . ON
  - ATC . . . . NOTIFY

R ■ **If Evacuation required :**

R – EVACUATION . . . . INITIATE
R *Announce an appropriate command such as "PASSENGER*
R *EVACUATION-EVACUATE THROUGH LH or RH DOORS" using the Passenger*
R *Address (PA) system, and press the EVAC COMMAND pushbutton, if installed.*

– ELT ⊲ . . . . CHECK EMITTING
If not, switch on the transmitter

R ■ **If Evacuation not required :**

R – CABIN CREW and PASSENGERS (PA) . . . . NOTIFY

■ **IT DITCHING ANTICIPATED**

APPROACH

- FOR LDG . . . . USE FLAP 3
  Only slats extend, and slowly.
- MIN APPR SPEED . . . . 150 KT
- VAPP . . . . DETERMINE
  Vapp is the maximum between Vref+25 knots/150 knots :

Weight (1000 kg)	40	44	48	52	56	60	64	68	72	76	78
Vapp	150	150	150	150	150	155	159	163	167	171	173

- **At a suitable altitude (not below 3000 feet AGL), configure the aircraft for ditching (CONF 3 ; L/G UP)**
  - L/G lever . . . . CHECK UP

ENG DUAL FAILURE – NO FUEL REMAINING (CONT'D)

AT 2000 FEET AGL

– CABIN .... NOTIFY FOR DITCHING
– DITCHING pushbutton .... ON
In case of strong crosswind, ditch face to the wind.
In the absence of strong crosswind, prefer ditching parallel to the swell. Touchdown with approximately 11 degrees of pitch and minimum aircraft vertical speed.

AT 500 FEET AGL

– BRACE FOR IMPACT .... ORDER

AT TOUCHDOWN

– ENG MASTERS .... OFF

AFTER DITCHING

– ATC (VHF 1) .... NOTIFY
– EVACUATION .... INITIATE
– ELT ◁ .... CHECK EMITTING
If not, switch on the transmitter

R # EMERGENCY EVACUATION

R *Apply this procedure when considering an emergency evacuation, or when required by the*
R *ECAM. Carefully analyze the situation before deciding to evacuate passengers. However do*
R *not waste valuable time.*

R – AIRCRAFT/PARKING BRK . . . . STOP/ON
R – ATC (VHF1) . . . . NOTIFY
Notify ATC of the nature of the emergency, and state intentions.
Only VHF 1 is available on batteries.
– CABIN CREW (PA) . . . . ALERT
R *Make a short and precise announcement to warn that an emergency evacuation may be*
R *required.*
– $\triangle$P (only if MAN CAB PR has been used) . . . . . . CHECK ZERO
If $\triangle$P is not at zero, MODE SEL on MAN and V/S CTL FULL UP, to fully open the outflow valve.
– ENG MASTER (ALL) . . . . OFF
Associated LP and HP valves close.
– FIRE Pushbuttons (ALL : ENG and APU) . . . . PUSH
– AGENTS (ENG and APU) . . . . AS RQRD
R *Engine Agent 2 is not available.*
R *The use of agents is required if the ENG FIRE or APU FIRE is displayed.*

R ■ **If Evacuation required :**

R – EVACUATION . . . . INITIATE
R *Announce an appropriate command such as "PASSENGER EVACUATION-EVACUATE*
R *THROUGH LH or RH DOORS" using the Passenger Address (PA) system, and press the*
R *EVAC COMMAND pushbutton, if installed.*

R ■ **If Evacuation not required :**

R – CABIN CREW and PASSENGERS (PA) . . . . NOTIFY

DITCHING

This procedure applies when engines are running. If engines are not running, refer to the QRH "ENG DUAL FAILURE" (with or without fuel remaining) procedure, which has been amended to include the ditching procedure when the engines are not running.

PREPARATION

– 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.

– CABIN AND COCKPIT . . . . PREPARE
Notify the cabin crew of the nature of the emergency and state intentions.
Specify the available time.
· loose equipment secured
· survival equipment prepared
· belts and shoulder harnesses locked

– GPWS SYS . . . . OFF
– GPWS TERR . . . . OFF
Pressing OFF the SYS and TERR pushbuttons avoids nuisance warnings.

R – SIGNS . . . . ON
– EMER EXIT LT . . . . ON
– COMMERCIAL . . . . OFF
– LDG ELEV . . . . SELECT 00
– BARO . . . . SET
Omit normal approach and landing check list.

– CREW MASKS/OXY SUPPLY (below FL100) . . . . OFF

APPROACH

– L/G lever . . . . UP
– SLATS and FLAPS . . . . MAX AVAIL

DITCHING (CONT'D)

R **AT 2000 FEET AGL**

- 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
- R CABIN . . . . NOTIFY FOR DITCHING
- DITCHING pushbutton . . . . ON
  The outflow valve, emergency ram air inlet, avionics ventilation inlet and extract valves, and pack flow control valves close.
  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)

R **AT 500 FEET AGL**

R – BRACE FOR IMPACT .... ORDER

R **AT TOUCHDOWN**

R – ENG MASTERS .... OFF
R – APU MASTER SW .... OFF

AFTER DITCHING

– ATC (VHF 1) .... NOTIFY
With engine and APU shut down, only VHF 1 is supplied.
– FIRE pushbutton (ENG and APU) .... PUSH
– AGENTS (ENG 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

This procedure applies when engines are running. If engines are not running, refer to the QRH "ENG DUAL FAILURE" (with or without fuel remaining) procedure, which has been amended to include the forced landing procedure when the engines are not running.

PREPARATION

– ATC/TRANSPONDER . . . . NOTIFY/AS RQRD
Notify the 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.

– CABIN and COCKPIT . . . . PREPARE
Notify the cabin crew of the nature of the emergency and state intentions.
Specify the available time.
· Loose equipment secured.
· Survival equipment prepared.
· Belts and shoulder harnesses locked.

– GPWS SYS . . . . OFF
– GPWS TERR . . . . OFF
Switching the SYS and TERR pushbuttons OFF avoids nuisance warnings.

R – SIGNS . . . . ON
– EMER EXIT LT . . . . ON
– COMMERCIAL . . . . OFF
– LDG ELEV . . . . SET
If not known, select an approximate value.

– BARO . . . . SET
Omit normal approach and landing checklist.

– CREW MASKS/OXY SUPPLY (below FL100) . . . . OFF

APPROACH

– RAM AIR . . . . ON
Switch ON the RAM AIR to ensure complete cabin depressurization on ground.

– L/G lever . . . . DOWN
– SLATS and FLAPS . . . . MAX AVAIL
– GND SPLR . . . . ARM
– MAX BRK PR . . . . 1000 PSi

FORCED LANDING (CONT'D)

AT 2000 FEET AGL

- CABIN .... NOTIFY FOR LANDING

AT 500 FEET AGL

- BRACE FOR IMPACT .... ORDER

AT TOUCHDOWN

- ENG MASTERS .... OFF
- APU MASTER SW .... OFF
- BRAKES ON ACCU ONLY

AFTER LANDING

● **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 and APU) .... PUSH
- AGENTS (ENG and APU) .... DISCH

R ■ **<u>If Evacuation required :</u>**

R – EVACUATION .... INITIATE

R *Announce an appropriate command such as "PASSENGER*
R *EVACUATION-EVACUATE THROUGH LH or RH DOORS" using the Passenger*
R *Address (PA) system, and press the EVAC COMMAND pushbutton, if installed.*

R ■ **<u>If Evacuation not required :</u>**

R – CABIN CREW and PASSENGERS (PA) .... NOTIFY

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 (⊲).

R – SIGNS . . . . ON

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

R *· If autothrust is engaged, check that THR IDLE is displayed on the FMA.*
R *· If not engaged, retard the thrust levers.*

– 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.

R *Landing gear may be extended below 25000 feet. Speed must be reduced to VLO/VLE.*

– 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.

R – MAX FL 100/MEA

⇩

EMER DESCENT (CONT'D)

● **IF CAB ALT > 14 000 feet :**

– PAX OXY MASKS . . . . MAN ON

Contact the cabin crew to confirm that the passenger oxygen masks are released.

Note : Notify the cabin crew, when a safe flight level has been reached and oxygen mask use can be terminated.

OVERWEIGHT LANDING

– LDG CONF . . . . AS REQUIRED

Use the ECAM flap setting, if required for abnormal operations. In all other cases :

– FULL is preferred for optimized landing performance.

– If the aircraft weight is above the maximum weight for go-around (given in the table below), use FLAP 3 for landing.

In all cases, if landing configuration is different from FLAP FULL, use 1+F for go-around.

R *Note : For weights greater than 70000 kg (or 154 000 lb) S speed is greater than VFE*
R *CONF 2 (200 knots). Consequently the crew must select on FCU a speed below*
R *200 knots before setting FLAPS 2. When in FLAPS 2, the crew can use managed*
R *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 the final stages of approach**

– TARGET SPEED . . . . VLS

Reduce the selected speed on the FCU to reach VLS at runway threshold.
Touch down as smoothly as possible (Maximum V/S at touchdown 360 ft/min).

● **At main landing gear touchdown**

– REVERSE THRUST . . . . USE MAX AVAILABLE

● **After nosewheel touchdown**

– BRAKES . . . . APPLY AS NECESSARY

Maximum braking may be used after nosewheel touchdown. But, if landing distance permits, delay or reduce braking to take full benefit of the available runway length.

● **Landing complete**

– BRAKE FANS (◁) . . . . ON

Be prepared for tire deflation, if temperatures exceed 800° C.

MAXIMUM WEIGHT FOR GO AROUND IN CONF 3 (1000 kg)

OAT °C	AIRPORT ELEVATION (FT)							
	0	**2000**	**4000**	**6000**	**8000**	**10000**	**12000**	**14000**
<10	85	83	84	81	77	71	66	61
15	85	83	83	81	77	70	64	57
20	85	83	83	81	75	67	61	55
25	85	83	83	79	72	64	58	
30	84	83	81	77	69			
35	84	83	79	73	66			
40	84	81	75	69				
45	82	76	70					
50	78	72						
55								

CREW INCAPACITATION

If a cockpit crew member becomes incapacitated, the remaining crew member must call a cabin attendant as soon as practicable. The best way to request assistance from the cabin crew, is by means of the passenger address system :
"ATTENTION, PURSER TO COCKPIT PLEASE". The purser or any other cabin attendant must proceed to the cockpit immediately.
The cabin attendant must then :
- tighten and manually lock the shoulder harness of the incapacitated crew member ;
- push the seat completely aft ;
- recline the seat back.

It takes 2 people to remove the dead weight of an unconscious body from a seat without endangering any controls and switches.
If it is not possible to remove the body, one cabin attendant must remain in the cockpit to take care of and observe the incapacited crew member.
In coordination with the purser :
- request assistance from any medically qualified passenger.
- check if a type qualified company pilot is on board to replace the incapacitated crew member.

BOMB ON BOARD

IF POSSIBLE, LAND AND EVACUATE THE AIRCRAFT IMMEDIATELY.
R If it is not possible to land and evacuate the aircraft within 30 minutes, apply the following procedures :

COCKPIT PROCEDURES

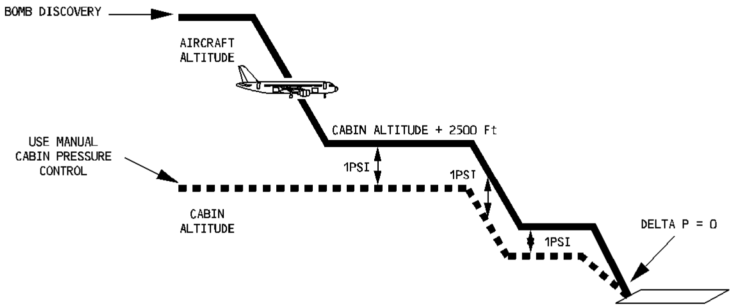
Background

To avoid the activation of an altitude-sensitive bomb, the cabin altitude should not exceed the value at which the bomb has been discovered.
To reduce the effects of the explosion, the aircraft should fly as long as possible with approximately 1 PSI differential pressure, to help the blast go outwards. 1 PSI differential pressure corresponds to a 2500 feet difference between the aircraft and the cabin altitude.
These conditions are achieved by using the manual pressure control.

Procedure

The following procedure assumes that it is initiated during climb or cruise :
- First, maintain the cabin altitude.
- While maintaining the cabin altitude, descend the aircraft to the cabin altitude + 2500 feet and maintain delta P at 1 PSI.
- During further steps of descent, maintain delta P at 1 PSI.
- For landing, reduce the differential pressure to zero, until the final approach.

If flight conditions are different, the crew should adapt the procedure, bearing in mind the above-mentioned principles (background paragraph).



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BOMB ON BOARD (CONT'D)

– AIRCRAFT (if climbing) . . . . LEVEL OFF
– CABIN PRESS MODE SEL . . . . MAN
The purpose is to immediately prevent the cabin altitude from increasing, in order to avoid the activation of an altitude-sensitive bomb.
– CAB ALT . . . . MAINTAIN
Use MAN V/S CTL to maintain the cabin altitude at the value it had when the bomb was discovered.
– CABIN CREW . . . . NOTIFY
– ATC/COMPANY OPERATIONS . . . . NOTIFY
To obtain expert advice from explosive specialists.
– FUEL RESERVES . . . . DETERMINE
Keep in mind that when flying at cabin altitude + 2500ft, fuel consumption in CONF 1, with landing gear down, will be about 2.1 times that consumed in clean configuration.
– NEXT SUITABLE AIRPORT . . . . DETERMINE
– FCU SPEED SELECTION KNOB . . . . PULL AND TURN
Select the most appropriate speed, taking into account the time to destination, the fuel consumption and the fact that low speed could reduce the consequences of possible structural damage, if the bomb explodes.
– DESCENT TO CAB ALT + 2500 FT or MEA or minimum obstacle clearance altitude . . . . INITIATE
Descending to 2500ft above the cabin altitude gives a cabin differential pressure of approximately 1 PSI, which helps to ensure that the blast goes outwards, if the bomb explodes.
– AVOID SHARP MANEUVERS
which might result in the bomb moving.
– CAB ALT . . . . MAINTAIN
Use MAN V/S CTL to maintain the cabin altitude. Initially brief UP input should be required; but, be careful not to increase the cabin altitude.

● **When at CAB ALT + 2500 FT** :
  – 1 PSI DELTA P . . . . MAINTAIN
  Use MAN V/S CTL to adjust delta P to 1 PSI. Brief DN input should be initially required to set 0 ft/min cabin vertical speed.
  – GALLEY . . . . OFF
  ● **When the bomb is secured at the LRBL** :
    – EMER EXIT LT . . . . ON
    To recover minimum cabin lighting when the COMMERCIAL will be switched OFF.
    – 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

This allows CPC to automatically control the cabin altitude to 0 during final approach.

● **When the aircraft is on ground and stopped in a remote area (if possible) :**

R ■ **<u>If Evacuation required :</u>**

R – EVACUATION . . . . INITIATE

R *Avoid exits and exiting on the same side as the bomb and near the bomb.*
R *Announce an appropriate command such as "PASSENGER*
R *EVACUATION-EVACUATE THROUGH LH or RH DOORS" using the Passenger*
R *Address (PA) system, and press the EVAC COMMAND pushbutton, if installed.*

R ■ **<u>If Evacuation not required :</u>**

R – CABIN CREW and PASSENGERS (PA) . . . . NOTIFY

<u>CABIN PROCEDURES</u>

If a suspect device is found in the cabin :

WARNING

Do not cut or disconnect any wires and do not open or attempt to gain entry to internal components of a closed or concealed suspect device. Any attempt may result in an explosion. Booby-trapped closed devices have been used on aircraft in the past.

WARNING

Alternate locations must not be used without consulting with an aviation explosives security specialist. Never take a suspect device to the flight deck.

CAUTION

The least risk bomb location for the aircraft structure and systems is center of the RH aft cabin door.

BOMB ON BOARD (CONT'D)

– EOD PERSONNEL ON BOARD .... CHECK

Announce "Is there any EOD personnel on board ?". By using the initials, only persons 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. On full flights, it may be necessary to double up passengers to achieve standoff from the suspect device.
Passengers near the bomb should protect their heads with pillows, blankets.
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.
Service items may need to be collected in order to secure tray tables.

– PORTABLE ELECTRONIC DEVICES .... SWITCH OFF

The cabin crews must command passengers to switch off all portable electronic devices.

– 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 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.

– EMERGENCY EQUIPMENTS .... REMOVE AND STOW

Emergency equipments (PBE, fire extinguisher, ...) located close to the LRBL must be removed and stowed in alternate location.

– GALLEY/IFE POWER .... OFF

All galley and IFE equipments located close to the LRBL must be switched off.

● **If the bomb can be moved :**

– RH AFT CABIN DOOR SLIDE .... DISARM

BOMB ON BOARD (CONT'D)

– LEAST RISK BOMB LOCATION (LRBL) . . . . PREPARE

Build up a platform of solid baggage against the door up to about 25 cm (10 in) below the middle of the door.
On top of this, build up at least 25 cm (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.

CAUTION

DO NOT OMIT THE PLASTIC SHEETS, AS THE SUSPECT DEVICE COULD GET WET AND POSSIBLY SHORT CIRCUIT ELECTRONIC COMPONENTS CAUSING INADVERTENT DEVICE ACTIVATION.

– BOMB INDICATION LINE . . . . POSITION

Note : A bomb location indicator line is a 6 to 8 foot (1.8 to 2.4 m) (e.g. neckties, headset cord, or belts connected together) preferably of constrating color, that helps the responding bomb squad find the precise location of the suspect device within the LRBL stack once constructed.
Position the bomb indication line from the location on the platform where you will place the suspect device, EXTENDING outward into the aisle.

– 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.

CAUTION

Ensure that the suspect device, when placed on the stack against the door, is above the slide pack but not against the door handle, and if possible, avoid placement in the view port.

– LEAST RISK BOMB LOCATION (LRBL) . . . . COMPLETE

Place an additional single thin sheet of plastic over the bomb.

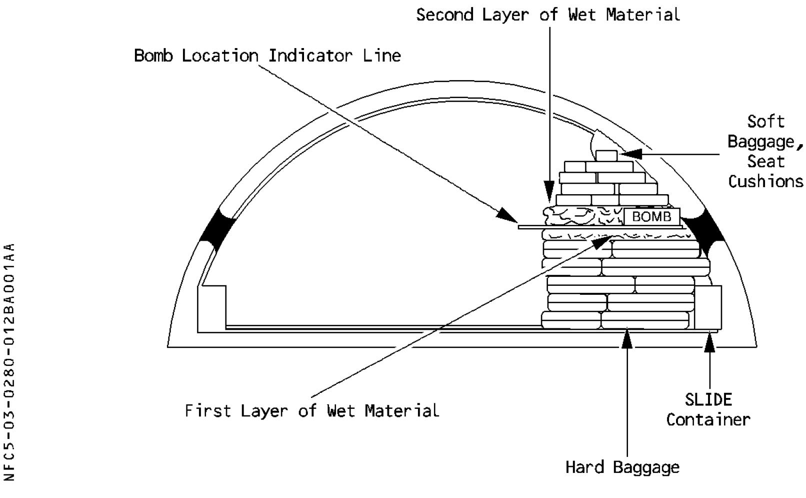
CAUTION

DO NOT OMIT THE PLASTIC SHEETS, AS THE SUSPECT DEVICE COULD GET WET AND POSSIBLY SHORT CIRCUIT ELECTRONIC COMPONENTS CAUSING INADVERTENT DEVICE ACTIVATION.

BOMB ON BOARD (CONT'D)

Build up at 25 cm (10 in) 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 directed in 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 stack 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.

LRBL STACK



BOMB ON BOARD (CONT'D)

- PASSENGERS .... MOVE/ADVISE

  Move passengers at least 4 seat rows away from the least risk bomb location (RH aft cabin door). On full flights, it may be necessary to double up passengers to achieve standoff from the suspect device.

  Passengers near the bomb should protect their heads with pillows, blankets. All passengers must remain seated with seatbelts on and, if possible, head below the top of the head rest. Seat backs and tray tables must be in their full upright position.

- CABIN CREW .... NOTIFY COCKPIT CREW

  Cabin crew notify the flight crew that the bomb is secured at the LRBL.

- 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/ADR CHECK PROC procedure.
  1. *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.*
  2. *If sufficient visibility is not granted for approach due to windshield/window damage, consider AUTOLAND. If AUTOLAND is not available, consider opening the sliding window on the PF's side, after cabin depressurization. To manually depressurize the cabin :*
     - CAB PRESS MODE SEL .... MAN
     - MAN V/S CTL .... FULL UP
     Due to the increased noise level, pay particular attention to visual warnings.

COCKPIT WINDSHIELD/WINDOW CRACKED

R *In case of a one ply crack, whichever one it may be, the windshield/windows are still able to sustain the maximum differential pressure. However, 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 △P 5 PSI, without resulting in an excessive cabin altitude and corresponding EXCESS CAB ALT warning.
The following procedure allows maintaining △P 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 :

△P = 5 PSI	FL	100	150	200	230
	CABIN ALTITUDE	0	3 000	6 000	8 000

● **When starting the final descent :**

– CAB PRESS MODE SEL . . . . AUTO

R *Note : If sufficient visibility is not granted for approach, consider AUTOLAND. If AUTOLAND*
R *is not available, consider opening the sliding window on the PF's side, after cabin*
R *depressurization. To manually depressurize the cabin :*
R *- CAB PRESS MODE SEL .... MAN*
R *- MAN V/S CTL .... FULL UP*
R *Due to the increased noise level, pay particular attention to visual warnings.*

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 on the rear C/B panel :

. ANTI ICE L WHSLD (AF10 on 123VU) . ANTI ICE/WINDOWS L C/B (X14 on 122VU)
. ANTI ICE R WHSLD (AF03 on 123VU) . ANTI ICE/WINDOWS R C/B (W14 on 122VU)

R
ECAM ADVISORY CONDITIONS

SYSTEM	CONDITIONS	RECOMMENDED ACTION
CAB PRESS	CAB VERTICAL SPEED V/S > 1800 ft/min	CPC changeover is recommended : MODE SEL . . . . MAN Wait 10 seconds, then : MODE SEL . . . . AUTO
	CAB ALTITUDE altitude ≥ 8800 ft	MODE SEL . . . . MAN Manual pressure control
	CAB DIFF PRESS △ P ≥ 1.5 psi in phase 7	LDG ELEV . . . . ADJUST If unsuccessful : MODE SEL . . . . MAN Manual pressure control
ELEC	IDG OIL TEMP ≥ 147°C	Reduce IDG load, if possible (GALLEY or GEN OFF). If required, restore when the temperature has dropped. Restrict generator use to a short time, if temperature rises again excessively.
FUEL	Difference between wing fuel quantities is greater than 1500 kg (3307 lb).	FUEL MANAGEMENT . . . . CHECK If a fuel leak is suspected, refer to the FUEL LEAK procedure. For limitations, see 3.01.28.
	Fuel temp is greater than : 45°C in inner cell, or 55°C in outer cell.	GALLEY . . . . OFF
	Fuel temp is lower than – 40°C in inner or outer cell.	Consider descending to a lower altitude, and/or increasing Mach to increase TAT.
OXY	Cockpit oxygen bottle pressure < 800 psi.	If mask is not being used, check if it is correctly stowed, as per FCOM 1.35.20.
APU	EGT > EGT MAX – 33°C (inhibited during APU start).	
	OIL QTY (LOW OIL LEVEL message pulses).	If there is no oil leak, then the remaining oil quantity allows normal APU operation for about 10 hours.

R ## ECAM ADVISORY CONDITIONS

SYSTEM	CONDITIONS	RECOMMENDED ACTION
ENG	OIL PRESS P < 16 PSI	· If oil pressure is between 16 and 13 psi (advisory), continue normal operation. · If oil pressure is below 13 psi (red indication) without the ENG OIL LO PR ECAM warning, continue normal engine operation (it can be assumed that the oil pressure transducer is faulty). In both cases, monitor other engine parameters especially oil temperature and oil quantity.
	OIL PRESS P > 90 PSI	Monitor other engine parameters closely for symptoms of engine malfunction. If high oil pressure is not accompanied by other abnormal indications operate engine normally for remainder of flight. Record high oil pressure and corresponding N2 readings for maintenance action.
	OIL TEMP T > 140°C	A rise in oil temperature during normal steady-state operation indicates a system malfunction and should be closely monitored for other symptoms of engine malfunction. Note : *If OIL TEMP rise follows thrust reduction, increasing thrust may reduce oil temperature.* In addition, a rise in oil temperature could be related to the IDG oil cooling system. To reduce oil temperature rise before limits are reached, the following are recommended : 1. Low Speed - Increase engine speed to increase fuel flow and thereby cool IDG oil. 2. High Speed - Reduce generator load or turn off generator. If oil temperature continues to rise, mechanically disconnect IDG.
	OIL QTY < 3 qt	If oil quantity low at high power setting, expect level increase after power reduction
	NAC TEMP ≥ 240°C	Monitor engine parameters and cross check with other engine
	VIBRATION N1 ≥ 6 units N2 ≥ 4,3 units	Refer to HIGH ENGINE VIBRATION procedure. Note : *The advisory threshold may be decreased by a MCDU procedure at the level of vibration reached during the last flight. If this function has been activated, the N1 and N2 VIB indication will respectively pulse below 6 and 4.3.*

R
LDG CONF/APPR SPD/LDG DIST FOLLOWING FAILURES

A320 FAMILY	FAILURE	FLAPS LEVER POSITION FOR LDG	△ VREF APPR SPD INCREMENT	MULTIPLY LDG DIST (CONF FULL) BY		
				DRY	WET (b)	CONTA (b)
ELEC	AC BUS 1 (a)	3 FULL	6 –	1.30 1.20	1.30 1.20	1.20 1.10
	DC BUS 2 (a)	3 FULL	6 –	1.40 1.25	1.50 1.35	1.40 1.25
	DC ESS BUS (a) if there is no ice accretion	3 FULL	6 –	1.30 1.20	1.40 1.25	1.30 1.20
	DC ESS BUS (a) if there is ice accretion	3 FULL	16 10	1.50 1.35	1.55 1.40	1.45 1.30
	DC EMER CONF (a)	3 FULL	6 –	3.35 3.05	2.80 2.55	2.50 2.25
	DC BUS 1+2 (a) if there is no ice accretion	3 FULL	6 –	2.15 1.95	1.80 1.65	1.60 1.45
	DC BUS 1+2 (a) if there is ice accretion	3 FULL	16 10	2.40 2.20	2.05 1.85	1.80 1.65
	EMER ELEC CONF	3	10	2.65	2.30	2.15
FTL CTL	ONE SPLR FAULT (a)	3 FULL	6 –	1.30 1.20	1.30 1.20	1.20 1.10
	TWO SPLR FAULT (a)	3 FULL	6 –	1.40 1.25	1.40 1.25	1.25 1.15
	THREE SPLR FAULT (a)	3 FULL	6 –	1.45 1.30	1.40 1.25	1.30 1.20
	ALL SPLR FAULT (a)	3 FULL	6 –	1.65 1.50	1.65 1.50	1.55 1.40
	SEC 1 or SEC 3 FAULT (a)	3 FULL	6 –	1.40 1.25	1.40 1.25	1.25 1.15
	SEC 2 FAULT (a)	3 FULL	6 –	1.30 1.20	1.30 1.20	1.20 1.10
	SEC 2+3 FAULT (a)	3 FULL	6 –	1.40 1.25	1.40 1.25	1.25 1.15
	SEC 1+3 FAULT (a)	3 FULL	6 –	1.50 1.35	1.60 1.45	1.55 1.40
	SEC 1+2 FAULT (a)	3 FULL	6 –	1.40 1.25	1.45 1.30	1.40 1.25
	RUDDER JAM (a)	3 FULL	6 –	1.65 1.50	1.55 1.40	1.50 1.35
	SEC 1+2+3 FAULT	3	10	1.60	2.20	2.25
	ALTN LAW/DIRECT LAW/ELAC 1+2/L+R ELEV FAULT/L(R) ELEV FAULT/STAB JAM	3	10	1.35*	1.30*	1.25*

R (a) Flaps FULL and Flaps 3 are both acceptable positions. Flaps FULL is
R recommended, but the flight crew can use Flaps 3, if necessary, for
R operational reasons.

(b) The landing distance coefficients for wet or contaminated runways assume the use of maximum reverse thrust on all of the operative reversers. Apply these coefficients to the actual landing distance with reversers.

R

A320 FAMILY	FAILURE		FLAPS LEVER POSITION FOR LDG	△ VREF APPR SPD INCREMENT	MULTIPLY LDG DIST (CONF FULL) BY		
					DRY	WET (b)	CONTA (b)
FLAPS/ SLATS	FLAPS and SLATS at zero		1	60 (APPR) 50 (THRESHOLD)	2.40*	2.10*	2.10*
	FLAPS <1	S<1 S≥1	3 3	45 25	2.30* 1.95*	2.00* 1.60*	2.00* 1.60*
	1≤FLAPS<2	S<1 S≥1	3 3	30 15	1.85* 1.50*	1.70* 1.45*	1.60* 1.35*
	2≤FLAPS<3	S<1 S≥1	3 3	25 10	1.70* 1.40*	1.55* 1.35*	1.50* 1.25*
	FLAPS = 3	S<1 1≤S≤3 S>3	3 3 3	25 10 5	1.65* 1.35* 1.30*	1.55* 1.30* 1.25*	1.50* 1.25* 1.20*
	FLAPS > 3	S<1	NOT ALLOWED				
		1≤S≤3 S>3	FULL FULL	10 5	1.30* 1.25*	1.30* 1.25*	1.20* 1.15*
HYD	GREEN (a)		3 FULL	6 –	1.45 1.30	1.50 1.35	1.45 1.30
	BLUE (a)		3 FULL	6 –	1.30 1.20	1.30 1.20	1.20 1.10
	YELLOW (a)		3 FULL	6 –	1.40 1.25	1.45 1.30	1.30 1.20
	BLUE + YELLOW (a)		3 FULL	6 –	1.85 1.70	2.10 1.90	2.05 1.85
	GREEN + BLUE		3	25	1.80	2.00	1.95
	GREEN + YELLOW		3	25	2.80	2.45	2.45
BRK	ANTI SKID (a)		3 FULL	6 –	1.95 1.75	1.45 1.30	1.20 1.10
	BRK RELEASED (a)		3 FULL	6 –	1.55 1.40	1.40 1.25	1.30 1.20
	ALTN L(R) RELEASED (a) if NORM BRK FAULT		3 FULL	6 –	2.60 2.35	2.05 1.85	2.10 1.90
	ALTN L(R) RELEASED (a) (if G SYS LO PR)		3 FULL	6 –	2.75 2.50	2.50 2.25	3.05 2.75
	NORM BRK FAULT (a)		3 FULL	6 –	1.40 1.25	1.30 1.20	1.25 1.15
	NORM + ALTN BRK FAULT (a)		3 FULL	6 –	1.95 1.75	1.45 1.30	1.20 1.10
NAV	IR 1+2+3 FAULT		3	10	2.60	2.10	1.70
	UNRELIABLE SPEED INDICATION/ADR CHECK PROC		3	15	1.45*	1.4*	1.3*
	DUAL IR FAULT/DUAL ADR FAULT ADR 1+2+3 FAULT		3	10	1.35*	1.30*	1.25*
BLEED	WING ANTI ICE NOT AVAIL (a) if there is ice acretion		3 FULL	16 10	1.45 1.30	1.45 1.30	1.30 1.20
ENG	REV UNLOCK with buffet (c)		1 3	55 (APPR) 40 (THRESHOLD) 10	2.15* 1.35*	2.05* 1.40*	2.05* 1.35*

R (a) Flaps FULL and Flaps 3 are both acceptable positions. Flaps FULL is
R recommended, but the flight crew can use Flaps 3, if necessary, for
R operational reasons.

(b) The landing distance coefficients for wet or contaminated runways assume the use of maximum reverse thrust on all of the operative reversers. Apply these coefficients to the actual landing distance with reversers.

(c) The applicable landing configuration (CONF 1 or CONF 3) is displayed on the ECAM STATUS page.

* See below for multiple failures

<u>USE OF THE TABLE (PREVIOUS PAGES)</u>

- *△ VREF values take into account the necessary corrections, due to failures and the required landing configuration. The △ VREF values are rounded off to take into account all possible weight ranges.*
  LDG DIST factors must be applied to the actual "LANDING DISTANCE WITHOUT AUTOBRAKE-CONFIGURATION FULL" (Refer to QRH 4.03).
- *For a single failure :*
  - *Determine the LDG CONF to be selected*
  - *Determine the △ VREF*
  - *VAPP = VREF + △ VREF + WIND CORRECTION (Refer to QRH 2.31).*
  - *Determine the LDG DIST factor.*
- *For multiple failures :*
  - *Only combine PRIMARY or SINGLE failures. In the case of a PRIMARY failure, the associated effects of SECONDARY(s) failure are taken into account by the △ VREF and LDG DIST factor computation.*
  - *Use the <u>lowest LDG CONF</u>*
  - *Use the <u>highest △ VREF</u> to compute the VAPP.*
  - *Multiply the applicable LDG DIST factors together, unless all values are marked with an asterisk (*). If all values are marked with an asterisk, use the highest LDG DIST factor.*
  - R *<u>Examples Applicable to Dry Runways</u> :*

FLAPS FAULT ($F < 3$, $S \geq 1$)	LDG CONF 3	△ VREF = 10 KT	LDG DIST × 1.40*
BRK ANTI SKID	LDG CONF FULL	△ VREF = 0	LDG DIST × 1.75
TOTAL	LDG CONF 3	△ VREF = 10 KT	LDG DIST × 2.45

VREF = 131 KT → VAPP = 131 + 10 + WIND (10 KT MAX)
= 141 KT + WIND (10 KT MAX)

ALTN LAW	LDG CONF 3	△ VREF = 10 KT	LDG DIST × 1.35*
FLAPS FAULT ($F < 1$, $S \geq 1$)	LDG CONF 3	△ VREF = 25 KT	LDG DIST × 1.95*
TOTAL	LDG CONF 3	△ VREF = 25 KT	LDG DIST × 1.95

VREF = 140 KT → VAPP = 140 + 25 + 0 (No wind correction) = 165 KT

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.

R *2. If the FD bars are not available, use an initial pitch attitude up to 17.5° with*
R *full backstick, if necessary. If needed, 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.

R – GO-AROUND . . . . PERFORM

This includes the use of full backstick, if required.

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.

TAILSTRIKE

In the event of a tailstrike, apply the following procedure :

LAND ASAP

– MAX FL . . . . 100 or MSA

500 feet/minute should be targeted for the climb, to minimize pressure changes, and for passenger and crew comfort. Similarly, the rate of descent must be limited to about 1000 feet/minute, except for the final approach that must be performed normally.
Notify the ATC of the aircraft's rate of climb.

– RAM AIR . . . . ON
– PACK 1 and 2 . . . . OFF

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.

R **COCKPIT-ASSIGNED DUTIES FOR EVACUATION**

– If it is NOT POSSIBLE to reach the passenger cabin :
The cockpit crew should evacuate the aircraft via the cockpit clearview windows, by using the escape ropes.
On ground, each crewmember must help passengers, and direct them away from the aircraft.
– If it is POSSIBLE to reach the passenger cabin :

R

CAPT	– Is the last person to leave the cockpit : Proceeds to the cabin, and helps with passenger evacuation, as necessary. – Is the last person to leave the aircraft : Checks that all persons have evacuated the aircraft. – Evacuates the aircraft, via the rear door, or any other available exit, if he/she cannot reach the rear door. – On ground, he/she takes command of operations until rescue units arrive.
F/O	– Proceeds to the cabin, and takes the emergency equipment. – Evacuates the aircraft, using any available exit. – Helps passengers on ground, and directs them away from the aircraft.

CABIN CREW-ASSIGNED AREAS FOR EVACUATION

R

CABIN CREW DESIGNATION	ASSIGNED JUMPSEAT AND DOOR	ASSIGNED JUMPSEAT	ASSIGNED AREA
1 PURSER	DOOR 1 LH	FWD OUTBOARD	FWD/MID
1 CABIN CREW	DOOR 1 LH	FWD INBOARD	FWD/MID
1 CABIN CREW	DOOR 2 RH	AFT CENTER	MID/AFT
1 CABIN CREW	DOOR 2 LH	REARWARD	MID/AFT

R *Note : These procedures are established for the minimum required number of 4 cabin*
R *crews.*

COMMUNICATIONS

1. EMERGENCY CALL			
FROM	TO	COMMUNICATION METHOD(S)	REMARKS
COCKPIT	CABIN	– Press "EMER" CALL pushbutton on the CALLS panel, or – Passenger Address (PA) System : "PURSER TO COCKPIT PLEASE!"	Purser must immediately go to the cockpit.
CABIN	COCKPIT	– Interphone : "PRIO CAPT"	Any cabin crewmember can make such a call. The cockpit crew must reply.

2. EMERGENCY ALERT			
FROM	TO	COMMUNICATION METHOD(S)	REMARKS
COCKPIT	CABIN	– PA System : "ATTENTION CREW! AT STATIONS !"	The cockpit crew makes a short and precise announcement to warn that an emergency evacuation may soon be required. Cabin crews must proceed to their emergency stations, and fasten their seatbelts.

R

3. NOTIFICATION TO PASSENGERS			
FROM	TO	COMMUNICATION METHOD(S)	REMARKS
COCKPIT	CABIN	– SIGNS ON – PA System	For psychological reasons, the cockpit crew should be the first to inform of an intended emergency landing.
PURSER	CABIN	– CABIN LIGHTS 100 % – PA System	Purser informs passengers that they have to pay special attention to these warnings : – "FINISH PREPARATION" – "BRACE FOR IMPACT" – "PASSENGERS EVACUATE"

R

4. FINISH PREPARATION			
FROM	TO	COMMUNICATION METHOD(S)	REMARKS
COCKPIT	CABIN	– Passenger Address (PA) System : "FINISH PREPARATION"	The cockpit crew gives this order a short time before an emergency landing.

R

5. BRACE FOR IMPACT			
FROM	TO	COMMUNICATION METHOD(S)	REMARKS
COCKPIT	CABIN	– PA System : "BRACE FOR IMPACT !"	The cockpit crew gives this order no later than 1 minute before impact.

R

6. INITIATE EVACUATION (RESTRICTED EXITS)			
FROM	TO	COMMUNICATION METHOD(S)	REMARKS
COCKPIT	CABIN	– PA System : "PASSENGERS EVACUATE" – Activate EVAC signals ◁	The cockpit crew orders an immediate evacuation, and the cabin crew directs passengers to all available exists.
CABIN	COCKPIT AND CABIN	– EVAC SIGNAL SYSTEM ◁ on FWD ATTND panel (FAP) – PA System or megaphone	Used by the cabin crew, if there is no signal or order from the cockpit, and if it is unmistakably clear that the aircraft must be evacuated.
CABIN	CABIN	– Verbal	The cabin crew stands up and shouts : – "SEATBELTS OFF!" – "LEAVE EVERYTHING!" – "GET OUT!" – "COME THIS WAY!"

R

7. EVACUATION NOT REQUIRED			
FROM	TO	COMMUNICATION METHOD(S)	REMARKS
COCKPIT	CABIN	– PA System : "CABIN CREW and PASSENGERS REMAIN SEATED !"	When the Captain decides that an evacuation is not required, the cockpit crew makes an immediate announcement to this effect.

ON GROUND EVACUATION

COCKPIT CREW PROCEDURES

- **The cockpit crew notifies the cabin crew of the nature of the emergency, and states intentions.**
- **The cockpit crew uses the Passenger Address system to make an appropriate announcement, such as : "PASSENGERS EVACUATE", and presses the EVAC COMMAND pushbutton.**

CABIN CREW PROCEDURES

When the cabin receives the order to evacuate, each cabin crewmember must proceed as follows :

- **STAND UP AND SHOUT . . . . "UNFASTEN SEATBELTS"**
- **OUTSIDE CONDITIONS . . . . CHECK**

● **If outside conditions are safe :**

  - **DOOR IN ARMED POSITION . . . . OPEN FIRMLY**
  - **SHOUT . . . . "COME THIS WAY"**

  ● **If the door does not open automatically :**

    - **DOOR . . . . PUSH AND OPEN MANUALLY**

R - **SLIDE (or SLIDERAFT) DEPLOYMENT . . . . CHECK FULL DEPLOYMENT**
R It takes approximately four seconds for the slide (or slideraft) to deploy.

R ● **If the slide (or slideraft) does not automatically inflate :**

    - **RED, MANUAL INFLATION HANDLE . . . . PULL**
R The red, manual inflation handle is located on the right-hand side of the slide (or slideraft) girt extension.

R - **ORDER . . . . "PASSENGERS EVACUATE"**
  - **PASSENGER EVACUATION . . . . EXPEDITE**

R ● **If the slide (or slideraft) becomes unserviceable :**

- **PASSENGER EVACUATION . . . . STOP**
- **PASSENGERS TO ANOTHER USABLE EXIT . . . . REDIRECT**

- **TOTAL ZONE EVACUATION . . . . CHECK**
- **CABIN CREW . . . . EVACUATE**
- **PASSENGERS AWAY FROM THE AIRCRAFT . . . . DIRECT**

● **If outside conditions are unsafe :**

- **EXIT DOOR . . . . BLOCK**
- R **PASSENGERS TO NEAREST USABLE EXIT . . . . REDIRECT**

COCKPIT EVACUATION THROUGH WINDOW

OPENING THE SLIDING WINDOW

- **HANDLE . . . . PUSH DOWN AND PULL BACK**
  Pulling the handle backwards, opens the sliding window.

COCKPIT EVACUATION WITH ESCAPE ROPE

- **ESCAPE ROPE STOWAGE . . . . OPEN**
  The escape rope stowage is located above the sliding window, on either side of the overhead panel.

- **ESCAPE ROPE . . . . UNROLL**
  Unroll the escape rope until the red flag appears, and throw it through the window.

- **SEAT . . . . STEP ON**

- **ESCAPE ROPE . . . . GRASP**
  Grasp the escape rope firmly with both hands, and slide down along the rope.

R **EVACUATION ON WATER**

CABIN CREW RESPONSIBLE FOR TYPE "I" DOORS

When the cabin receives the order to evacuate, each cabin crewmember must proceed as follows :

– **CHILDREN LIFEVESTS . . . . DISTRIBUTE**

– **STAND UP AND SHOUT . . "UNFASTEN SEATBELTS – PUT ON YOUR LIFEVEST"**
Inflate the lifevest, only once outside the aircraft.

R – **ORDER . . . . "REMOVE SHOES"**

● **If the Type I door is usable :**

– **DOOR IN ARMED POSITION . . . . OPEN**

– **SLIDE . . . . DEPLOY**

– **RED, MANUAL INFLATION HANDLE . . . . PULL**
Do not wait for automatic inflation of the slide.

■ **If the water level is close to the door sill :**
The slide inflates on the water.

– **SLIDE . . . . LEAVE ATTACHED TO CABIN FLOOR**

R – **PASSENGER LIFEVESTS . . . . INFLATE WHEN EVACUATING AIRCRAFT**

R – **PASSENGERS . . . . EVACUATE**
R Evacuate passengers into the water. The slide is used as a flotation device.

– **TOTAL ZONE EVACUATION . . . . CHECK**

– **LAST CREWMEMBER . . . . EVACUATE**

– **SLIDE . . . . SEPARATE FROM DOOR SILL**
The last crewmember must separate the slide from the door sill.

– **MOORING LINE . . . . CUT**

■ **If the water level is too far away from the door sill :**

– **SLIDE . . . . DISCONNECT FROM DOOR SILL**
The slide remains tied to the aircraft by a 6–meter (20 feet) mooring line.

– **MOORING LINE . . . . HOLD**
To keep the slide close to the exit, hold the mooring line.

R – **PASSENGER LIFEVESTS . . . . INFLATE WHEN EVACUATING AIRCRAFT**

– **PASSENGERS . . . . EVACUATE**
R Evacuate passengers into the water. The slide is used as a flotation device.

– **TOTAL ZONE EVACUATION . . . . CHECK**

– **LAST CREWMEMBER . . . . EVACUATE**

– **MOORING LINE . . . . CUT**

FOREWORD

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.
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
R TECHNIQUES Chapter (3.04), and in the SPECIAL OPERATIONS Chapter (2.04).

TECHNICAL CONDITION OF THE AIRCRAFT

- The crew will verify the technical state of the aircraft (deferred defect list), with regard to airworthiness, acceptability of malfunctions (MEL), and influence on the flight plan.

WEATHER BRIEFING

- The crew will get a weather briefing.
- The briefing should include :
  - Actual and expected weather conditions, including runway conditions for takeoff and climb-out.
  - Significant weather enroute, including winds and temperatures.
  - Terminal forecasts for destination and alternate airports.
  - Actual weather for destination and alternates, for short range flights and recent past weather, if available.
  - Survey of the meteorological conditions at airports along the planned route.

Weather can affect the choice of routing (for example, influence which route is quickest) and the choice of flight level. The flight crew must also consider the possibility of runways being contaminated at the departure and destination airfields. The flight crew must also verify ISA deviations and enroute icing conditions, and must consider the possibility of holding due to weather at the destination.

NOTAMS

- The flight crew must examine NOTAMs for changes to routings, unserviceable navaids, availability of runways and approach aids etc, all of which may affect the final fuel requirement.
- In order to prevent the risks of projection of debris towards the trimmable horizontal stabilizer and the elevators, it is not recommended to takeoff from runways in bad condition (loose surface, under repair, covered with debris...).
- GPS Primary availability :
  - For RNP AR operations, the GPS Primary availability prediction should be checked to ensure the RNP will be available for the estimated time of operation.

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.

OPTIMUM FLIGHT LEVEL

The flight crew should choose a flight level that is as close to the optimum as possible. To obtain the optimum flight level, use the chart in the QRH or in the FCOM (Refer to FCOM
R 2.05.20).
As a general rule, an altitude that is 4000 feet below the optimum produces a significant penalty (approximately 5 % of fuel). Flight 8000 feet below the optimum altitude produces a penalty of more than 10 % against trip fuel. (The usual contingency allowance is 5 %).

FUEL REQUIREMENTS

COMPUTERIZED FLIGHT PLAN CHECK

In most cases the flight crew uses a computer-derived flight plan to obtain the correct fuel requirements. Although these computerized requirements are normally accurate, the flight crew must check them for gross errors.
The easiest way to do this is to use the "Quick Determination of F-PLN" tables in FCOM
R 2.05.40. Although the aircraft will fly at ECON MACH that is based on the cost index, the 0.78 Mach table is accurate enough to permit the crew to check for gross error.
Ensure that both the captain and the first officer have verified that the fuel calculations and required fuel on board are correct and that the figure complies with the applicable regulations.

FUEL TRANSPORTATION

The flight crew must check the policy covering the "tankering" of fuel on sectors where there is a favourable fuel price differential or operational requirement.
Remember that carrying unnecessary extra fuel increases the fuel consumption for that sector and therefore reduces the economy of the operation (lower flex temperature, more tire and brake wear, more time in climb phase, lower optimum flight level etc).

SAFETY EXTERIOR INSPECTION

Items marked by (*) are the only steps to be completed during a transit stop.
This inspection ensures that the aircraft and its surroundings are safe for operations.
On arriving at the aircraft, check for obstructions in the vicinity, engineering activity, refueling, etc.

*– **WHEEL CHOCKS . . . . CHECK IN PLACE**

*– **LANDING GEAR DOORS . . . . CHECK POSITION**

WARNING
Do not pressurize the green hydraulic system without clearance from ground personnel, if any gear door is open. Remember that the green hydraulic system is pressurized if the yellow system is pressurized and the PTU is on auto.

*– **APU AREA . . . . CHECK**
Observe that the APU inlet and outlet are clear.

PRELIMINARY COCKPIT PREPARATION

Items marked by asterisks (*) are the only steps to be completed during a transit stop.
The following procedure, performed by the PNF ensures that all required checks are performed before the application of electrical power to avoid inadvertent operation of systems and danger to the aircraft and personnel.
Included is APU starting and the establishment of electrical and pneumatic power.

ENG

– **MASTER 1 and 2 . . . . OFF**

– **MODE selector . . . . NORM**

L/G

– **L/G lever . . . . Check DOWN position**

WIPERS

– **WIPERS . . . . OFF**

ELEC

■ **If the aircraft has not been electrically supplied for 6 hours or more, perform the following check :**

– **BAT 1 and 2 . . . . CHECK OFF**

– **BAT 1 and 2 VOLTAGE . . . . CHECK ABOVE 25.5 V**
Battery voltage above 25.5 V ensures a charge above 50 %.

● **If battery voltage is below 25.5 V :**
a charging cycle of about 20 minutes is required.

– **BAT 1 and 2 . . . . AUTO**

– **EXT PWR . . . . ON**
Check on ECAM ELEC page, battery contactor closed and batteries charging.

● **after 20 minutes :**

– **BAT 1 + 2 . . . . OFF**

– **BAT 1 and 2 VOLTAGE . . . . CHECK ABOVE 25.5 V**

● **If battery voltage is above 25.5 V :**

– **BAT 1 and 2 . . . . AUTO**
If the APU is started on batteries only, it should be started within 30 minutes after the selection of batteries to AUTO (35 minutes after battery selection to AUTO, the battery charge is less than 25 % of maximum capacity).

■ **<u>If the aircraft has been electrically supplied during the last 6 hours :</u>**

– **BAT 1 and 2 . . . . AUTO**

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

<u>HYD</u>

WARNING

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

<u>APU FIRE</u>

– **APU FIRE pushbutton . . . . IN and GUARDED**

– **AGENT light . . . . OUT**
If the APU is already running, ensure that the following check has already been completed. If not, perform it.

– **APU FIRE TEST pushbutton . . . . PRESS**
Check :
· APU FIRE warning on ECAM + CRC + MASTER WARN light (if AC Power available).
· APU FIRE pushbutton lighted red.
· SQUIB and DISCH lights on

APU START

■ **If EXT PWR ON light is on :**

– **APU MASTER switch** . . . . **ON**
ON light comes on.
APU page appears on ECAM.

R – **APU START** . . . . **ON**
FLAP OPEN indication appears on ECAM APU page.
On ECAM APU page, N and EGT rise.
When N = 95 % :
. On ECAM APU page, AVAIL indication appears.
. On APU panel : START ON light goes out.
AVAIL light comes on.
10 seconds later :
. ECAM DOOR page replaces ECAM APU page.

– **EXT PWR** . . . . **AS RQRD**

■ **if EXT PWR ON light is out:**

– **APU MASTER switch** . . . . **ON**
ON light comes on.

– **APU START** . . . . **ON**
At 95% RPM :
· START ON light goes out.
· AVAIL light comes on.
· APU GEN comes on line.
· ECAM APU page appears after 10 seconds.
If required, adjust brightness on ECAM control panel.
10 seconds later :
· ECAM DOOR page replaces ECAM APU page.

COCKPIT LIGHTS

*– **COCKPIT LIGHTS . . . . AS RQRD**
· Set OVHD INTEG LT, STBY COMPASS, DOME, ANN LT switches as required.
· Set FLOOD LT, and INTEG LT as required.
DOME light should be on because it is the only lighting source in the EMER ELEC configuration. The DIM position is recommended for takeoff.

* PARKING BRAKE

*– **PARKING BRAKE . . . . ON**

*– **ACCU PRESS & BRAKES PRESS indicators . . . . CHECK**
– Check for normal indications.
– The ACCU PRESS indication must be in the green band. If required use the electric pump on yellow hydraulic system to recharge the brake accumulator.

WARNING

Yellow and green hydraulic systems are pressurized from yellow electric pump. Get ground crew clearance before using the electric pump.

F/CTL

– **FLAPS . . . . CHECK POSITION**
Check the upper ECAM display to confirm that the FLAPS position agrees with the handle position.

R *– **SPEEDBRAKE lever . . . . CHECK RETRACTED and DISARMED**

WARNING
If flight control surface positions do not agree with the control handle positions, check with the maintenance crew before applying hydraulic power.

PROBE/WINDOW HEAT

– **PROBE/WINDOW HEAT . . . . CHECK AUTO**

AIR COND

– **APU BLEED . . . . ON**
R Do not use APU BLEED, if ground personnel confirms that ground air unit is connected.
R Pilots should also check the ECAM BLEED page to determine whether an HP ground air
R unit is connected (pressure in the bleed system).

– **ALL WHITE LIGHTS . . . . OFF**

– **X BLEED . . . . AUTO**

– **Zone temperature selectors . . . . AS RQRD**
Full range temperature 24 ± 6° C (75 ± 11° F).

CARGO HEAT ◁

– **SELECTORS . . . . AS RQRD**
Set temperature selectors, as required.

ELEC

– **Scan and check that there are no amber lights, except GEN FAULT lights.**

VENT

– **Check all lights off.**

INTENTIONALLY LEFT BLANK

*** ECAM**

*– **RECALL . . . . PRESS**
· Press the RECALL pushbutton for at least 3 seconds, to recall all warnings that have been cleared or canceled.
· If applicable, check warnings are compatible with the MEL, then CLEAR or CANCEL them.
If any action is required, call maintenance personnel as soon as possible.

*– **DOOR . . . . PRESS**
If the oxygen pressure is half boxed in amber, check the “MIN FLT CREW OXY CHART” to verify if the pressure 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 *** OPERATIONS ENGINEERING BULLETINS (OEB)**

R *– **OEB in QRH . . . . CHECK**
R Go to the OEB section of the QRH and review all OEBs (particularly red OEBs) that are
R applicable to the aircraft.

R *Note : If there is a transfer of duties during this flight, the flight crew must remind the*
R *incoming flight crew of the applicable OEB(s) during the briefing that is done*
R *when transferring the duties.*

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.

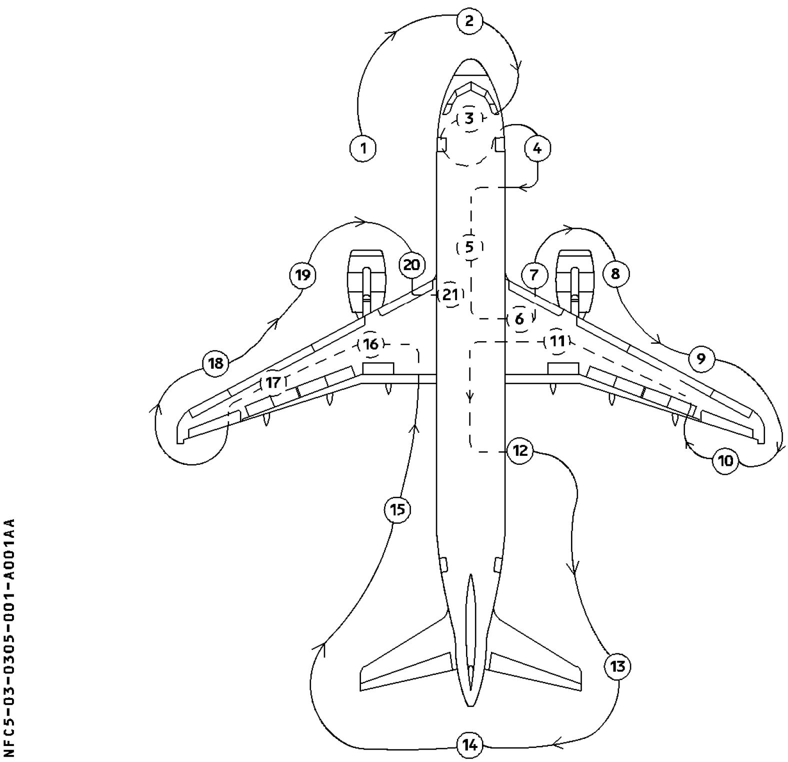
GENERAL

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
- Wing leading edge ventilation intake . . . . CLEAR

*– 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

R — Oil fill access door (CFM and IAE only) . . . . CLOSED
— Master magnetic chip detector access door (IAE only) . . . . CLOSED
R — Thrust Recovery Nozzle* (PW only) . . . . CLOSED/LATCHED
R — Hydraulic filter visual door (PW 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 (CFM and IAE only) . . . . . CLOSED
R — Nose cowl pressure relief door (PW only) . . . . CLOSED
R — Engine oil fill access/starter air valve override access door (PW only) . . . CLOSED
R — Master chip detector access door (PW only) . . . . CLOSED
R — IDG servicing access door (PW only) . . . . CLOSED
R — Turbine exhaust . . . . 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

INTRODUCTION

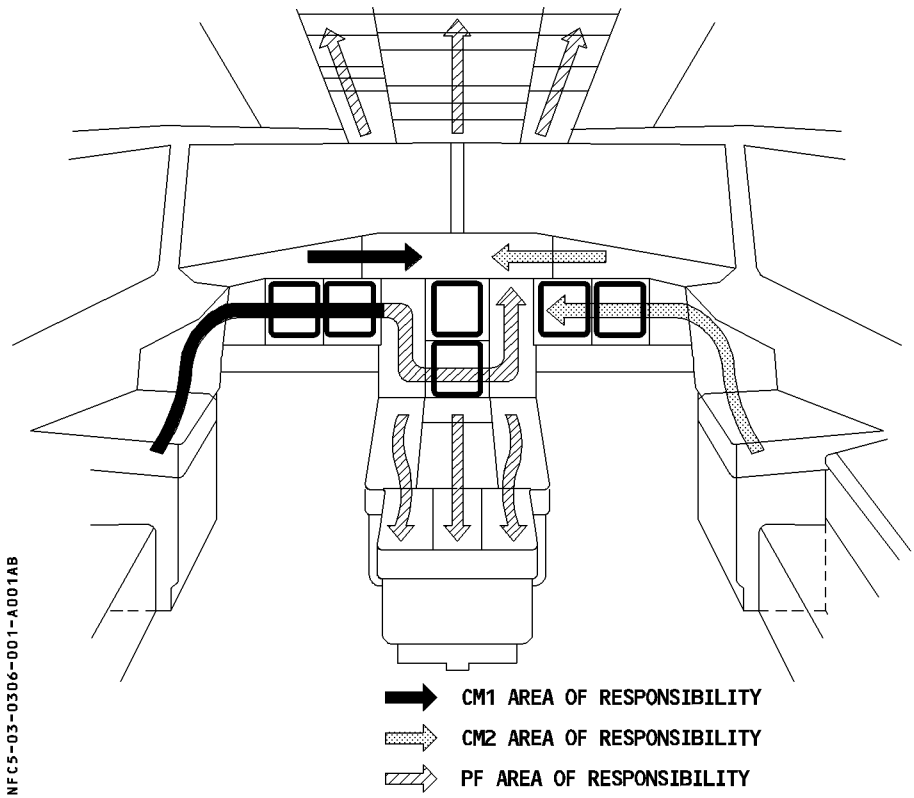
Items marked by (*) are the only steps to be completed during a transit stop.
The PF and PNF should perform the cockpit preparation according to the panel scan sequence, defined below, and the task sharing defined in the Quick Reference Handbook (QRH).

DOCUMENTATION AND MAINTENANCE

On entering the aircraft, obtain the technical (maintenance) log and verify that the certificate of maintenance and daily inspection (or similar) are up to date and signed. Check the deferred or carried-forward defects. If refueling has already been completed, check the uplift.

PANEL SCAN SEQUENCE

R



*– **GEAR PINS and COVERS . . . . CHECK**
Check that three are on board and stowed.

OVERHEAD PANEL

IT IS A GENERAL RULE TO TURN OFF ALL WHITE LIGHTS FOR ALL THE SYSTEMS DURING THE SCAN SEQUENCE. THEREFORE, THESE ACTIONS ARE NOT LISTED HERE.

RCDR

*– **RCDR GND CTL . . . . ON**

– **CVR TEST . . . . PRESS AND RELEASE**
Check low frequency signal through the loudspeakers.

Note : The parking brake must be ON to perform the CVR test.

R **EVAC**

– **CAPT and PURS/CAPT switch . . . . AS RQRD**
The usual position is CAPT.

*** ADIRS**

– **Mode selectors (3) . . . . NAV**
- The ADIRS outputs are used by many of the aircraft's systems : Set the selectors to NAV as soon as possible, to provide data to the related systems.
- Perform a complete alignment if :
  - R ∗ It is the first flight of the day
  - ∗ The GPS is not available, and long segments in poor radio NAVAID coverage airspace are expected.
- For other flights, perform a fast alignment, if the residual ground speed is greater than 5 knots. The alignment is not necessary, if the residual ground speed is less than 5 knots.
- In case of ADIRS alignment, check that the ALIGN lights of the three ADIRS are on.
- For more information on ADIRS OPERATION, refer to SUPPLEMENTARY TECHNIQUES, 3.04.34.

EXT LT

– **EXTERIOR LIGHTS . . . . AS RQRD**
Set STROBE switch to AUTO, 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 Setting BAT 1+2 to OFF, then to ON initiates a charging cycle. Check on the ECAM ELEC
R page that both batteries are loaded correctly : battery currents will drop below 60 A after
R 10 seconds and continue to decrease. If not, the flight crew must wait until the charging
R cycle of the batteries is completed (batteries no longer connected to DC BAT BUS)
R before performing this check again.

*** FUEL**

Apply the following procedure, if your airline is affected by FUEL CTR TK PUMPS LO PR cautions on ground or 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**

■ **If the center tank is NOT empty for the flight :**

CAUTION

If the FUEL MODE SEL pushbutton is unduly left in the MAN position on ground, when the CTR TK PUMP 1 & 2 pushbuttons are not in the OFF position : There is a possibility of fuel spillage, if there are any hidden failures.

– **FUEL MODE SEL . . . . CHECK AUTO**

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.**

CTR INSTRUMENT PANEL

*– **ISIS . . . . CHECK**
– Adjust brightness, check IAS, altimeter readings, altimeter settings and attitude display.
– Check no flags – Reset attitude, if necessary.

Note : Use of the ISIS bugs function is not recommended (Refer to FCOM 1.34.25).

*** CLOCK**

– **Check time ; and adjust, if necessary ; elapsed time at zero, chrono at zero.**

NOSEWHEEL STEERING

*– **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.

<u>* ECAM control panel</u>

*– **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 the correct position of the LDG ELEV selector.

<u>COCKPIT DOOR</u>

If required by local Airworthiness Authorities :

– **ANN LT** . . . . **TEST**
· Check that the OPEN and FAULT lights (on the pedestal), and the three LED lights (on the overhead panel) come on.

– **ANN LT** . . . . **BRT**
· Check that all lights go off.

– **CKPIT DOOR** . . . . **CHECK CORRECT OPERATION**
· Set the toggle switch to the UNLOCK position. Check that the door opens, and that the OPEN light comes on.
· Then, with the door fully open, release the toggle switch (check that it returns to the NORM position). Close the door. Check that it is locked, and that the OPEN indication goes off.

– **CKPIT DOOR MECHANICAL OVERRIDE** . . . . **CHECK**
· Check that the door opens normally, and that it closes when the mechanical override is used.

***THRUST LEVERS**

*– **THRUST LEVERS . . . . CHECK IDLE**

*** ENG**

*– **ENG MASTER switch . . . . CHECK OFF**

*– **ENG MODE selector . . . . CHECK NORM**

*** PARKING BRK**

*– **PARKING BRAKE . . . . ON THEN OFF**
· Check pressure on the BRAKE PRESS indicator.
· 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**
Perform the appropriate ATC selection to allow the ATC transponder to operate in mode S (refer to FCOM 1.34.50), TCAS is on standby. To prevent possible interference to radar surveillance systems, TCAS should not be selected before the holding point/lining up.

– **ALT RPTG . . . . ON**

R – **ATC SYS 1 . . . . SELECT**
R For RVSM operations (refer to FCOM 2.04.50), select SYS 1 if AP 1 is used, and SYS
R 2 if AP 2 is used.
Only system 1 is available, in emergency electrical configuration.

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 ◁**

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.
R · On the MCDU ACFT STATUS page, the last day of the active database validity period
R is the same day as the first day of the second database validity period. On this day,
R the message "CHECK DATA BASE CYCLE" will not be triggered. For any flight on that
R day, manually select the second database.

*– **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.
For an RNP AR departure, access the SEL NAVAID page and deselect the required navaid(s).

*– **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.

*– **ADIRS POSITION INITIALIZATION . . . . AS APPROPRIATE**
· ADIRS position initialization involves setting the ADIRS navigation starting point. This is only necessary for a complete or fast alignment.
· Press the ALIGN IRS prompt to send the coordinates displayed on the MCDU INIT page to the three ADIRS.
· Use the defaulted departure airport reference point coordinates to initialize the ADIRS.
· When flying without GPS on long segments without radio coverage, it is better to use the gate coordinates to initialize the ADIRS : To insert these coordinates, slew them on the MCDU, and then press the ALIGN IRS prompt.

*– **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 databases will only include departure and arrival airport idents and en-route waypoints.

The flight 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 FCOM 4.04, LATERAL FUNCTIONS).

· 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 FCOM 4.04, VERTICAL FUNCTIONS).

*– **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) :

*– **ZFWCG/ZFW** . . . . **INSERT**

*– **BLOCK FUEL** . . . . **INSERT**

CAUTION

The characteristic speeds displayed on the MCDU (green dot, F, S, VLS) are computed from the ZFW and ZFWCG 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 ZFWCG 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 ZFWCG, 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, the crew must set the acceleration altitude at, or above, 3000 feet, and adjust the values according to local noise abatement regulations.

*– **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.

RNP INSERTION (PROG page) :

*– **RNP** . . . . **SET or CHECK**
For RNP AR departure, check or insert the RNP.

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 (or QFE) on the EFIS control panel and on the standby altimeter
· Check barometer settings and altitude indications on the PFD and standby altimeter. (Tolerance limits are given in 3.04.34).

*– **FD . . . . CHECK ON**

*– **LS . . . . AS RQRD**

<u>Note</u> : Do not engage the autothrust on ground, as it may generate the AUTO FLT 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

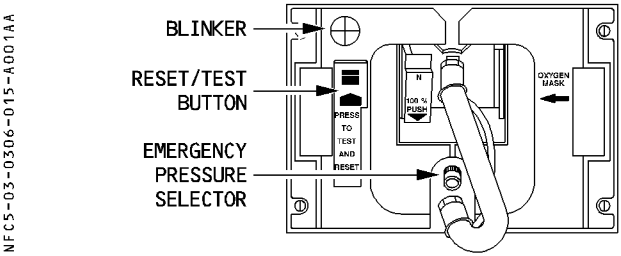
*– **SPD MACH window . . . . DASHED**

*– **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.
· Press the emergency pressure selector again, and check that the blinker does not turn 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.

*– **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.

*– **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.

* FMGS DATA CONFIRMATION

*– **AIRFIELD DATA . . . . CONFIRM**

*– **ATC CLEARANCE . . . . OBTAIN**

*– **IRS ALIGN . . . . CHECK**
On the POSITION MONITOR page, check that the IRS are in NAV mode, and check that the distance between each IRS and the FMS position is lower than 5 NM. Select ND in ROSE-NAV or ARC mode, and confirm that the aircraft position is consistent with the position of the airport, the SID and the surrounding NAVAIDs.

*– **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.
· Ensure 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.

*TAKEOFF BRIEFING

*– **TAKEOFF BRIEFING . . . . PERFORM**

*PC DEDICATED TO MAINTENANCE ⊲

Check that the Personal Computer (PC) dedicated to maintenance use and located in front of lower stowage at RH rear corner is stowed.
Check that the light of its manual switch is off. If not, switch it off.
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 (LTS), particularly for gross errors. Make sure that the loadsheet data is correct : Correct flight, correct aircraft, dry operating index, configuration, Fuel On Board, etc.
R Compare the ZFWCG/ZFW with the previously-entered data, and adjust if necessary.
Check that the takeoff CG is within the LTS operational limits.

– **TAKEOFF DATA . . . . PREPARE and CHECK/REVISE**
When the loadsheet is checked :
- The PNF checks or recalculates 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, HARNESSES, RUDDER PEDALS, ARMRESTS . . . . ADJUST**
The seat is correctly adjusted, when the pilot's eyes are in line with the red and white balls.

– **MCDU . . . . IN TAKEOFF CONFIGURATION**
It is recommended that the crew display 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 yellow 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**
- Check that the cockpit windows are closed and locked.
- Check, on the ECAM lower display, that all the aircraft doors are closed.
- When required by local airworthines authorities, check that the cockpit door is closed and locked (no cockpit door open/fault indication).
  If entry is requested, identify the person requesting entry before unlocking the door. With the cockpit door selector on NORM, the cockpit door is closed and locked. If entry is requested from the cabin, and if no further action is performed by the pilot, the cabin crew will be able to unlock the door by using the emergency access procedure. Except for crew entry/exit, the cockpit door should remain closed until engine shutdown.

– **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 the 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 the engine drain mast, run the engine at idle for 5 minutes. If the leak disappears during these 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 the flight.

– **ENG MODE selector . . . . IGN/START**
  The lower ECAM displays the ENG page.

R – **START ENGINE 2 . . . . ANNOUNCE**
  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 starts closing. (It is fully closed between 50 % and 56 % N2) Igniter indication off.

(*) : With the current ECU standard, the FF indication may be crossed up to approximately 200 kg/h (440 lb/h).

– 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.

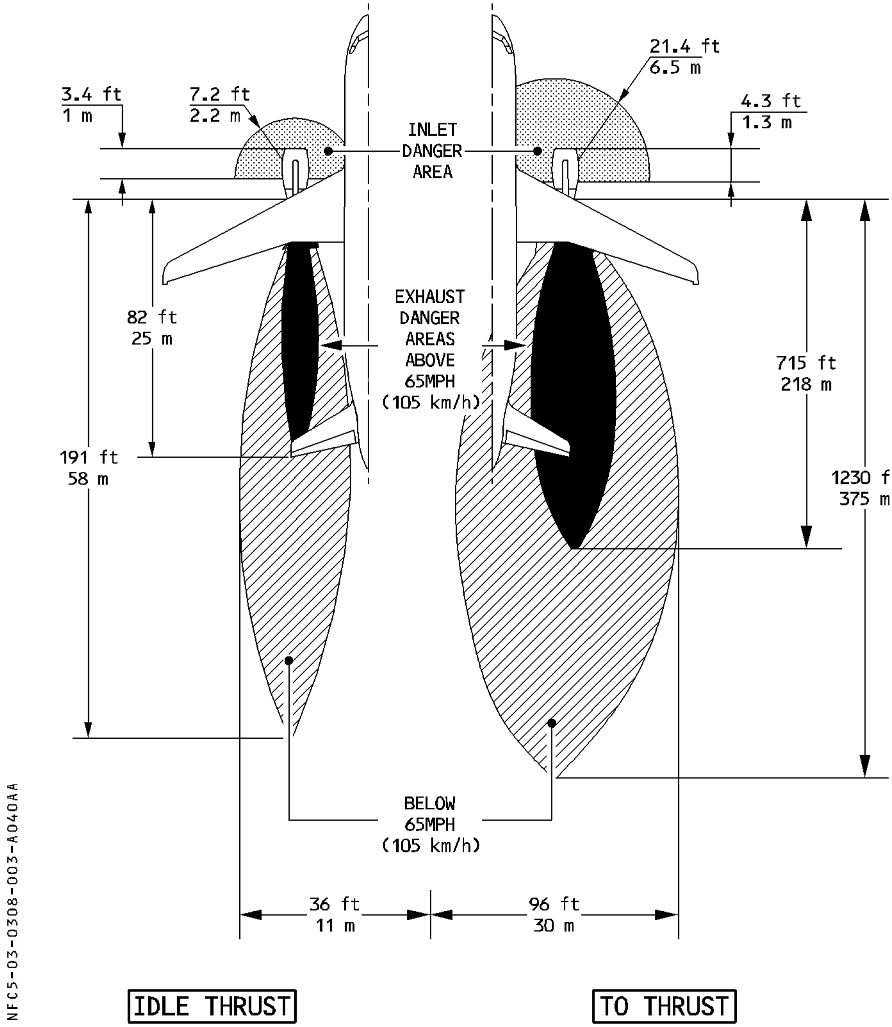
– **MAIN AND SECONDARY ENG. IDLE PARAMETERS . . . . CHECK NORMAL**
At ISA sea level : N1 about 19.5 %
N2 about 58.5 %
EGT about 390° C
FF about 275 kg/h (600 lb/h)
Grey background on N2 indication disappears.

R – **START ENGINE 1 . . . . ANNOUNCE**

– **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 %.

<u>Note</u> : *A PTU FAULT is triggered, if the second engine is started within 40 seconds following the end of the cargo doors operation.*

GROUND RUN UP – DANGER AREAS



AFTER START

– **ENG MODE selector . . . . NORM**
- Turning the ENG MODE selector to NORM indicates the end of the start sequence. AFTER START actions may be performed.
- On ECAM lower display the WHEEL page replaces the ENG page.
- Leaving the ENG MODE selector at the START/IGN position would prevent continuous relight selection on the ground (would be supplied at lift off). In addition, the ENG page would remain displayed. The selector must be cycled to recover normal control of ignition and to display WHEEL page.
- After start, to avoid thermal shock, the pilot should operate the engine at idle or near idle for at least 2 minutes before advancing the thrust lever to high power. Taxi time at idle may be included in the warm-up period.
- The last engine started must run for at least 2 minutes before takeoff initiation, to ensure that takeoff is not initiated before the center tank pumps test is finished, since takeoff on center tank is prohibited.

– **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.

– **ENG ANTI ICE . . . . AS RQRD**

<u>Note</u> : *Icing conditions may be expected when the OAT (on ground and for takeoff), or the TAT (in flight), is 10°C or below, and there is visible moisture in the air (such*
R *as clouds, fog with low visibility, rain, snow, sleet, ice crystals), or when standing water, slush, ice or snow is present on the taxiways or runway.*

R – During ground operation, when in icing conditions for more than 30 minutes, the
R following procedure should be applied for ice shedding :

CAUTION

R If, during thrust increase, the aircraft starts to move, immediately retard the
R thrust levers to IDLE.

R If ground surface conditions and the environment permit, the flight crew should accelerate the engines to approximately 70% of N1 for 30 seconds at intervals not greater than 30 minutes.
In addition, this engine acceleration should also be performed just before take-off, with particular attention to engine parameters to ensure normal engine operation.
R If ground surface or environment do not permit to accelerate the engine to 70% N1, then power setting and dwell time should be as high as practical.
When operating in conditions of freezing rain, freezing drizzle, freezing fog or heavy snow, ice shedding may be enhanced, by additional run ups at intervals, to not
R exceed 10 minutes, advancing throttles to 70% N1 momentarily (no hold time).

– **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.

– **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 DOOR page . . . . SELECT**
· Check that all slides are armed
· Deselect the DOOR page after verifying the slides.

– **ECAM STATUS . . . . CHECK**
· PNF checks and PF crosschecks that there is no status reminder (STS) on the upper ECAM display.
· If STS is displayed, press the STS pushbutton and review the ECAM Status page.

– **CLEAR TO DISCONNECT . . . . ANNOUNCE**
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.

R · If an arc is displayed on the ECAM WHEEL page, above the brake temperature, set the brake fans on (if installed).

– **FLIGHT CONTROLS . . . . CHECK**

1. At a convenient stage, prior to or during taxi, and before arming the autobrake, the PF silently applies full longitudinal and lateral sidestick deflection.
R On the F/CTL page, the PNF checks full travel and the correct sense of all elevators and all ailerons, and the correct deflection and retraction of all spoilers.
The PNF calls out "full up", "full down", "neutral", "full left", "full right", "neutral", as each full travel/neutral position is reached.
The PF silently checks that the PNF calls are in accordance with the sidestick order.

Note : In order to reach full travel, full sidestick must be held for a sufficient period of time.

2. The PF presses the PEDAL DISC pushbutton on the nosewheel tiller, and silently applies full left rudder, full right rudder, and neutral. The PNF calls out "full left", "full right", "neutral", as each full travel/neutral position is reached.
3. The PNF applies full longitudinal and lateral sidestick deflection, and silently checks full travel and the correct sense of all elevators and all ailerons, and the correct deflection and retraction of all spoilers, on the ECAM F/CTL page.

Note : The F/CTL page is automatically displayed for 20 seconds.

INTENTIONALLY LEFT BLANK

– **ATC clearance . . . . CONFIRM**

TAKEOFF DATA/CONDITIONS

If takeoff data has changed, or in case of a 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**
Carefully 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, in case of a radar vector departure, preset the heading on the FCU. NAV mode will be disarmed.
· RWY TRK mode will keep the aircraft on the runway track.

R – **FD . . . . CHECK BOTH SELECTED ON**

NO CHANGE

– **RADAR (if required) . . . . ON**

R To check the radar and the departure path, set the Multiscan selector to MAN. The flight
R crew can then set the radar to the AUTO position.
R Gain must be manually set to +8, when MULTISCAN selector is set to AUTO and when
R flying below FL 150.

R *Note : 1. MULTISCAN AUTO mode provides an efficient ground clutter rejection. During*
R *operation in good or non significant weather conditions, no weather pattern*
R *will be displayed on the ND's. In this case, the flight crew confirms correct*
R *radar operation, using temporarily MANUAL TILT.*
R *2. The flight crew monitors the weather radar display in AUTO mode, and*
R *confirms any weather display that is ambiguous or unexpected weather*
R *display using manual tilt according to standard techniques.*

NO CHANGE

– **FMA** . . . . **CHECK**

– **RNP pushbutton** . . . . **ON**
Only for RNP AR departure.

– **FLIGHT INSTRUMENTS** . . . . **CHECK**

– **RADAR (if required)** . . . . **ON**
To check the radar and the departure path, set the MULTISCAN toggle switch to MAN. The flight crew can then set the radar to the AUTO position.

– **PREDICTIVE WINDSHEAR SYSTEM** ◁ . . . . **AUTO**

– **ATC code** . . . . **CONFIRM/SET**

– **TERR ON ND** ◁ . . . . **AS RQRD**
· In mountainous areas, consider displaying terrain on ND.
· If use of radar is required, consider selecting the radar display on the PF side, and TERR ON ND on the PNF side only.
For RNP AR operations (in mountainous terrain), set EGPWS TERR ON both sides. If required, one pilot may select the weather radar for weather avoidance.

– **RNP pushbutton** . . . . **ON**
Only for RNP AR departure.

– **AUTO BRK** . . . . **MAX**
· ON light comes on.
· Autobrake may be armed, with the parking brake on.
· In the event of an aborted takeoff, selecting the MAX mode before takeoff improves safety.
If the takeoff must be aborted, the autobrake system applies maximum braking as soon as the thrust levers are set to idle, if the ground speed is above 72 knots.

– **TAKEOFF BRIEFING** . . . . **CONFIRM**
Refer to FCTM (Normal Operations – Taxi).

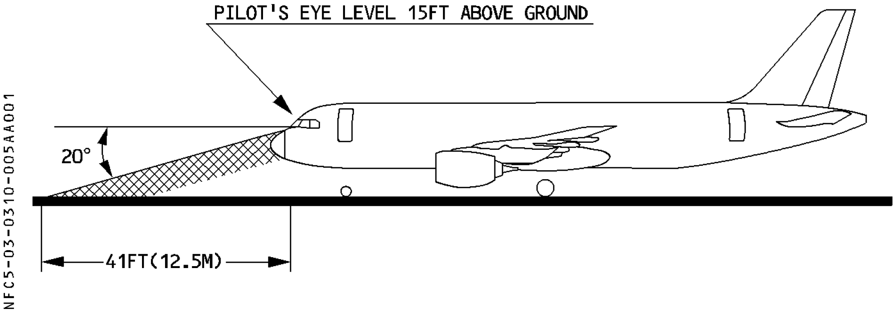
– **CABIN REPORT** . . . . **RECEIVE**
Obtain cabin report from the purser, as a minimum : “CABIN SECURED FOR TAKEOFF”

– **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

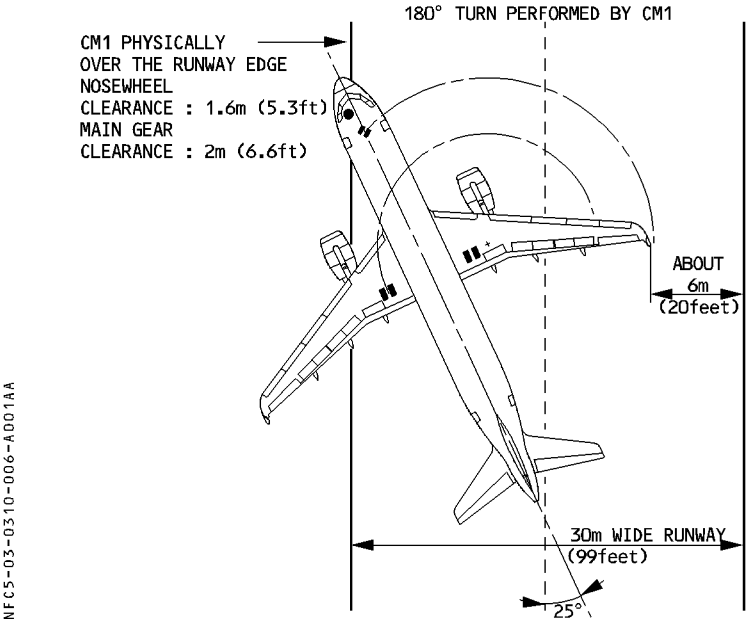
The standard width of a runway is 45 meters. However, this aircraft only needs a runway width of 30 meters (99 feet) for a 180° turn.
The following procedure is recommended for performing a 180° turn on the runway.

- **FOR THE CM1**
  - Taxi on the right of the runway and turn left, maintaining 25° of divergence from the runway axis.
  - When physically over the runway edge :
    - · Turn the nosewheel fully right
    - · On ENG 1, set N1 to between 30 % and 35 % (CFM engines), or the EPR to between 1.02 and 1.03 (IAE engines)
    - · Set ENG 2 to idle.

  The Ground Speed (GS) for the entire maneuver should be between 5 knots and 8 knots, to prevent the width of the turn from increasing.

- **FOR THE CM2**

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



<u>Note</u> : *To prevent the nosewheel from skidding on a wet runway, it is possible to perform the turn at a very low speed using asymmetric thrust and differential braking, as necessary.*

BEFORE TAKEOFF

- **TAKEOFF OR LINE UP CLEARANCE . . . . OBTAIN**
- **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...)
- **APPROACH PATH CLEAR OF TRAFFIC . . . . CHECK**
  Check that the approach path is clear of traffic, visually and using TCAS display on ND.
- **PACK 1 and 2 . . . . AS RQRD**
  Consider selecting packs OFF, or APU bleed ON.
  This will improve performance when using TOGA thrust.
  In case of a FLEX takeoff, selecting packs OFF or APU bleed ON will reduce takeoff EGT, and thus reduce maintenance costs.
  The use of flex thrust may reduce maintenance costs. The effect is particularly significant with the first degrees of FLEX.
  Use of APU bleed is not authorized, if wing anti-ice is to be used.
- **EXTERIOR LIGHTS . . . . SET**
  Set the RWY TURN OFF, LAND, and NOSE switches at ON/TO in order to minimize bird strike hazard during takeoff.
  Set the STROBE lights to ON, before entering the runway.
- **QFU/THRESHOLD . . . . CONFIRM**
- **SLIDING TABLE ◁ . . . . STOW**

<u>**RNP AR Departure**</u>

- **GPS 1+2 on GPS MONITOR page . . . . CHECK BOTH IN NAV**
- **GPS PRIMARY on PROG page . . . . CHECK AVAILABLE**
- **FMA . . . . CHECK**
  Verify NAV is armed (blue).

- **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.

– **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.

– **CABIN CREW . . . . ADVISE**

– **BEFORE TAKEOFF CHECKLIST below the line . . . . COMPLETE**
Read the checklist below the line, when line up or takeoff clearance is received.

TAKEOFF

Rolling takeoff is permitted.

R – **TAKEOFF . . . . ANNOUNCE**

– **BRAKES . . . . RELEASE**

● **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.
- 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.
- 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. Therefore, 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**
1. Check the FMA on the PFD. The following modes are displayed : MAN TOGA (or MAN FLX xx) / SRS / RWY (or blank) / A/THR (in blue).

Note : If an ILS that corresponds to the departure runway is tuned, RWY mode appears. If not, no lateral mode appears until the aircraft lifts off.

2. Check the FMS position on the ND (aircraft on runway centerline).

Note : If GPS PRIMARY is not available, check the FMS position update.

– **FMA . . . . ANNOUNCE**

● **Before reaching 80 knots :**

– **TAKEOFF N1 . . . . CHECK**
Check that the actual N1 of the individual engines has reached the N1 rating limit, before the aircraft reaches 80 knots. Check EGT.

– **THRUST SET . . . . ANNOUNCE**

– **PFD and ENG indications . . . . SCAN**
· Scan airspeed, N1, and EGT throughout the takeoff.

– **ONE HUNDRED KNOTS . . . . ANNOUNCE**
· The PF crosschecks and confirms the speed indicated on the PFD.
· Below 100 knots the Captain may decide to abort the takeoff, depending on the circumstances.
· Above 100 knots, rejecting the takeoff is a more serious matter.

– **V1 . . . . ANNOUNCE**

– **ROTATION . . . . ORDER**

— **ROTATION . . . . PERFORM**

NO CHANGE

— **POSITIVE CLIMB . . . . ANNOUNCE**

R — **LDG GEAR UP . . . . ORDER**

— **LDG GEAR . . . . SELECT UP**

NO CHANGE

— **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**

NO CHANGE

— **FMA . . . . ANNOUNCE**

– **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. In strong crosswind conditions, small lateral stick inputs may be used, if necessary, to aim at maintaining wings level.
· 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.

– **POSITIVE CLIMB . . . . ANNOUNCE**

– **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.
The AP must be engaged for RNP AR $<$ 0.3 NM.

– **FMA . . . . ANNOUNCE**

● **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.

R – **FMA . . . . ANNOUNCE**

– **PACK 1 and 2 (if applicable) . . . . ON**
· Select PACK 1 on after CLB thrust reduction.
· Select PACK 2 on after flap retraction.

<u>Note</u> : *1. Selecting pack on before reducing takeoff thrust would result in an EGT increase.*
2. PACK 2 may be selected earlier, but not sooner than 10 seconds after PACK 1 is selected on, for passenger comfort.
3. If packs are not switched on after the takeoff phase, an ECAM caution will be triggered.

● **At acceleration altitude :**

R – **FMA . . . . ANNOUNCE**
Check the target speed change from V2 + 10 to the first CLB speed (either preselected or managed).

R <u>Note</u> : *1. When THR RED and ACC ALT are equal, the FMA will change from MAN*
R *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**

R – **FLAPS 1 . . . . ORDER**

– **FLAPS 1 . . . . SELECT**

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

• **At S speed**

NO CHANGE

R – **FLAPS ZERO . . . . ORDER**

– **FLAPS ZERO . . . . SELECT**

Note : The CRUISE page replaces the ECAM ENG page.

– **DERATED CLB OPS ◁ . . . . REFER TO 3.04**

- **Above acceleration altitude (or once in climb phase) :**
  The following procedure ensures that the aircraft is effectively accelerating toward climb speed.

R • **<u>At F speed</u>**

R – **FLAPS 1 . . . . SELECT**

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

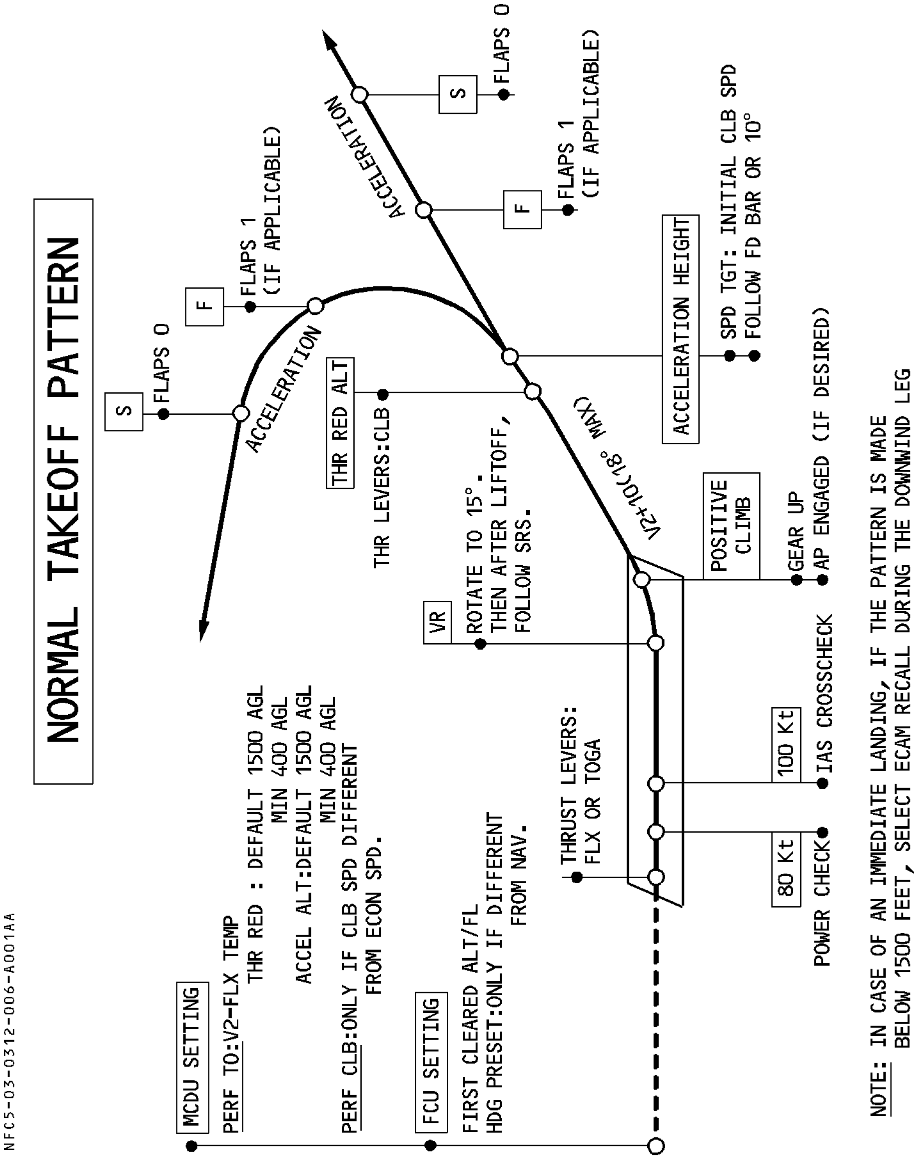
R • **<u>At S speed</u>**

R – **FLAPS ZERO . . . . SELECT**

<u>Note</u> : CRUISE page replaces ECAM ENG page.

– **DERATED CLB OPS ◁ . . . . REFER TO 3.04**

R


NORMAL TAKEOFF PATTERN
MCDU SETTING
PERF TO:V2-FLX TEMP
THR RED : DEFAULT 1500 AGL
MIN 400 AGL
ACCEL ALT:DEFAULT 1500 AGL
MIN 400 AGL
PERF CLB:ONLY IF CLB SPD DIFFERENT
FROM ECON SPD.
FCU SETTING
FIRST CLEARED ALT/FL
HDG PRESET:ONLY IF DIFFERENT
FROM NAV.
THRUST LEVERS:
FLX OR TOGA
80 Kt
POWER CHECK
100 Kt
IAS CROSSCHECK
VR
ROTATE TO 15°.
THEN AFTER LIFTOFF,
FOLLOW SRS.
POSITIVE CLIMB
GEAR UP
AP ENGAGED (IF DESIRED)
V2+10(18° MAX)
THR RED ALT
THR LEVERS:CLB
ACCELERATION HEIGHT
SPD TGT: INITIAL CLB SPD
FOLLOW FD BAR OR 10°
F
FLAPS 1
(IF APPLICABLE)
S
FLAPS 0
ACCELERATION
F
FLAPS 1
(IF APPLICABLE)
S
FLAPS 0
ACCELERATION
NOTE: IN CASE OF AN IMMEDIATE LANDING, IF THE PATTERN IS MADE
BELOW 1500 FEET, SELECT ECAM RECALL DURING THE DOWNWIND LEG
NFC5-03-0312-006-A001AA

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.

– **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".

<u>Note</u> : *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

<u>Note</u> : *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** . . . . **AS APPROPRIATE**

● **At 10 000 ft :**

R – **LAND lights** . . . . **RETRACT**

– **SEAT BELTS** . . . . **AS RQRD**

– **EFIS option** . . . . **AS RQRD**
Select CSTR on one side, for grid MORA, and ARPT on the other side.

– **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**

NO CHANGE

– **RADAR . . . . AS APPROPRIATE**

R Gain must be manually set to +8, when MULTISCAN selector is set to AUTO and when
R flying below FL 150.

R <u>Note</u> : 1. *MULTISCAN AUTO mode provides an efficient ground clutter rejection. During*
R *operation in good or non significant weather conditions, no weather pattern*
R *will be displayed on the ND's. In this case, the flight crew confirms correct*
R *radar operation, using temporarily MANUAL TILT.*
R 2. *The flight crew monitors the weather radar display in AUTO mode, and*
R *confirms any weather display that is ambiguous or unexpected using manual*
R *tilt according to standard techniques.*

NO CHANGE

CRUISE

– **ECAM MEMO . . . . REVIEW**

– **ECAM SYS PAGES . . . . REVIEW**

Periodically review system display pages and, in particular :

ENG : Oil pressure and temperature
BLEED : BLEED parameters
ELEC : Parameters, GEN loads
HYD : A slight decrease in quantity is normal.
Fluid contraction during cold soak can be expected.
Green system is lower than on ground, following landing gear retraction.
FUEL : Fuel distribution.
COND : Duct temperature, compared with zone temperature.
Avoid large differences for passenger comfort.
FLT CTL : Note any unusual control surface position.

– **FLIGHT PROGRESS . . . . CHECK**

Monitor flight progress in the conventional way.
When overflying a waypoint :
· Check track and distance to the next waypoint.
R When overflying the waypoint, or every 30 minutes :
· Check FUEL : Check FOB (ECAM), and fuel prediction (FMGC), and compare with the computer flight plan or the in-cruise quick-check table (Refer to 3.05.20).
Check that the sum of the fuel on board and the fuel used is consistent with the fuel on board at departure. If the sum is unusually greater than the fuel on board at departure, suspect a frozen fuel quantity indication. Maintenance action is due before
R the next flight. If the sum is unusually smaller than the fuel on board at departure, or
R if it decreases, suspect a fuel leak.

CAUTION

This check must also be performed each time a FUEL IMBALANCE procedure is necessary. Perform the check before applying the FUEL IMBALANCE procedure. If a fuel leak is confirmed, apply the FUEL LEAK procedure.

– **STEP FLIGHT LEVEL . . . . AS APPROPRIATE**

(Refer to 3.05.15).

– **NAVIGATION ACCURACY . . . . CHECK**

On aircraft equipped with GPS primary, no navigation accuracy check is required, as long as GPS PRIMARY is available.
Otherwise, navigation accuracy must be monitored, at all times but especially when any of the following occurs :
· IRS only navigation
· The PROG page displays LOW accuracy.
· "NAV ACCUR DOWNGRAD" appears on the MCDU.
Methods for checking accuracy :
Refer to FCTM (Supplementary Information – Navigation Accuracy)
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 . . . . AS APPROPRIATE**

– **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.

NO CHANGE

– **RADAR . . . . AS APPROPRIATE**

R Gain must be manually set to +8, when MULTISCAN selector is set to AUTO and when
R flying below FL 150.

R *Note :* 1. *MULTISCAN AUTO mode provides an efficient ground clutter rejection. During*
R *operation in good or non significant weather conditions, no weather pattern*
R *will be displayed on the ND's. In this case, the flight crew confirms correct*
R *radar operation, using temporarily MANUAL TILT.*
R 2. *The flight crew monitors the weather radar display in AUTO mode, and*
R *confirms any weather display that is ambiguous or unexpected using manual*
R *tilt according to standard techniques.*

NO CHANGE

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.
For RNP AR approach verify that wind and temperature are within limits.

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.

– **DES WIND . . . . CHECK**
Enter winds for descent starting at cruise flight level.

– **PERF CRUISE page . . . . CHECK**
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.

<u>Note</u> : *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 Barometer DA/DH, whichever applies.

<u>Note</u> : *To avoid undershooting the published MDA (MDH) during go-around, due to aircraft inertia during pull-up, some Authorities may require Operators to add a specific number of feet to the published MDA (MDH).*

CAUTION

If the QNH altimeter setting is used for an aircraft with the QFE option, refer to 3.04.34.

<u>Note</u> : *Changing the RWY or type of arrival (VOR, ILS) automatically erases the previous MDA/MDH or DA/DH.*

– Check or modify the landing configuration. Always select the landing configuration on the PERF APP page : CONF FULL in the normal landing configuration. CONF 3 should be considered, depending on the available runway length and go-around performance, or if windshear/severe turbulence is considered possible during approach.

– **GO-AROUND page . . . . CHECK/MODIFY**
Check THR RED ALT and ACC ALT, and modify, if necessary.

– **RAD NAV page . . . . CHECK**
Set navaids, as required, and check idents on the NDs (VOR-ADF) and PFDs (ILS). If a VOR/DME exists close to the airfield, select it and enter its ident in the BRG/DIST field of the PROG page, for NAV ACCY monitoring during descent.

– **SELECT NAVAID page . . . . CHECK/MODIFY**
For RNP AR approaches, deselect NAVAIDS as required.

– **SEC F-PLN page . . . . AS RQRD**
Before the top of descent, the SEC F-PLN should either be set to an alternate runway for destination, or to the landing runway in case of circling. In all cases, routing to the alternate should be available. If there is a last-minute runway change, then the flight crew only needs to activate the secondary F-PLN, without forgetting to set the new MDA or DH and navaids.

– **GPWS LDG FLAP 3 . . . . AS RQRD**
If the pilot plans on landing in FLAPS 3 configuration, the GPWS LDG FLAP 3 switch should be set to ON.

R – **APPROACH BRIEFING . . . . PERFORM**

– **AUTO BRK . . . . AS RQRD**
Use of autobrake is preferable.
Use of MAX mode is not recommended at landing.
On short or contaminated runways, use MED mode.
On long runways, LO mode is recommended.

<u>Note</u> : If, on very long runways, the flight crew anticipates that braking will not be needed, use of the autobrake is not necessary.

Firmly press the appropriate pushbutton, according to the runway length and condition, and check that the related ON light comes on.

– **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 selects a higher idle thrust which gives better protection against flame-out.
· 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.

R *Note : In some cases, when the aircraft is at the Top Of Descent, it is possible that for*
R *a few minutes the ECAM may erroneously indicate that the fuel flow is at zero.*
R *Therefore, in such cases, the flight crew must monitor the engine parameters,*
R *in order to check that the engine is operating correctly.*

NO CHANGE

DESCENT INITIATION

– **DESCENT . . . . INITIATE**
The normal method of initiating the descent is to select DES mode at the FMGS calculated top of descent (TOD).

■ **<u>If ATC requires an early descent :</u>**
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).

■ **<u>If ATC delays the descent :</u>**
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 (⊲).

R – **PNF MCDU . . . . F-PLN**

– **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).
R The NDs show a level-off symbol ↳ along the flight path. Its position is based on the
R current active AP/FD and A/THR modes.
  The flight crew can use this symbol 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.

FPA (°) = △ 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.

NO CHANGE

– **RADAR . . . . AS APPROPRIATE**

R Gain must be manually set to +8, when MULTISCAN selector is set to AUTO and when
R flying below FL 150.

R *Note : 1. MULTISCAN AUTO mode provides an efficient ground clutter rejection. During*
R *operation in good or non significant weather conditions, no weather pattern*
R *will be displayed on the ND's. In this case, the flight crew confirms correct*
R *radar operation, using temporarily MANUAL TILT.*
R *2. The flight crew monitors the weather radar display in AUTO mode, and*
R *confirms any weather display that is ambiguous or unexpected using manual*
R *tilt according to standard techniques.*

NO CHANGE

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.*

R – **RADAR . . . . AS APPROPRIATE**

– **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.

– **TERR ON ND ◁ . . . . AS RQRD**
· In mountainous areas, consider displaying terrain on ND.
· 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 recommendations.

– **SEATBELTS . . . . AS RQRD**

R – **EFIS option . . . . CSTR**
R Select CSTR on both sides.

– **LS pushbutton . . . . AS RQRD**
Select LS, 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 radio navaids 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.

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.

INITIAL APPROACH

– **ENG MODE selector . . . . AS RQRD**
Select IGN if the runway is covered with standing water, or if heavy rain or severe turbulence is expected during approach or go-around.

R – **SEAT BELTS . . . . ON/AUTO**

– **APPROACH PHASE . . . . CHECK/ACTIVATE**
· If the aircraft overflies the DECEL pseudo waypoint in NAV mode, the APPR phase activates automatically.
· If the aircraft is in HDG/TRK mode, approximately 15 NM from touchdown activate and
R confirm APPROACH phase on the MCDU.

– **POSITIONING . . . . MONITOR**
· In NAV mode, use VDEV information on the PFD and PROG page.
· In HDG or TRK mode, use the energy circle on ND representing the required distance to land.

– **MANAGED SPEED . . . . CHECK**
If ATC requires a particular speed, then use selected speed. When the ATC speed constraint ("maintain 170 knots to the outer marker", for example) no longer applies, return to managed speed.

– **SPEEDBRAKES . . . . AS RQRD**
If the pilot uses speedbrakes to increase the rate of deceleration, or to increase the rate of descent, it is important to note 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. The speedbrakes may then be extended, if necessary. The landing gear may always be extended out of sequence to facilitate 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.

<table>
<tr><th rowspan="2">NAVIGATION ACCURACY</th><th colspan="2">ND</th><th rowspan="2">AP/FD mode</th></tr>
<tr><th>PF</th><th>PNF</th></tr>
<tr><td>GPS PRIMARY</td><td colspan="2" rowspan="3">ARC or ROSE NAV with NAVAID raw data</td><td rowspan="3">NAV</td></tr>
<tr><td>NAV ACCUR HIGH</td></tr>
<tr><td>NAV ACCUR LOW and NAV ACCURACY check ≤ 1 NM</td></tr>
<tr><td>GPS PRIMARY LOST and NAV ACCUR LOW and NAV ACCURACY check > 1 NM</td><td rowspan="2">ROSE ILS</td><td rowspan="2">ARC or ROSE NAV or ROSE ILS with NAVAID raw data</td><td rowspan="2">HDG or TRK</td></tr>
<tr><td>GPS PRIMARY LOST and Aircraft flying within unreliable radio NAVAID area</td></tr>
</table>

– **RADAR . . . . AS APPROPRIATE**

– **APPROACH CHECKLIST . . . . COMPLETE**

NO CHANGE

– **RADAR . . . . AS APPROPRIATE**

R Gain must be manually set to +8, when MULTISCAN selector is set to AUTO and when
R flying below FL 150.

R <u>*Note*</u> *: 1. MULTISCAN AUTO mode provides an efficient ground clutter rejection. During*
R *operation in good or non significant weather conditions, no weather pattern*
R *will be displayed on the ND's. In this case, the flight crew confirms correct*
R *radar operation, using temporarily MANUAL TILT.*
R *2. The flight crew monitors the weather radar display in AUTO mode, and*
R *confirms any weather display that is ambiguous or unexpected using manual*
R *tilt according to standard techniques.*

NO CHANGE

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

R The objective is to be stabilized on the final descent path at VAPP in the landing
R configuration, at 1 000 feet above airfield elevation (in instrument conditions, or at 500 feet
R above airfield elevation in visual conditions, after continuous deceleration on the glide
R slope).
R To be stabilized, all of the following conditions must be achieved prior to, or upon reaching
R this stabilization height :
R – The aircraft is on the correct lateral and vertical flight path
R – The aircraft is in the desired landing configuration
R – The thrust is stabilized, usually above idle, to maintain the target approach speed along
R the desired glide path
R – No excessive flight parameter deviation.
R If the aircraft is not stabilized on the approach path in landing configuration, at 1 000 feet
R above airfield elevation in instrument conditions, or at 500 feet above airfield elevation in
R visual conditions, or as restricted by Operator policy/regulations, the flight crew must
R initiate a go-around, unless they think that only small corrections are necessary to rectify
R minor deviations from stabilized conditions due, amongst others, to external perturbations.

– **APPR pushbutton on FCU . . . . PRESS**
  · Press the APPR pushbutton, only when ATC cleares the aircraft for the approach. This arms the LOC and G/S modes.
  · LOC and/or G/S capture modes will engage no sooner than 3 seconds after being armed.

– **Both APs . . . . ENGAGE**
  When APPR mode is selected, both autopilots should be engaged.

R **AT GREEN DOT SPEED**

R – **FLAPS 1 . . . . SELECT**
– FLAPS 1 should be selected more than 3 NM before the FAF (Final Approach Fix).

Note : The ECAM automatically displays the STATUS page, 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 glideslope with FLAPS 1 and S speed at, or above, 2 000 feet AGL.
– If the aircraft speed is significantly higher than S on the glideslope, or if the aircraft does not decelerate on the glideslope, extend the landing gear to slow it down. It is also possible to use speedbrakes. However, the flight crew should be aware that the use of speedbrakes causes an increase in VLS.

– **TCAS (◁) . . . . TA or TA/RA**
The FAA recommends selecting 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**
R The flight crew must always monitor the capture of LOC beam. During the capture phase, the associated deviation indications on the PFD and ND must indicate movement
R towards the center of the scale.

– **G/S CAPTURE . . . . MONITOR**

AT GREEN DOT SPEED

R — **FLAPS 1 . . . . ORDER**

— **FLAPS 1 . . . . SELECT**

NO CHANGE

— **TCAS (◁) . . . . TA or TA/RA**

The FAA recommends selecting 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**

The flight crew must always monitor the capture of LOC beam. During the capture phase, the associated deviation indications on the PFD and ND must indicate movement towards the center of the scale.

— **G/S CAPTURE . . . . MONITOR**

- **If above the glideslope :**

NO CHANGE

— **GO-AROUND ALT . . . . SET**
Set the go around altitude on the FCU.

AT 2000 FT AGL (minimum)

R — **FLAPS 2 . . . . ORDER**

— **FLAPS 2 . . . . SELECT**
- 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.

- **If above the glideslope :**

  – **V/S mode . . . . SELECT**

  – **FCU ALTITUDE . . . . SET ABOVE A/C ALTITUDE**

Note : 1. When reaching VFE, the AP maintains VFE and reduces the V/S without MODE REVERSION.
2. If the aircraft intercepts the ILS above the radio altimeter validity range (no radio altitude indication available on the PFD), CAT 1 is displayed on the FMA. Check that the FMA displays the correct capability for the intended approach, when the aircraft is below 5 000 feet.

– **GO-AROUND ALT . . . . SET**
Set the go around altitude on the FCU.

AT 2000 FT AGL (minimum)

– **FLAPS 2 . . . . SELECT**
· 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.

R **WHEN FLAPS ARE AT 2**

R – **LDG GEAR . . . . SELECT DOWN**

R – **AUTO BRK . . . . CONFIRM**
R If the runway conditions have changed from the approach briefing, consider another
R braking mode.

R – **GROUND SPOILERS . . . . ARM**

WHEN FLAPS ARE AT 2

R — **LDG GEAR DOWN . . . . ORDER**

— **LDG GEAR . . . . SELECT DOWN**

— **AUTO BRK . . . . CONFIRM**
If the runway conditions have changed from the approach briefing, consider another braking mode.

— **GROUND SPOILERS . . . . ARM**

R — **EXTERIOR LIGHTS . . . . SET**
R Set : The NOSE switch to TAXI
R The RWY TURN OFF switch to ON
R The LAND switch to ON.

WHEN LANDING GEAR IS DOWN

R — **FLAPS 3 . . . . ORDER**

— **FLAPS 3 . . . . SELECT**

▲
NO CHANGE
▼

— **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 :**

— **RESIDUAL BRAKING PROC . . . . APPLY**

▲
NO CHANGE
▼

R — **FLAPS FULL . . . . ORDER**

— **FLAPS FULL . . . . SELECT**

▲
NO CHANGE
▼

R **WHEN LANDING GEAR IS DOWN**

– **FLAPS 3 . . . . SELECT**

R Select FLAPS 3 below VFE.

– **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 :**

– **RESIDUAL BRAKING PROC . . . . APPLY**

Note : Due to the accomplishment of the alternate braking functional test after the landing is downlocked, brief brake pressure indications may be observed on
R *BRAKE PRESS indicator.*

– **FLAPS FULL . . . . SELECT**

· Select FLAPS FULL below VFE.
· Retract the speedbrakes before selecting FLAPS FULL to avoid an unexpected pitch down, when the speedbrakes retract automatically.
R · Check deceleration towards VAPP.

– **A/THR . . . . CHECK IN SPEED MODE OR OFF**

– **WING ANTI ICE . . . . OFF**
Only switch the WING ANTI ICE to ON, in severe icing conditions.

– **EXTERIOR LIGHTS . . . . SET**
Set : The NOSE switch to TAXI
The RWY TURN OFF switch to ON
The 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**
The PF announces any FMA modification.
The PNF calls out, if :
– The speed becomes less than the speed target – 5 knots, or greater than the speed target + 10 knots.
– The pitch attitude becomes less than – 2.5°, or greater than 10° nose up.
– The bank angle becomes greater than 7°.
– The descent rate becomes greater than 1000 feet/min.
– Excessive LOC or GLIDE deviation occurs.
1/4 dot LOC ; 1 dot GS

R Following PNF flight parameter exceedance callout, the suitable PF response will be:
R – Acknowledge the PNF callout, for proper crew coordination purposes
R – Take immediate corrective action to control the exceeded parameter back into the
R defined stabilized conditions
R – Assess whether stabilized conditions will be recovered early enough prior to landing,
R otherwise initiate a go-around.

— **A/THR . . . . CHECK IN SPEED MODE OR OFF**

— **WING ANTI ICE . . . . OFF**

R Only switch the WING ANTI ICE to ON, in severe icing conditions.

— **SLIDING TABLE ◁ . . . . STOW**

— **LDG MEMO . . . . CHECK NO BLUE LINE**

— **CABIN REPORT . . . . OBTAIN**

— **CABIN CREW . . . . ADVISE**

— **LANDING CHECKLIST . . . . COMPLETE**

— **FLIGHT PARAMETERS . . . . CHECK**

NO CHANGE

AT DH + 100 FT (or MDA/MDH + 100 FT) :

– **ONE HUNDRED ABOVE . . . . MONITOR OR ANNOUNCE**

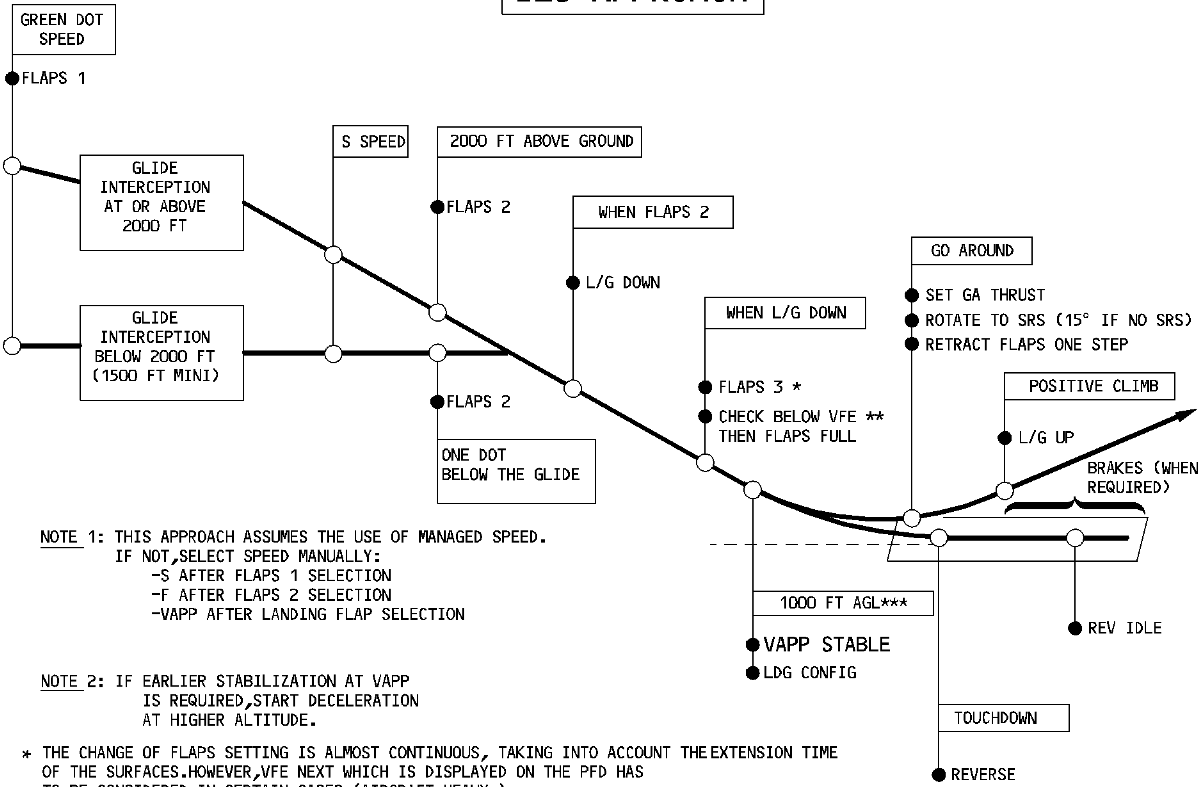
AT DH (or MDA/MDH)

– **MINIMUM . . . . MONITOR OR ANNOUNCE**

– **CONTINUE OR GO AROUND . . . . ANNOUNCE**
Do not duck under the glideslope. Maintain a stabilized flight path down to the flare. At 50 feet, one dot below the glideslope is 7 feet below the glideslope.

NFC5-03-0318-009-A001AA

ILS APPROACH



NOTE 1: THIS APPROACH ASSUMES THE USE OF MANAGED SPEED.
IF NOT,SELECT SPEED MANUALLY:
-S AFTER FLAPS 1 SELECTION
-F AFTER FLAPS 2 SELECTION
-VAPP AFTER LANDING FLAP SELECTION

NOTE 2: IF EARLIER STABILIZATION AT VAPP IS REQUIRED,START DECELERATION AT HIGHER ALTITUDE.

* THE CHANGE OF FLAPS SETTING IS ALMOST CONTINUOUS, TAKING INTO ACCOUNT THE EXTENSION TIME OF THE SURFACES.HOWEVER,VFE NEXT WHICH IS DISPLAYED ON THE PFD HAS TO BE CONSIDERED IN CERTAIN CASES (AIRCRAFT HEAVY).

** TO MINIMIZE FLAPS WEAR,EXTEND FLAPS AT VFE-15 Kt WHEN POSSIBLE.

*** 1000Ft AGL MINIMUM IMC,
500Ft AGL MINIMUM VMC OR AS RESTRICTED BY AIRLINE POLICY/REGULATIONS.

INTRODUCTION

APPROACH GUIDANCE FOR NON PRECISION APPROACHES OTHER THAN LOC, LOC B/C 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.

R For straight in approaches, 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 :
  - R The approach stored in the navigation database has been produced by approved suppliers compliant with ED76/DO200A requirements, or has been validated and approved by the operator.
  - R The effect of low OAT on obstacle clearance needs to be evaluated. A minimum OAT, below which selected vertical guidance should be used, may have to be defined.
  - 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.
  - R Conventional radio navaids must be available and monitored during the approach, and must be considered with altitude as the primary means of navigation.

<u>Note</u> : *For additional information on recommended flight crew procedures, and on navigation database vertical flight path validation, refer to the dedicated FCOM Bulletin "Use of managed guidance in approach and NAV database validation" and the FMGS Pilot's Guide (4.05.70).*

If the FM/GPS POS DISAGREE ECAM caution is triggered during the approach, use selected guidance to continue the approach with radio navaid raw data.
If GPS PRIMARY is lost, NAV and FINAL APP mode can be used to continue the approach, provided the radio navaid raw date indicates the correct navigation.

APPROACH GUIDANCE FOR RNAV APPROACH OR RNP AR (SAAAR or EQUIVALENT)

Two different approach strategies are available to perform RNAV approaches :

1. Lateral guidance, managed by the FM, and vertical guidance selected by the crew : NAV-FPA (or NAV-V/S) modes.
   This strategy applies, when LNAV ONLY (Lateral Navigation only) RNAV approach is intended.

   Note : Not applicable to RNP AR (SAAAR or equivalent).

2. Lateral and vertical guidance, managed by the FM : FINAL APP mode.
   This strategy applies, when LNAV/VNAV (Lateral and Vertical Navigation) RNAV approach is intended.
   For straight in approaches, 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.
   Before starting a RNAV (GPS) approach, two navigation systems must be operative : 2 FMS and 2 GPS.

RNAV approach can be performed in NAV-FPA (or NAV-V/S) modes provided :

- The approach stored in the navigation database has been produced by approved suppliers compliant with ED76/DO200A requirements, or has been validated and is approved by the operator.
- Before starting the approach, the crew must check the lateral FM F-PLN against the published approach chart using MCDU and ND.
- The final approach is laterally and vertically monitored, using the appropriate data : the distance to the runway or to the MAP versus altitude is the primary means of vertical navigation, the deviation on the PFD may be unreliable.

RNAV approach can be performed in FINAL APP mode provided :

- The approach stored in the navigation database has been produced by approved suppliers compliant with ED76/DO200A requirements, and the vertical flight path has been validated by the operator, or, the lateral and vertical flight path has been validated and approved by the operator.

  Note : RNP AR (SAAAR or equivalent) approaches coded in the navigation database must be fully validated by the operator.

  If no minimum OAT is published on the approach chart, the effect of low OAT on obstacle clearance needs to be evaluated.

- 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 VDEV and appropriate raw data (distance to the runway, altitude, FPV).

Note : *For additional information on recommended flight crew procedures, and on navigation database flight path validation, refer to the FCOM Bulletin "Use of managed guidance in approach and NAV database validation" and the FMGS Pilot's guide (4.02.20 and 4.05.70).*

For RNAV Approach with GPS PRIMARY

Unless an instrument approach procedure, not requiring GPS PRIMARY, is available at destination or destination alternate (and at required takeoff alternate, and enroute alternate), the GPS PRIMARY availability must be verified before flight.
RAIM is available worldwide, if 24 or more GPS satellites are operative.
If the number of GPS satellites is 23 or less, check RAIM availability, using the approved version of the Honeywell ground-based prediction software.
If the GPS PRIMARY availability cannot be verified before flight, RAIM availability can be checked in flight, using the PREDICTIVE GPS MCDU page.

Note : For RNP AR (SAAAR or equivalent), before flight, the flight crew must check that the GPS Primary is predicted available, for the ETA. This prediction should take into account the terrain environment.

Before starting the approach, check that GPS PRIMARY is available on both MCDUs.
If the GPS PRIMARY LOST indication appears on the ND during the approach, discontinue the approach, unless :
- GPS is not required and navigation accuracy is confirmed against the radio NAVAID raw data, or
- For RNAV approach not requiring GPS, HIGH accuracy appears on the MCDU, with the appropriate RNP value.
- If GPS PRIMARY is lost on only one FMGC, the approach can be continued, using the AP/FD associated to the other FMGC.

If the FM/GPS POS DISAGREE ECAM caution is triggered during the approach, discontinue the approach, unless radio NAVAID raw data is available and indicates correct navigation to continue the approach using selected FMGS modes.

For RNAV approach without GPS PRIMARY (Not applicable for RNP AR (SAAAR or equivalent))

Before starting the approach, check FM position accuracy with radio NAVAID raw data.
Check, in addition, that HIGH accuracy appears on the MCDU, with the specified RNP value.
If HIGH accuracy is lost on one FMGC, the approach can be continued with the AP/FD associated to the other FMGC.
If HIGH accuracy is lost on both FMGCs, discontinue the approach.

APPROACH GUIDANCE FOR LOC AND LOC B/C NON PRECISION APPROACHES

The Standard Operating Procedure of this section can be used for flying LOC or LOC B/C approaches, provided the following approach guidance items are observed.
The FM NAV mode can be used down to LOC or LOC B/C interception.
For LOC or LOC B/C intermediate and final approach, use the LOC or LOC B/C 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
R given by radio-navaid).

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.
R The objective is to be stabilized on the final descent path at VAPP in the landing
R configuration, at 1 000 feet above airfield elevation (in instrument conditions, or at 500 feet
R above airfield elevation in visual conditions, after continuous deceleration on the final
R descent path).
R To be stabilized, all of the following conditions must be achieved prior to, or upon reaching
R this stabilization height :
R · The aircraft is on the correct lateral and vertical flight path
R · The aircraft is in the desired landing configuration
R · The thrust is stabilized, usually above idle, to maintain the target approach speed along
R the desired final approach path
R · No excessive flight parameter deviation.
R If the aircraft is not stabilized on the approach path in landing configuration, at 1 000 feet
R above airfield elevation in instrument conditions, or at 500 feet above airfield elevation in
R visual conditions, or as restricted by Operator policy/regulations, the flight crew must
R initiate a go-around, unless they think that only small corrections are necessary to rectify
R minor deviations from stabilized conditions due, amongst others, to external perturbations.

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.

● **For RNP AR approach :**

– **GPS 1+2 on GPS MONITOR page . . . . CHECK BOTH IN NAV**

– **RNP on PROG page . . . . CHECK/INSERT**

– **GPS PRIMARY on PROG page . . . . CHECK AVAILABLE**

– **HIGH ACCURACY . . . . CHECK**

– **RNP pushbutton . . . . ON**
Only for the RNP AR approach.

– **AP . . . . AS RQRD**

Note : AP must be engaged for RNP AR < 0.3.

– **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 :

<table>
<tr><th rowspan="2">NAVIGATION ACCURACY</th><th rowspan="2">Approach guidance</th><th colspan="2">ND</th><th rowspan="2">AP/FD mode</th></tr>
<tr><th>PF</th><th>PNF</th></tr>
<tr><td>GPS PRIMARY</td><td rowspan="3">Managed***</td><td colspan="2" rowspan="3">ARC or ROSE NAV *
With NAVAID
raw data</td><td rowspan="3">NAV-FPA
or APP-NAV/
FINAL ***</td></tr>
<tr><td>NAV ACCUR HIGH</td></tr>
<tr><td>NAV ACCUR LOW and
NAV ACCURACY check ≤ 1NM</td></tr>
<tr><td>GPS PRIMARY LOST and
NAV ACCUR LOW and
NAV ACCURACY check
> 1 NM</td><td rowspan="2">Selected</td><td rowspan="2">ROSE VOR
**</td><td rowspan="2">ARC or
ROSE NAV
or ROSE
VOR **
With
NAVAID
raw data</td><td rowspan="2">TRK-FPA</td></tr>
<tr><td>GPS PRIMARY LOST and
aircraft flying within unreliable
radio NAVAID area</td></tr>
</table>

(*) For VOR approaches, one pilot may select ROSE VOR.
(**) For LOC approaches, select ROSE ILS.
(***) Managed vertical guidance can be used, provided the approach coding in the navigation database has been validated. For RNP AR approach, FINAL APP mode is required.

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 DOWNGRAD message, if raw data indicates that the guidance is satisfactory.

– **RADAR TILT . . . . ADJUST**

– **APPROACH CHECKLIST . . . . PERFORM**

NO CHANGE

— **RADAR** . . . . **AS APPROPRIATE**

R Gain must be manually set to +8, when MULTISCAN selector is set to AUTO and when
R flying below FL 150.

R <u>Note</u> : *1. MULTISCAN AUTO mode provides an efficient ground clutter rejection. During*
R *operation in good or non significant weather conditions, no weather pattern*
R *will be displayed on the ND's. In this case, the flight crew confirms correct*
R *radar operation, using temporarily MANUAL TILT.*
R *2. The flight crew monitors the weather radar display in AUTO mode, and*
R *confirms any weather display that is ambiguous or unexpected using manual*
R *tilt according to standard techniques.*

NO CHANGE

INTERMEDIATE/FINAL APPROACH

NO CHANGE

AT GREEN DOT SPEED

R – **FLAPS 1 . . . . ORDER**

– **FLAPS 1 . . . . SELECT**
  – Check deceleration toward S speed.
  – If the aircraft speed is significantly higher than S speed on the glideslope, or if the aircraft does not decelerate on the flight path, extend the landing gear to slow it down. It is also possible to use speedbrakes. However, the flight crew must be aware that the use of speedbrakes causes an increase in VLS.

– **TCAS Mode Selector . . . . TA OR TA/RA**
  · See ILS approach (Refer to 3.03.18)

– **ND DISPLAY . . . . SELECT RANGE/MODE**

INTERMEDIATE/FINAL APPROACH

- **For RNAV approach :**

  – **GPS 1+2 on GPS MONITOR page . . . . CHECK BOTH IN NAV**

  – **GPS PRIMARY on PROG page . . . . CHECK AVAILABLE**

  - **If GPS PRIMARY is not available**

    – **RNP for approach . . . . CHECK/ENTER**

    – **HIGH accuracy . . . . CHECK**

  Note : RNAV approach without GPS is subject to a specific operational approval.

- **For RNP AR approach only :**

  – **Altimeters . . . . SET/CHECK**
  Between IAF and FAF, verify current QNH and crosscheck altimeters are within 75 feet.

- **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

– **FLAPS 1 . . . . SELECT**
  – Check deceleration toward S speed.
  – If the aircraft speed is significantly higher than S speed on the glideslope, or if the aircraft does not decelerate on the flight path, extend the landing gear to slow it down. It is also possible to use speedbrakes. However, the flight crew must be aware that the use of speedbrakes causes an increase in VLS.

– **TCAS Mode Selector . . . . TA OR TA/RA**
  · See ILS approach (Refer to 3.03.18)

– **ND DISPLAY . . . . SELECT RANGE/MODE**

R **AT S SPEED**

R – **FLAPS 2 . . . . SELECT**
R – Check deceleration toward F speed.
R – If the aircraft speed is significantly higher than F speed on the flight path, or if the
R aircraft does not decelerate on the flight path, extend the landing gear in order to
R slow down the aircraft. The use of speedbrakes is not recommended.
R – When the speedbrakes are deployed, extending the flaps beyond FLAPS 1 may cause
R a slight roll movement, and in calm conditions a small lateral control asymmetry may
R remain until it is affected by control input or an atmospheric disturbance.

R **WHEN FLAPS ARE AT 2**

R – **LDG GEAR . . . . SELECT DOWN**

R – **AUTO BRK . . . . CONFIRM**
R If the runway conditions have changed from the approach briefing, consider another
R braking mode.

R – **GROUND SPOILERS . . . . ARM**

R **WHEN LANDING GEAR DOWN :**

– **FLAPS 3 . . . . SELECT**
R · Select FLAPS 3 below VFE.

– **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 :**

– **RESIDUAL BRAKING PROC . . . . APPLY**

Note : Due to the accomplishment of the alternate braking functional test after the landing gear is downlocked, brief brake pressure indications may be observed on BRAKE PRESS indicator.

AT S SPEED

R — **FLAPS 2 . . . . ORDER**

— **FLAPS 2 . . . . SELECT**
- Check deceleration toward F speed.
- If the aircraft speed is significantly higher than F speed on the flight path, or if the aircraft does not decelerate on the flight path, 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 cause a slight roll movement, and in calm conditions a small lateral control asymmetry may remain until it is affected by control input or an atmospheric disturbance.

WHEN FLAPS ARE AT 2

R — **LDG GEAR DOWN . . . . ORDER**

— **LDG GEAR . . . . SELECT DOWN**

— **AUTO BRK . . . . CONFIRM**
If the runway conditions have changed from the approach briefing, consider another braking mode.

— **GROUND SPOILERS . . . . ARM**

R — **EXTERIOR LIGHTS . . . . SET**
R Set NOSE switch to TAXI, set RWY TURN OFF switch to ON, and set LAND switch to
R ON.

WHEN LANDING GEAR DOWN :

R — **FLAPS 3 . . . . ORDER**

— **FLAPS 3 . . . . SELECT**
· Select FLAPS 3 below VFE.

— **ECAM WHEEL page . . . . CHECK**
· The ECAM WHEEL page appears below 800 feet, or at landing gear extension.
· Check the three landing gear green indications.

▲
NO CHANGE
▼

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R — **FLAPS FULL** . . . . **ORDER**

— **FLAPS FULL** . . . . **SELECT**

NO CHANGE

– **FLAPS FULL . . . . SELECT**
- Select FLAPS FULL below VFE.
- Retract the speedbrakes before selecting FLAPS FULL to avoid an unexpected pitch down when the speedbrakes automatically retract.
- Check deceleration towards VAPP.
- Check correct TO waypoint on the ND.

MANAGED VERTICAL GUIDANCE	SELECTED VERTICAL OR SELECTED LATERAL AND VERTICAL GUIDANCE
. After the FAF : **– FINAL APP . . . . CHECK** Check FINAL APP green on the FMA. **– GO AROUND ALTITUDE . . . . SET** Set, when below the go-around altitude.	**. At FAF :** **– FPA for final approach . . . . SET** **. After the FAF :** **– GO AROUND ALTITUDE . . . . SET** Set, when below the go-around altitude.
– POSITION/FLIGHT PATH . . . . MONITOR **· For approach in overlay to a conventional radio navaid procedure :** Use radio navaid raw data and altitude to monitor the lateral and vertical navigation. If the navigation is unsatisfactory, revert to selected guidance. In particular, monitor the vertical guidance, using altitude indication versus radio navaid position, and be prepared to revert to NAV-FPA, if the vertical guidance is unsatisfactory. **· For RNAV approach :** Monitor VDEV and FPV (on the PFD) and XTK error (on the ND). Use altitude indication versus distance to the runway to monitor the vertical navigation. If the vertical guidance is unsatisfactory, revert to NAV/FPA or consider the go-around. If the lateral guidance is unsatisfactory, perform a go-around. **· For RNP AR approach :** Monitor LDEV and VDEV (on the PFD) and XTK error (on the ND). Use altitude indication, crossing approach waypoints to monitor vertical navigation. If the lateral or vertical guidance is unsatisfactory, consider the go-around.	**– POSITION/FLIGHT PATH . . MONITOR/ADJUST** **· For approach in overlay to a conventional radio navaid procedure :** Use radio navaid raw data to monitor the lateral navigation. Using altitude indication versus radio navaid position, adjust the FPA, as necessary, to follow the published descent profile, taking into account the minimum altitudes. Do not use the FMGC VDEV on the PFD. If the lateral navigation is unsatisfactory, revert to TRK/FPA. **· For RNAV approach :** Monitor XTK error on ND. Using altitude indication versus distance to the runway, adjust the FPA as necessary to follow the published descent profile, taking into account the minimum altitudes. If the lateral guidance is unsatisfactory, perform a go-around.

– **A/THR . . . . CHECK IN SPEED MODE OR OFF**

– **WING ANTI ICE . . . . OFF**
Switch WING ANTI ICE ON in severe icing conditions only.

– **EXTERIOR LIGHTS . . . . SET**
Set NOSE switch to TAXI, set RWY TURN OFF switch to ON, and set 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 :
– "SPEED", when the speed goes below V target – 5, or goes above the speed target + 10
– "SINK RATE", when V/S is greater than – 1000 feet/minute.
– "BANK", when the bank angle goes above 7 degrees.
– "PITCH", when the pitch attitude goes below – 2.5 degrees, or goes above + 10 degrees.
– "COURSE", when the course deviation is greater than 1/2 dot or 2.5 degrees (VOR), or 5 degrees (ADF).
– "_ FT HIGH (LOW)" at altitude checkpoints.
R Following PNF flight parameter exceedance callout, the suitable PF response will be :
R – Acknowledge the PNF callout, for proper crew coordination purposes
R – Take immediate corrective action to control the exceeded parameter back into the
R defined stabilized conditions
R – Assess whether stabilized conditions will be recovered early enough prior to landing,
R otherwise initiate a go-around.

— **A/THR** . . . . **CHECK IN SPEED MODE OR OFF**

— **WING ANTI ICE** . . . . **OFF**

R Switch WING ANTI ICE ON in severe icing conditions only.

— **SLIDING TABLE** . . . . **STOW**

— **LDG MEMO** . . . . **CHECK NO BLUE LINE**

— **CABIN REPORT** . . . . **OBTAIN**

— **CABIN CREW** . . . . **ADVISE**

— **LANDING CHECKLIST** . . . . **COMPLETE**

— **FLIGHT PARAMETERS** . . . . **CHECK**

NO CHANGE

- **AT ENTERED DA/DH, MDA/MDH + 100 FT :**

  – **ONE HUNDRED ABOVE . . . . MONITOR OR ANNOUNCE**

- **At ENTERED DA/DH, MDA or MDH**

  – **MINIMUM . . . . MONITOR OR ANNOUNCE**

  - **If ground references are visible :**

    – **CONTINUE . . . . ANNOUNCE**

    – **AP . . . . OFF**
    Continue, as with a visual approach (Refer to 3.03.20).

  - **If ground references are not visible :**

    – **GO AROUND . . . . ANNOUNCE**
    Initiate a go-around.

    Note : *1. In managed guidance (FINAL APP mode engaged), when the aircraft reaches MDA (MDH) – 50 or 400 feet (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 the pilot 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.

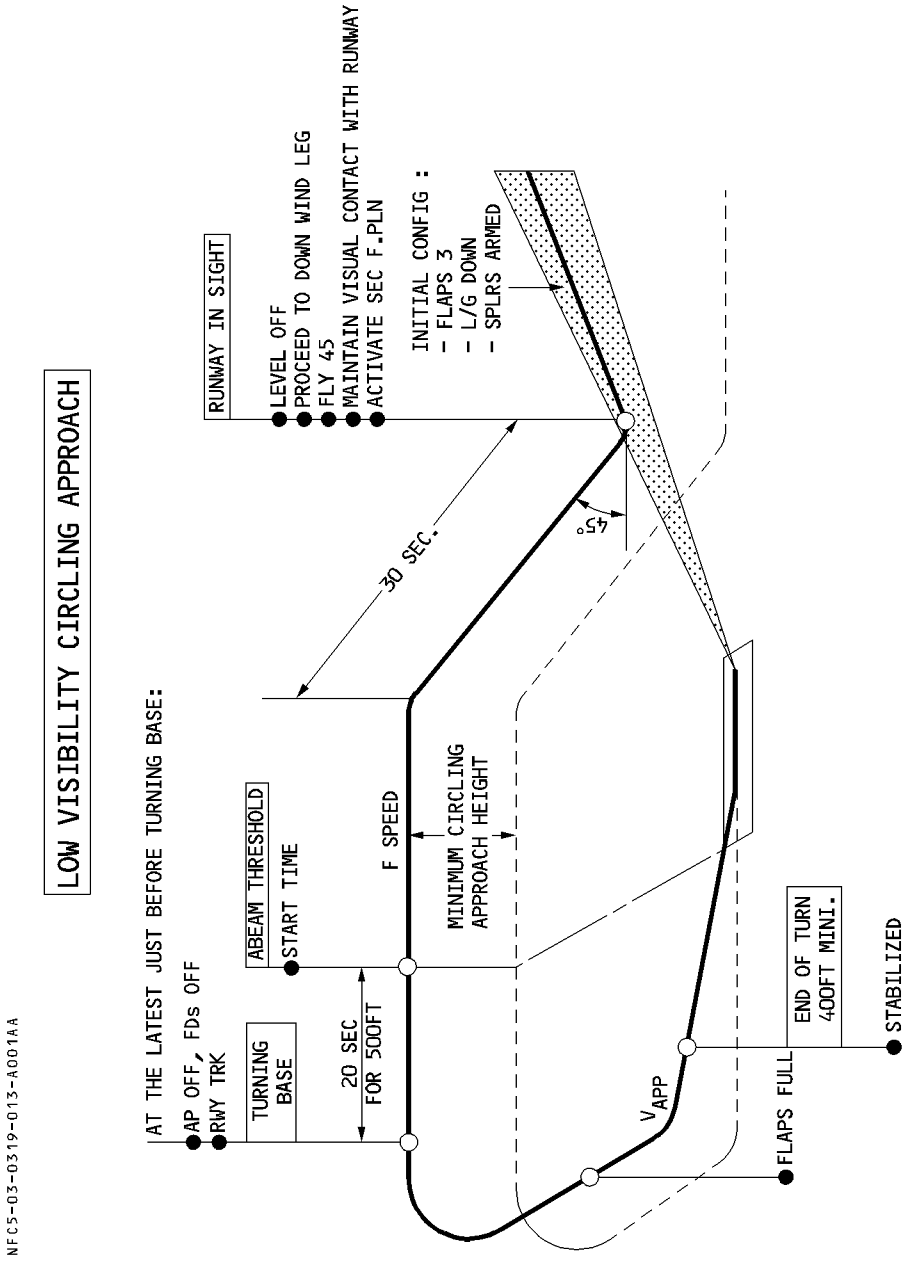
- **If the flight crew finds no visual reference :**
  - **AT MAP : Initiate go-around**
- **If the flight crew finds sufficient visual references :**
  - **Select TRK for downwind**
  - **Early on downwind : Activate SEC F-PLN**

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.**

R – **Select both FDs OFF.**

R


LOW VISIBILITY CIRCLING APPROACH
AT THE LATEST JUST BEFORE TURNING BASE:
AP OFF, FDs OFF
RWY TRK
TURNING BASE
20 SEC FOR 500FT
ABEAM THRESHOLD
START TIME
F SPEED
MINIMUM CIRCLING APPROACH HEIGHT
30 SEC.
45°
RUNWAY IN SIGHT
LEVEL OFF
PROCEED TO DOWN WIND LEG
FLY 45
MAINTAIN VISUAL CONTACT WITH RUNWAY
ACTIVATE SEC F.PLN
INITIAL CONFIG :
- FLAPS 3
- L/G DOWN
- SPLRS ARMED
V APP
FLAPS FULL
END OF TURN 400FT MINI.
STABILIZED
NFC5-03-0319-013-A001AA

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.

Bear in mind the possible risk of optical illusions due to hindered night vision.

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.**

- **Select FDs to OFF.**

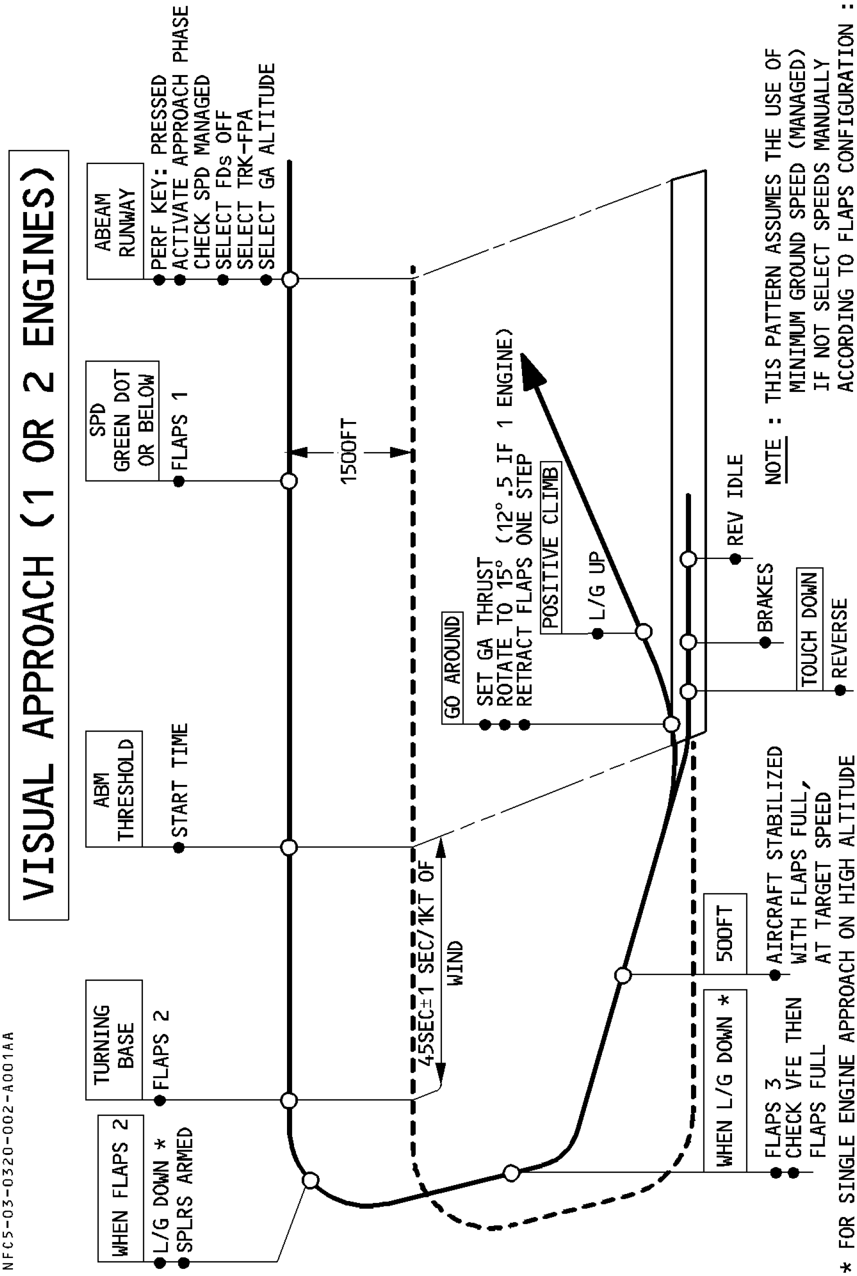
- **Select TRK-FPA to have FPV displayed.**

- **Check A/THR active.**
  Extend the downwind leg to 45 seconds (± wind correction).
  Turn into base leg with a maximum of 30° of bank. Descent with approximate FPA, in FLAPS 2, at F speed.

FINAL APPROACH

- The speed trend arrow and FPV help the flight crew make timely and correct thrust settings (if in manual thrust), and approach path corrections. Avoid descending through the correct approach path with idle thrust. (Late recognition of this situation without a prompt thrust increase may lead to considerable speed decay and altitude loss).
  Ensure that the aircraft is stabilized on the final descent path at VAPP (or ground speed mini) in the landing configuration with the thrust stabilized (usually above idle) at 500 feet above airfield elevation or as restricted by Operator policy/regulations. If the aircraft is not stabilized, the flight crew must initiate a go-around, unless they think that only small corrections are necessary to rectify minor deviations from stabilized conditions due, amongst others, to external perturbations.
- 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.

R



NOTE : THIS PATTERN ASSUMES THE USE OF MINIMUM GROUND SPEED (MANAGED)
IF NOT SELECT SPEEDS MANUALLY ACCORDING TO FLAPS CONFIGURATION :
S AFTER FLAPS 1 SELECTION
F AFTER FLAPS 2 SELECTION
VAPP AFTER FLAPS FULL SELECTION

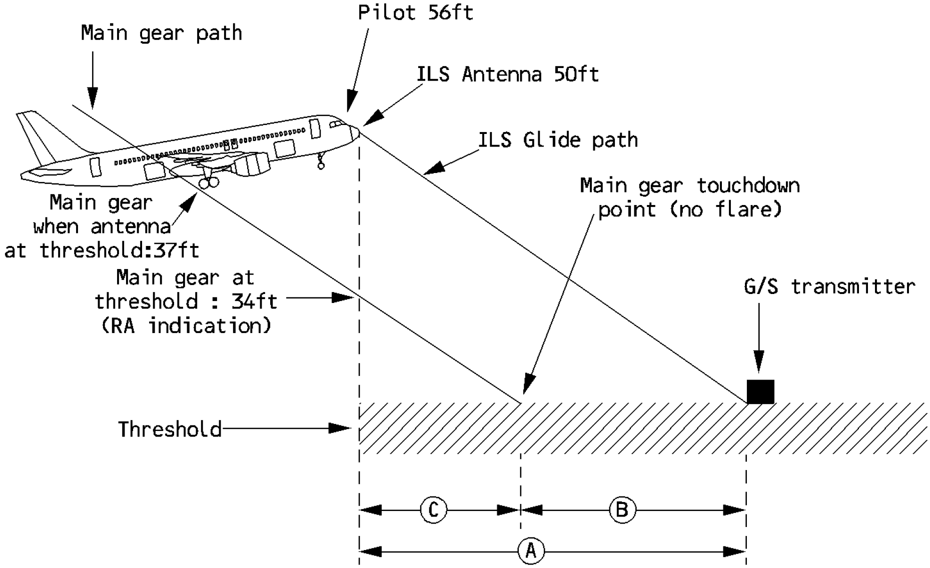
* FOR SINGLE ENGINE APPROACH ON HIGH ALTITUDE AIRPORTS, WITH HIGH LANDING WEIGHT, DELAY SELECTION OF GEAR DOWN AND LANDING FLAPS/SLATS CONFIGURATION TILL FINAL APPROACH.

PRECISION APPROACH

R (Refer to FCOM 4.05.70).

ILS FINAL APPROACH AND LANDING GEOMETRY

R

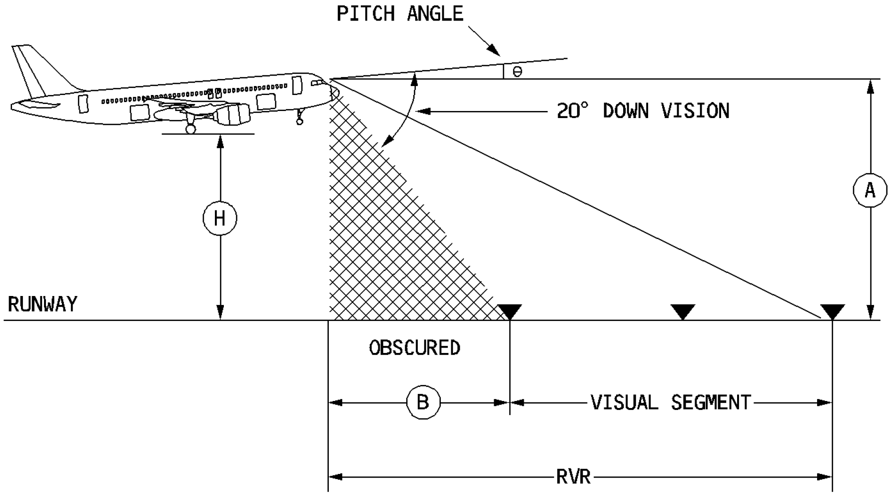


CONDITIONS :	GLIDE PATH (°)	A	B	TOUCHDOWN POINT C
- FLAPS FULL - ILS ANTENNA AT 50 ft AT THRESHOLD	2°5	348 m 1145 ft	112 m 366 ft	236 m 779 ft
- NO FLARE - PITCH ANGLE : 4°	3°	291 m 954 ft	93 m 306 ft	198 m 648 ft

NFC5-03-0322-001-A040AA

MINIMUM VISUAL GROUND SEGMENTS (Flare phase)

R



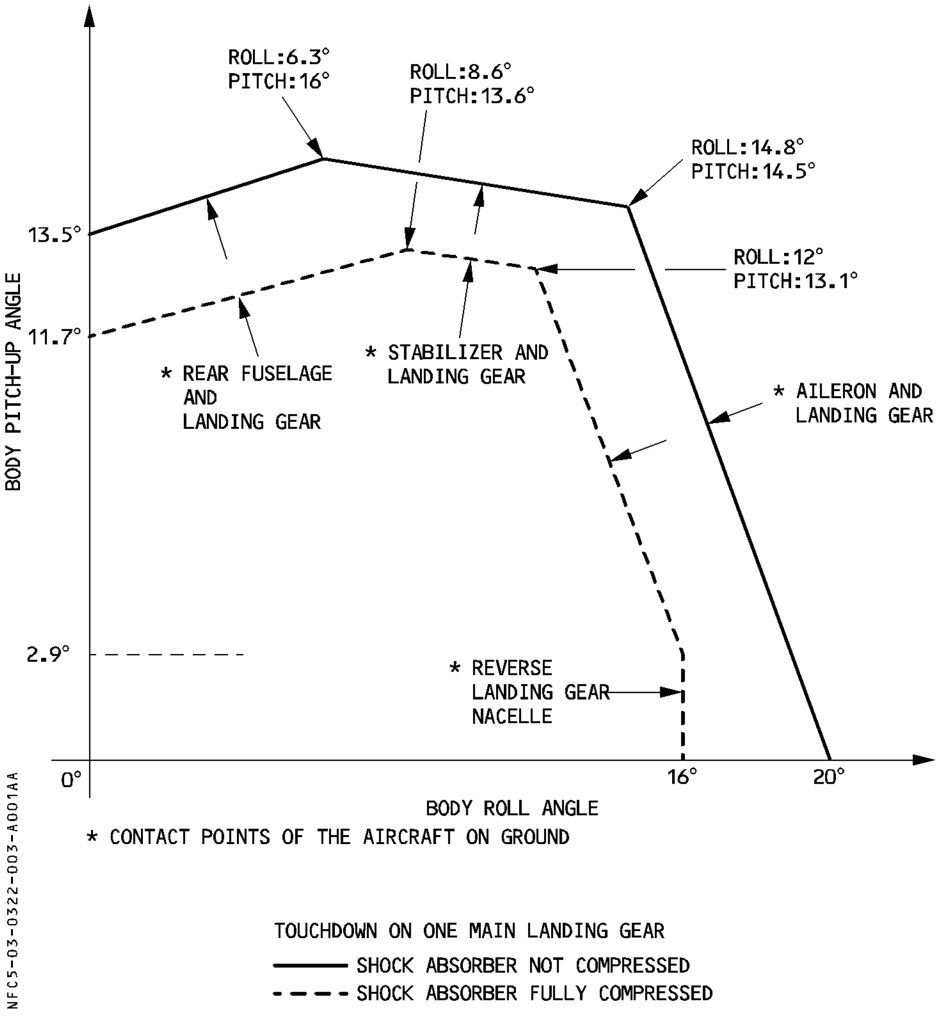
	CAT III		CAT II
H	15 ft (θ = 5.4°)	50 ft (θ = 4.7°)	100 ft (θ = 4.7°)
VISUAL SEGMENT	60 m (197 ft)		120 m (394 ft)
A	36 ft	71 ft	121 ft
OBSCURED B	43 m (140 ft)	79 m (259 ft)	134 m (442 ft)
MINIMUM RVR	103 m (337 ft)	139 m (456 ft)	254 m (836 ft)

NFC5-03-0322-002-A040AA

R *Note : This drawing shows that, for a CAT III landing (60 meters minimum visual segment),*
R *the minimum RVR is 103 meters at 15 feet.*

GROUND CLEARANCE DIAGRAM

R



LANDING

The cockpit cut-off angle is 20 degrees.

● **In stabilized approach conditions, the flare height is approximately 30 feet :**

– **FLARE . . . . PERFORM**

– **ATTITUDE . . . . MONITOR**
The PNF should monitor the attitude, and call out :
– "PITCH, PITCH", if the pitch angle reaches 10 degrees.
– "BANK, BANK", if the bank angle reaches 7 degrees.

– **THRUST levers . . . . IDLE**
R If autothrust is engaged, it automatically disconnects when the pilot sets both thrust
R levers to the IDLE detent.
In manual landing conditions, the "RETARD" callout is triggered at 20 feet Radio Altitude (RA), in order to remind the pilot to retard the thrust levers.

R *Note : If one or both thrust levers remain above the IDLE detent, ground spoilers*
R *extension is inhibited.*

Ground clearance
· Avoid flaring high.
· A tailstrike occurs, if the pitch attitude exceeds 13.5 degrees (11 degrees with the landing gear compressed).
A wingtip or engine scrape occurs, if the roll angle exceeds 20 degrees (16 degrees 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 thrust reversers, select and maintain the thrust levers in reverse idle position until taxi speed is reached.
A slight pitch up that can be easily controlled by the pilot, may occur when the thrust reversers are deployed before the nose landing gear touches down.
Lower the nosewheel without undue delay.
· The PNF continues to monitor the attitude.
· In the case of an engine failure, the use of the remaining thrust reverser is recommended.
· Braking may begin before the nosewheel has touched down, if required for performance reasons. However, when comfort is the priority, the flight crew should delay braking until the nosewheel has touched down.
During rollout, the flight crew should avoid sidestick inputs (either lateral or longitudinal).
If directional control problems are encountered, the flight crew should reduce thrust to reverse idle until directional control is satisfactory.
· After reverse thrust is selected, the flight crew must perform a full stop landing.

R – **GROUND SPOILERS . . . . CHECK/ANNOUNCE**
R Check that the ECAM WHEEL page displays the ground spoilers extended after
R touchdown.
R · If no ground spoilers are extended :
R – Verify and confirm that both thrust levers are set to IDLE or REV detent
R – Set both thrust reverser levers to REV MAX, and fully press the brake pedals.

R *Note : If ground spoilers are not armed, ground spoilers extend at reverser thrust*
R *selection.*

R – **REVERSERS . . . . CHECK/ANNOUNCE**
R Check that the ECAM E/WD page displays that the reverse deployment is as
R expected (REV 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 rapidly, a brake pressure indication appears briefly on the BRAKE PRESS indicator.

R *Note : If no ground spoilers are extended, the autobrake is not activated.*

R – **DECELERATION . . . . CHECK/ANNOUNCE**
R The deceleration is felt by the flight crew, and confirmed by the speed trend on the
R PFD.
R The deceleration may also be confirmed by the DECEL light (if autobrake is on).

● **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**

- **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.

- **GO AROUND . . . . ANNOUNCE**

- **FMA . . . . CHECK AND ANNOUNCE**
  Check the FMA on the PFD. The following modes are displayed : MAN TOGA/SRS/GA TRK/A/THR (in blue).

- **NAV mode . . . . SELECT**
  For RNP AR, NAV mode must be engaged immediately (minimum height 100 feet).

- **FLAPS . . . . RETRACT ONE STEP**

- **POSITIVE CLIMB . . . . ANNOUNCE**

R - **LDG GEAR UP . . . . ORDER**

- **LDG GEAR . . . . SELECT UP**

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**

GO AROUND

Apply the following three actions simultaneously :

– **THRUST LEVERS . . . . TOGA**

– **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.

– **GO AROUND . . . . ANNOUNCE**

– **NAV mode . . . . SELECT**
  For RNP AR, NAV mode must be re-engaged immediately (minimum height 100 feet).

– **FMA . . . . CHECK AND ANNOUNCE**
  Check the FMA on the PFD. The following modes are displayed : MAN TOGA/SRS/NAV/A/THR (in blue).

– **FLAPS . . . . RETRACT ONE STEP**

– **POSITIVE CLIMB . . . . ANNOUNCE**

– **LDG GEAR . . . . SELECT UP**

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 that the target speed increases to green dot.**

  - **If the 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.

GO-AROUND FROM AN INTERMEDIATE APPROACH ALTITUDE

To interrupt the approach, or to perform a go-around, from an intermediate altitude in the approach, and if TOGA thrust is not required, proceed as follows :

– **SET the thrust levers to TOGA detent, then retard the thrust levers as required.**
This enables to engage the GO-AROUND phase, with associated AP/FD modes.

– **SELECT the applicable AP/FD and A/THR modes on the FCU.**
For RNP AR, the NAV mode must be re-engaged immediately.

Note : If the thrust levers are not set briefly to TOGA detent, the FMS does not engage the GO AROUND phase, and flying over, or close to the airport (less than 7 NM) will sequence the Destination waypoint in the F-PLN.

INTENTIONALLY LEFT BLANK

INTENTIONALLY LEFT BLANK

AFTER LANDING

– **LAND lights . . . . RETRACT**
R Retract landing lights, unless they are needed.

R – **STROBE LIGHTS . . . . AUTO**
R When leaving the runway, set the STROBE lights to AUTO

R – **OTHER EXT LIGHTS . . . . AS RQRD**
R External lights can be turned off, unless they are needed.
R Set the NAV & LOGO ⩤ to ON, as required, to turn on the navigation and logo ⩤ lights.

– **GROUND SPOILERS . . . . DISARM**

– **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.

– **ENG MODE selector . . . . NORM**

– **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.

– **TCAS . . . . SET on standby**

– **ATC . . . . AS RQRD**
Depending on local regulation, ATC transponder may be operated in mode S (Refer to FCOM 1.34.50).

– **APU . . . . START**
APU START may be delayed until just prior to engine shutdown.

– **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).

– **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
R stabilization and thus avoid oxidation of brake surface hot spots. Selecting the brake
R fans before reaching the gate prevents the brake fans from blowing carbon brake dust
R on the ground personnel.
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, consider “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**
· When one brake temperature is above 500°C (or 350°C with brake fans ON ◁), avoid applying the parking brake, unless operationally necessary.
· Check the brake pressure on the Triple Indicator for the left and right brakes.

CAUTION
If the aircraft starts to move with the parking brake ON : Immediately release the PARKING BRK handle, to restore braking with the pedals.

– **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. This 3-minute period includes operating time at idle, such as taxiing. If operational requirements dictate, the engine may be shut down after a one-minute cooling period.
· If APU is not available, set EXT PWR to ON, then set ENG MASTERS to OFF.
· Check that engine parameters decrease.

<u>Note</u> : *If the engine fails to shut down, switch the corresponding master lever to ON,*
then to OFF. If the engine still fails to shut down, press the corresponding ENG
R *FIRE pushbutton. The successful shutdown via the LP fuel valve, can take up to*
R *2 minutes and 30 seconds, depending on airport altitude and fuel recirculation*
R *system operation.*

· 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.

R – **BEACON LT . . . . OFF**
R Turn off the BEACON lights, when all engines have spooled down.

R – **OTHER EXTERIOR LIGHTS . . . . AS RQRD**

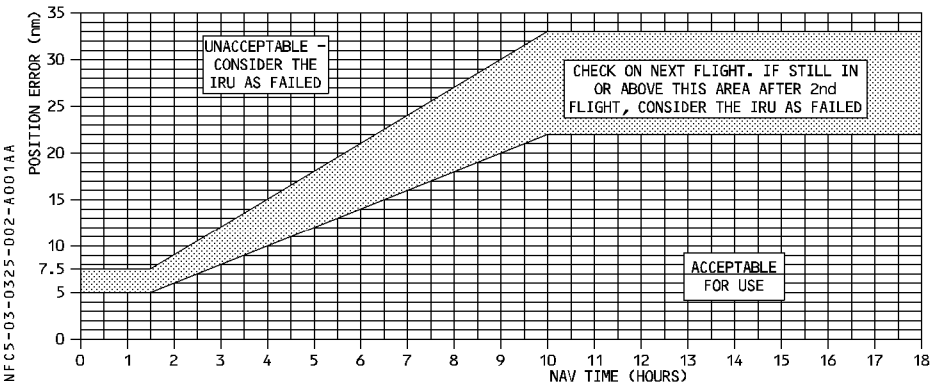
– **SEAT BELTS . . . . OFF**

– **ELAPSED TIME (⊲) . . . . STOP**

– **FUEL PUMPS . . . . OFF**

– **ATC . . . . SET on standby**

– **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 one brake temperature is above 300°C (or above 150°C with brake fans ON ◁).
  Releasing the parking brake prevents the critical structures from being exposed to high temperature levels for an extended time. However, if operational conditions dictate (e.g. slippery tarmac), the parking brake may remain applied.
  · When parking with a flat tire on the nose gear, keep the parking brake on, to avoid aircraft yawing at parking brake release.

- **DUs . . . . DIM**
Dim EFIS, ECAM and MCDU display units.

- **PARKING CHECKLIST . . . . COMPLETE**

- **REPORT SEVERE ICING CONDITIONS**
Report severe icing conditions in the log book, requiring inspection of the fan accoustic panels of the engines during the walkaround.

SECURING THE AIRCRAFT

Prior to performing this check consideration should be given to COLD WEATHER (Refer to 3.04.91).

- **PARKING BRAKE . . . . CHECK ON**
  Keep the parking brake on to reduce hydraulic leak rate in the brake accumulator.

- **OXYGEN CREW SUPPLY . . . . OFF**

- **ADIRS (1 + 2 + 3) . . . . OFF**
  ADIRS should not be switched off during transits at latitudes above 82°N, in order to avoid their requiring excessive alignment time.
  After having switched off the ADIRS, wait at least 10 seconds before switching off the electrical supply to ensure that the ADIRS memorize the last data.

- **EXTERIOR LIGHTS . . . . OFF**

- **MAINT BUS switch . . . . AS RQRD**
  Should electrical power be required for crew or servicing personnel consider selecting the MAINT BUS switch (overhead in the forward cabin) to the ON position prior to selecting aircraft power off.

- **APU BLEED . . . . OFF**

- **APU MASTER switch . . . . OFF**
  Switch off the APU after the passengers have disembarked.

- **EMER EXIT LT . . . . OFF**

- **NO SMOKING . . . . OFF**
  Switching off the NO SMOKING signs permits the emergency batteries to be charged (provided external power is supplying the aircraft network).

- **EXT PWR . . . . AS RQRD**

- **BAT 1 and 2 . . . . OFF**
  Wait until the APU flap is fully closed (about 2 minutes after the APU AVAIL light goes
  R out) before switching off the batteries. Switching the batteries off before the APU flap
  R is closed may cause smoke in the cabin during the next flight. If the batteries are off
  R while the APU is running, there is no APU fire extinguishing.

- **SECURING THE AIRCRAFT CHECKLIST . . . . COMPLETE**

COMMUNICATIONS AND STANDARD TERMS

Standard phraseology is essential to ensure effective crew communication. The
R phraseology should be concise and exact. The following Chapter lists the callouts 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.

CHECKLIST CALLOUTS

– "CHECK" : A command for the other pilot to check an item.
– "CHECKED" : A response that an item has been checked.
R – "CROSSCHECKED" : A callout verifying information from both pilot stations.
If a checklist needs to be interrupted, announce : "HOLD CHECKLIST AT ___" and "RESUME 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.
R All actions performed on the FCU and MCDU must be checked on the PFD and ND (eg :
R "FL 350 blue", "FL 200 magenta). Ensure that the correct FCU knob is used, then verify
R indications 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
R mode or target.

R The "PULL" command means pulling an FCU knob to engage a selected mode or target.
Example :

R – "PULL HDG 090"	(Heading knob is pulled and turned).
– "MANAGE NAV"	(Heading knob is pushed).
– "FL 190 PULL"	(Altitude knob is turned and pulled).
– "FL 190 MANAGE"	(Altitude knob is turned and pushed).
R – "PULL SPEED 250 KNOTS"	(Speed knob is pulled and turned).
– "MANAGE SPEED"	(Speed knob is pushed).

Note : If the value was previously set, there is no requirement to repeat the figure.
R *Simply call e.g. PULL HDG : PULL SPEED : FL PULL*

The VS/FPA selector knob has no managed function. The standard callouts 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).
R e.g. : BIRD ON (The HDG-V/S/TRK-FPA pushbutton is pushed.)

FMA

Unless listed otherwise (eg CAT II & III task sharing), all FMA changes will be normally
R called out by the PF and checked by the PNF :
R – All armed modes are announced by calling out their associated color (blue, magenta)
R e.g. : "G/S blue", "LOC blue".
R – All active modes are announced without calling out the color (green, white)
R e.g. : "NAV", "ALT".

ALTITUDE

R The PNF calls out "one thousand to go" when passing 1000 feet before the cleared altitude
R or FL, and the PF calls out "checked".

FLAPS OR GEAR CONFIGURATION

FLAPS' CALLOUTS

FLAPS' CONFIGURATION	CALLOUT
1	"FLAPS ONE"
1 + F	"FLAPS ONE"
0	"FLAPS ZERO"

The reply will be given when selecting the new flap position. e.g. :

	CALLOUT	REMARK
PF	"FLAPS ONE"	
PNF	"SPEED CHECKED" "FLAPS ONE"	PNF checks the speed : – Above the S or F speed and accelerating (Takeoff) – Below Vfe next and decelerating (Approach) PNF selects the flaps lever position and replies after checking the blue number on the ECAM flaps indicator to confirm the correct selection has been made.

GEAR CALLOUTS

	CALLOUT	REMARK
PF	"GEAR UP (DOWN)"	
PNF	"GEAR UP (DOWN)"	The PNF selects the gear lever position and replies after checking the red lights on the landing gear indicator to confirm gear operation.

FLIGHT PARAMETERS IN APPROACH

PNF will make callouts 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 :
  · 1/4 dot LOC ; 1 dot GS
– "COURSE" when greater than 1/2 dot or 2.5 degrees (VOR) or 5 degrees (ADF).
– "__ FT HIGH (LOW)" at altitude checks points.

● **For RNP AR approach :**

The PNF will make callouts for the following conditions during final approach :
– "LDEV", when LDEV is at half of RNP or 1 dot.
– "VDEV", when 1/2 dot deviation above or below path.
– "SINK RATE", when V/S is greater that – 1200 feet/minute.
– "BANK", when the bank angle goes above 30 degrees.

FLIGHT PARAMETERS IN GO-AROUND

During a go-around, the PNF will make a callout for the following conditions :
– "BANK" : If the bank angle becomes greater than 7°,
– "PITCH" : If the pitch attitude becomes greater than 20° up or less than 10° up,
– "SINK RATE" : If there is no climb rate.

PF/PNF DUTIES TRANSFER

To tranfer control, flight crewmembers must use the following callouts :
To give control : The pilot calls out "YOU HAVE CONTROL". The other pilot accepts this transfer by calling out "I HAVE CONTROL", before assuming PF duties.
To take control : The pilot calls out "I HAVE CONTROL". The other pilot accepts this transfer by calling out "YOU HAVE CONTROL", before assuming 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. For status page ; REMOVE STATUS will be used.
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.

MEMORY ITEMS

The aim of such callouts is to callout the appropriate procedure by calling out, in most cases, the title of the procedure. This will allow the crew to be aware of the situation and be prepared to properly react (crew coordination, task sharing and communication).
GPWS
As soon as avoidance manoeuver is envisaged.
"PULL UP TOGA"
R REACTIVE WINDSHEAR
"WINDSHEAR TOGA"
UNRELIABLE SPEED INDICATION
"UNRELIABLE SPEED"
TCAS
As soon as "TRAFFIC" warning is triggered
"TCAS, I have control"
EMERGENCY DESCENT
"EMERGENCY DESCENT"
LOSS OF BRAKING
"LOSS OF BRAKING"

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

R

BEFORE ENGINE START/PUSH BACK		
EVENT	**PF**	**PNF**
Before start up clearance received	BEFORE START C/L DOWN TO THE LINE	BEFORE START C/L DOWN TO THE LINE COMPLETE
After start up clearance received	BEFORE START C/L BELOW THE LINE	BEFORE START C/L COMPLETE

PUSH BACK/ENGINE START		
EVENT	**PF**	**GND Mech.**
When ready for pushback, and pushback clearance received from ATC	GROUND (from) COCKPIT, CLEARED FOR PUSH	COCKPIT (from) GROUND, RELEASE BRAKES
Start of push	BRAKES RELEASED READY TO PUSH	
When ready to start engines	CLEAR TO START ? STARTING ENG(S)—	CLEAR TO START
When pushback complete	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
2. Ailerons/Spoilers		FULL LEFT, FULL RIGHT, NEUTRAL
3. Rudder *	RUDDER	FULL LEFT, FULL RIGHT, NEUTRAL
During taxi	BEFORE TAKEOFF C/L DOWN TO THE LINE	BEFORE TAKEOFF C/L DOWN TO THE LINE COMPLETE
Lining up on the runway	BEFORE TAKEOFF C/L BELOW THE LINE	BEFORE TAKEOFF C/L COMPLETE

*Note : * The PNF should follow pedal movement with his/her feet*

R

TAKEOFF		
EVENT	**PF**	**PNF**
Setting thrust levers to initial stabilisation value	TAKEOFF	
Before passing 80 kts		THRUST SET
At 100 kts	CHECKED	ONE HUNDRED KNOTS
At V1		V1
At VR		ROTATE
Gear retraction	GEAR UP	POSITIVE CLIMB GEAR UP
If AP is engaged by PNF	AP 1(2) ON	
Check List	AFTER TAKEOFF/CLIMB C/L DOWN TO THE LINE	AFTER TAKEOFF/CLIMB C/L DOWN TO THE LINE COMPLETE
At transition altitude	AFTER TAKEOFF/CLIMB C/L BELOW THE LINE	AFTER TAKEOFF/CLIMB C/L COMPLETE

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R

TAXI		
EVENT	**PF**	**PNF**
When taxi clearance obtained	CLEAR LEFT (RIGHT) SIDE	CLEAR RIGHT (LEFT) SIDE
Brake check	BRAKE CHECK	
Flight control check in following sequence (can be done before start of taxi)	FLIGHT CONTROL CHECK	
1. Elevators		FULL UP, FULL DOWN, NEUTRAL
2. Ailerons/Spoilers		FULL LEFT, FULL RIGHT, NEUTRAL
3. Rudder *	RUDDER	FULL LEFT, FULL RIGHT, NEUTRAL
During taxi	BEFORE TAKEOFF C/L DOWN TO THE LINE	BEFORE TAKEOFF C/L DOWN TO THE LINE COMPLETE
Lining up on the runway	BEFORE TAKEOFF C/L BELOW THE LINE	BEFORE TAKEOFF C/L COMPLETE

*Note : * The PNF should follow pedal movement with his/her feet*

TAKEOFF		
EVENT	**PF**	**PNF**
Setting thrust levers to initial stabilisation value	TAKEOFF	
Before passing 80 kts		THRUST SET
At 100 kts	CHECKED	ONE HUNDRED KNOTS
At V1		V1
At VR		ROTATE
Gear retraction	GEAR UP	POSITIVE CLIMB GEAR UP
If AP is engaged by PNF	AP 1(2) ON	
Check List	AFTER TAKEOFF/CLIMB C/L DOWN TO THE LINE	AFTER TAKEOFF/CLIMB C/L DOWN TO THE LINE COMPLETE
At transition altitude	AFTER TAKEOFF/CLIMB C/L BELOW THE LINE	AFTER TAKEOFF/CLIMB C/L COMPLETE

R

MALFUNCTION BEFORE V1 AT TAKEOFF		
EVENT	**CAPT**	**F/O**
If GO decision	GO	
If RTO decision . REV green on EWD . Deceleration	STOP	 REVERSE GREEN* DECEL**

In case of failure or no positive deceleration :
* NO REVERSE ENGINE__or NO REVERSE
** NO DECEL
DECEL callout means that the deceleration is felt by the crew, and confirmed by the speed trend on the PFD. It can also be confirmed by the DECEL light.

ALTIMETER SETTING CHANGES TO/FROM QNH/QFE-STD		
EVENT	**PF**	**PNF**
Barometric setting change and subsequent altimeter cross-check	SET STANDARD (SET QNH/QFE) CHECKED	 STANDARD CROSS-CHECKED (QNH/QFE) PASSING FL__(__FT) NOW

APPROACH AND LANDING		
EVENT	**PF**	**PNF**
Approach check list	APPROACH C/L	APPROACH C/L COMPLETE
Activation of approach Phase	ACTIVATE APPROACH PHASE	APPROACH PHASE ACTIVATED
RA alive	CHECKED	RADIO ALTIMETER ALIVE (see Note 4 and 5 below)
At “GS*” or below GO altitude for NPA	SET GA ALTITUDE __FT	GA ALTITUDE — SET,
FAF	CHECKED	PASSING__(Fix Name),__FT,
Landing check list	LANDING C/L	LANDING C/L COMPLETE
1000 feet RA	CHECKED	ONE THOUSAND (see Note 5 below)
100 feet above MDA/DH	CHECKED	ONE HUNDRED ABOVE
MDA/DH visual reference	CONTINUE	MINIMUM
MDA/DH no visual reference	GO AROUND-FLAPS	MINIMUM
		ONE HUNDRED FIFTY (see Note 5 below)
After touchdown Ground spoilers extended REV green on EWD		SPOILERS (see Note 6 below), REVERSE GREEN, (See note 7 below)
Deceleration		DECEL (See Note 8 below)
At 70 knots	CHECKED	SEVENTY KNOTS

Note 4 : Crew awareness, crew should now keep RA in scan to landing
Note 5 : PNF monitors pin-programmed auto callout, or announces if inoperative.
Note 6 : If the spoilers are not extended, call NO SPOILER
Note 7 : If reverse deployment is not as expected, call NO REVERSE ENGINE__ or NO REVERSE, as appropriate.
Note 8 : DECEL Callout means that the deceleration is felt by the crew, and confirmed by the speed trend on the PFD. It can also be confirmed by the DECEL light. If no positive deceleration, call NO DECEL.

GO AROUND		
EVENT	**PF**	**PNF**
GO AROUND decision	GO AROUND – FLAPS	
Flaps retraction		FLAPS—
Gear retraction	GEAR UP	POSITIVE CLIMB GEAR UP
Check list	AFTER TAKEOFF/CLIMB C/L DOWN TO THE LINE	AFTER TAKEOFF/CLIMB C/L DOWN TO THE LINE COMPLETE
At transition altitude	AFTER TAKEOFF/CLIMB C/L BELOW THE LINE	AFTER TAKEOFF/CLIMB C/L COMPLETE

AFTER LANDING		
EVENT	**PF**	**PNF**
Check list	AFTER LANDING C/L	AFTER LANDING C/L COMPLETE

PARKING		
EVENT	**PF**	**PNF**
Check list	PARKING C/L	PARKING C/L COMPLETE

SECURING THE AIRCRAFT		
EVENT	**PF**	**PNF**
Check list	SECURINT THE AIRCRAFT C/L	SECURING THE AIRCRAFT C/L COMPLETE

04.00 CONTENTS

GENERAL

This chapter shows the speed symbols and definitions.
The source of the computation is also given, when applicable.

CHARACTERISTIC SPEEDS

The characteristic speeds displayed on the PFD are computed by the Flight Augmentation Computer (FAC), according to the FMS weight data (for PFD/MCDU display consistency and accuracy purposes), and aerodynamic data as a backup.
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 FMS, based on the aircraft gross weight (which is computed according to the entered ZFW and the FOB), or the 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, 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 fight tests. 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, Authorities allow aircraft of the A320 family to use the following factors :
V2 = 1.2 × 0.94 VS1g = 1.13 VS1g
VREF = 1.3 × 0.94 VS1g = 1.23 VS1g
These speeds are identical to those that the conventional 94 % rule would have defined for these aircraft. The A318, 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.
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.
R In addition, VLS increases with speed brakes extension.

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 1.18 VS to 1.22 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 1.22 VS to 1.25 VS of clean configuration.

0 : Green dot speed.
Engine out operating speed in clean configuration.
(Best lift to drag ratio speed).
Corresponds also to the final takeoff speed.
Represented by a green dot on the PFD scale.
Below 20000 feet equal to 2 × weight (tonnes) + 85
Above 20000 feet add 1 knot per 1000 feet

PROTECTION SPEEDS

Vα PROT, Vα MAX and VSW are computed by the FAC, based on aerodynamic data. They are only used for display on the PFD, and not for flight control protection (the activation of the protections is computed by the ELAC).

Vα PROT	:	Angle of attack protection speed. Corresponds to the angle of attack at which the angle of attack protection becomes active. Represented by the top of a black and amber strip along the PFD speed scale, in normal law.
Vα MAX	:	Maximum angle of attack speed. Corresponds to the maximum angle of attack that may be reached in pitch normal 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

R R R	VA	:	Maximum design maneuvering speed. This corresponds to the maximum structural speed permitted for full control deflection, if alternate or direct law is active.
	VMCG	:	Minimum speed, on the ground during takeoff, at which the aircraft can be controlled by only using the primary flight controls, 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).
	VMCL	:	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 (approach flap setting).
	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 at the latest.
Displayed on the MCDU TAKEOFF page.

VR : The speed at which the pilot rotates in order to reach V2 at an altitude of 35 feet at the latest after an engine failure.
Inserted manually through the MCDU by the crew.
Displayed on the MCDU TAKEOFF page.

V2 : Takeoff safety speed that the aircraft attains at the latest at an altitude of 35 feet with one engine failed and maintains during the second segment of the takeoff.
Represented by the SPEED SELECT symbol on the speed scale.
Minimum value equal to 1.13 VS for the corresponding configuration.
Inserted manually through the MCDU by the crew.
Displayed on the MCDU TAKEOFF page.

VREF : Reference speed used for normal final approach.
Equal to 1.23 × VS of configuration FULL.
Displayed on the MCDU APPR page if landing is planned in CONF FULL (VLS CONF FULL).

VAPP : Final approach speed.
Displayed on MCDU APPR page.
Calculated by the FMGCs.
Represents : VAPP = VLS + wind correction.
The wind correction is limited to a minimum of 5 knots and a maximum of 15 knots.
The flight crew may modify VAPP through the MCDU.
– During autoland or when A/THR is on or in case of ice accretion or gusty crosswind greater than 20 knots, VAPP must not be lower than VLS + 5 knots.

VAPP TARGET : Represented by a magenta triangle.
Calculated by the FMGCs
Gives efficient speed guidance in approach during various windy conditions.
Represents :
VAPP TARGET = GS mini + actual headwind (measured by ADIRS)
GS mini = VAPP – TOWER WIND (headwind component along runway axis calculated by FMGC from tower wind entered on MCDU).

AIR CONDITIONING

R An external HP source may be used for air conditioning, provided the air supply is
R confirmed to be free from oil contamination.

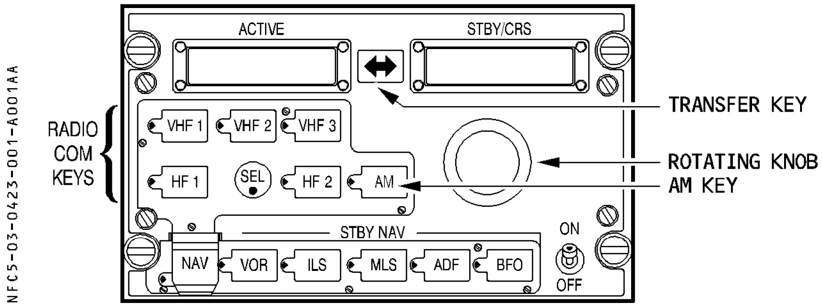
INTENTIONALLY LEFT BLANK

VHF, HF UTILIZATION

Note : 1. *Reception of some frequencies could be noisy, on one or more VHFs. In such 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 light . . . . CHECK OFF**
If the SEL light is on, select the appropriate radio systems dedicated to the onside RMP.

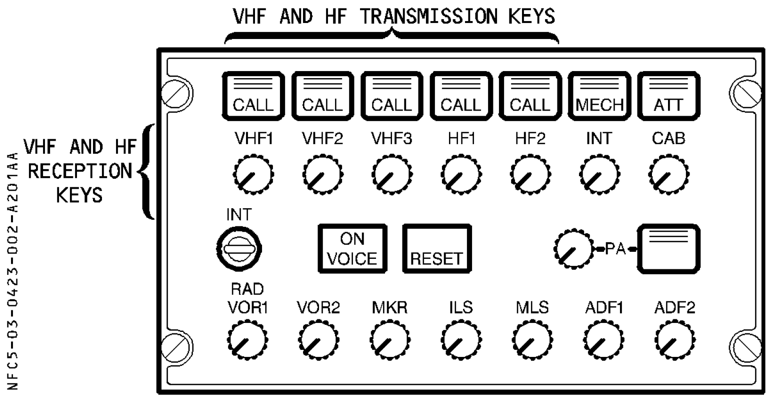
Failure cases :

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 RMP1 fails tune VHF1 through RMP3. If RMP2 fails, tune VHF2 through RMP3. If RMP3 fails, tune HF1 (if installed) through RMP1, HF2 (if installed) through RMP2. If two RMPs fail, tune all receivers through the remaining RMP.

TRANSMISSION AND RECEPTION

Note : *If the VHF3 VOICE DIRECTORY page is customized with user frequencies :*
- *Use it as a pure directory.*
- *Do not press the key adjacent to the desired frequency for direct turning.*
- *VHF3 in VOICE mode should either be tuned using the MANUAL FREQ field, or using the RMP.*



– **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 2 are inoperative.*

CAPT-ATT CALL

PROCEDURE FOR CALLING ATT STATION WHEN PREVIOUS CALL HAS NOT BEEN RESET

If, after a call from cockpit to the attendant's station, the attendant does not press the RESET key on the attendant's panel, the pilot must use the following procedure to call the station :

– **CAB transmission key (on audio control panel) . . . . PRESS**
  Green lines light up.

– **INT/RAD (on ACP) . . . . MAINTAIN IN RAD POSITION for 2 seconds.**
  Wait 60 seconds for automatic cancellation of previous CAPT-ATT calls, then :

– **CAB transmission key . . . . PRESS**

<u>Note</u> : *This procedure will no longer be necessary after the introduction of CIDS Mark II standard, which includes a function to reset the system automatically after 60 seconds if no one has pressed the RESET key.*

TRIPPED C/B REENGAGEMENT

In flight, do not reengage a circuit breaker (C/B) that has tripped by itself, unless the Captain judges it necessary to do so for the safe continuation of the flight. This procedure should be adopted only as a last resort, and only one reengagement should be attempted. On ground, do not reengage the C/B of the fuel pump(s) of any tank. For all other C/Bs, if the flight crew coordinates the action with maintenance, the flight crew may reengage a tripped C/B, provided that 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 C/B 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 C/B.

PROCEDURE

To perform a computer reset :
- Set the related normal cockpit control to OFF, or pull the corresponding reset pushbutton 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 pushbutton 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.

Note : Due to the many customization possibilities of the C/B panel :
Before taking any action on the C/B panel, the flight crew must crosscheck that the C/B label corresponds to the affected system.

R **COMPUTER RESET TABLE**

R The computers that are most prone to reset are listed in the table of the next pages with
R the associated reset procedure, or FCOM reference when applicable.
R Specific reset procedures, included in OEB or Temporary revisions, are normally not
R referenced in this table and, when issued, superseed this table.

R *Note : Repetitive resets have to be reported to maintenance.*

R – On ground, almost all computers can be reset, and are not limited to the ones indicated
R in the table.
R Following computers are not allowed to be reset in all circumstances :
R · ECU (Engine Control Unit on CFM engines) or EEC (Electronic Engine Control on IAE
R engines) and EIU (Engine Interface Unit) while the engine is running.
R · BSCU (Brake Steering Control Unit) if the aircraft is not stopped. (Refer to 3.04.32).
R – In flight, as a general rule, the crew must restrict computer resets to those listed in the
R table, or to those in applicable TRs or OEBs. Before taking any action on other computer
R the flight crew must consider and fully understand the consequences.

CAUTION

R Do not pull the following circuit breakers :
R – SFCC (could lead to SLATS/FLAPS locked)
R – ECU or EEC, EIU.

R *Note : In the table's "reset" column, the "if applicable" note signifies that, depending on*
R *the computer standard, the reset procedure may no longer be necessary. If this is*
R *the case, the reset procedure is removed from the applicable FCOM section.*

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R

ATA	System malfunction or ECAM warning/caution	Affected system	Reset
21	VENT AVNCS SYS FAULT	AEVC	On ground only : – Pull C/B Y 17 on 122VU. – Wait 1 second before pushing the C/B.
	AIR PACK REGUL FAULT	ACSC	On ground only : – Pull C/B W21 and W22 on 122VU. – Pull C/B X21 and X22 on 122VU. – Pull C/B Y18, Y20 and Y21 on 122VU. – Pull C/B D8 on 49VU. – Wait 5 seconds before pushing all the C/Bs.

NO CHANGE

R

ATA	System malfunction or ECAM warning/caution	Affected system	Reset
21	VENT AVNCS SYS FAULT	AEVC	On ground only : – Pull C/B Y 17 on 122VU. – Wait 1 second before pushing the C/B.
22	AUTO FLT FCU 1(2) FAULT	FCU	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. On ground: – Pull the C/B B05 on 49VU for FCU1, or M21 on 121VU for FCU2. – Push it after 5 seconds. – If FCU1(2) FAULT disappears, CHECK the displayed targets and barometer reference, and correct them if necessary (RESET successful) – If FCU1(2) FAULT remains, pull both C/B B05 on 49VU and M21 on 121VU – Push them after 7 minutes, with a delay of less than 5 seconds between side 1 and 2 – Wait at least 30 seconds for FCU1 and FCU2 safety tests completion – CHECK the displayed targets and barometer reference, and correct them if necessary (RESET successful)

ATA	System malfunction or ECAM warning/caution	Affected system	Reset
22	AUTO FLT FCU 1 + 2 FAULT	FCU	In flight: – Pull the C/B B05 on 49VU for FCU1, and then pull M21 on 121VU for FCU2. – Push them after 5 seconds. – CHECK the displayed targets and the barometer reference, and correct them if necessary. On ground: – Pull the C/B B05 on 49VU for FCU1, and then pull M21 on 121VU for FCU2. – Push the C/Bs after 5 seconds. – If FCU 1+2 FAULT disappears, CHECK the displayed targets and barometer reference, and correct them if necessary (RESET successful) – If FCU 1+2 FAULT remains, pull again both C/B B05 on 49VU and M21 on 121VU – Push them after 7 minutes, with a delay of less than 5 seconds between side 1 and 2 – Wait at least 30 seconds for FCU1 and FCU2 safety tests completion – CHECK the displayed targets and barometer reference, and correct them if necessary (RESET successful) FCU targets are synchronized on current aircraft values and displayed as selected targets. – RE–ENTER the barometer altimeter setting value, if necessary.

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R

ATA	System Malfunction or ECAM Warning/Caution	Affected System	Reset
			NO CHANGE
23	Uncommanded EVAC horn activation	CIDS	On ground, or in flight : Press the EVAC HORN SHUT OFF pushbutton. Set the EVAC CAPT and PURS/CAPT switch to the CAPT only position. Wait for 3 seconds. . IF UNSUCCESSFUL : – Pull the C/Bs for DIR2 in the following order : G02 on 49VU, M06 on 121VU. . IF UNSUCCESSFUL : – Pull the C/Bs for DIR1 in the following order : G01 on 49VU, M05 on 121VU. – Wait for 1 minute, then : – Push the C/Bs for DIR2 in the following order : M06, G02. – After CIDS reset, wait approximately 4 minutes, before recovering normal operation.
			NO CHANGE

ATA	System Malfunction or ECAM Warning/Caution	Affected System	Reset
22	AUTO FLT YAW DAMPER 1(2) FAULT	FAC 1(2)	Refer to the FCOM 3.02.22, if applicable.
	WINDSHEAR DET FAULT or REAC W/S DET FAULT (◁)	FAC 1 + 2	
	One MCDU locked or blank Both MCDU locked or blank FMGC malfunction	MCDU FMGC FMGC	Refer to the FCOM 4.06.20
23	COM CIDS 1+2 FAULT	CIDS	On ground, or in flight : – Pull the C/Bs in the following order : M05 and M06 on 121VU, G01 and G02 on 49VU. – Wait 10 seconds, then – Push the C/Bs in the following order : G01, G02, M05, M06. – After CIDS reset, wait approximately 4 minutes, before recovering normal operation.
	Uncommanded EVAC horn actuation	CIDS	On ground, or in flight : Press the EVAC HORN SHUT OFF pushbutton. · IF UNSUCCESSFUL : – Pull the C/Bs in the following order : M05 and M06 on 121VU, G01 and G02 on 49VU. – Wait 10 seconds, then – Push the C/Bs in the following order : G01, G02, M05, M06. – After CIDS reset, wait approximately 4 minutes, before recovering normal operation.
	Frozen RMP	RMP	Refer to the FCOM 3.04.23.
	FAP freezing	FAP or Tape reproducer/PRAM	On ground or in flight : – Pull CB M14 (or Q14 ◁) of the FAP in the 121VU. – Wait 10 seconds before pushing the C/B. · IF UNSUCCESSFUL : – Pull the tape reproducer/PRAM C/B F07 on 2000 VU (cabin). – Wait 10 seconds, before pushing the C/B.
24	GPU cannot be connected to the aircraft	GAPCU	On ground only : The GPU cannot be connected to the electrical network of the aircraft (AVAIL light is OFF) : · If at least one power source (IDG 1 or 2, APU GEN or batteries) is connected to the electrical network of the aircraft. – Reset the EXT PWR pushbutton switch on 35VU (Press and release) · If no power source is connected to the electrical network of the aircraft. – Set the BAT 1+2 pushbutton switches to AUTO.

R

ATA	System malfunction or ECAM warning/caution	Affected system	Reset
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, in case of uncommanded maneuvers during the flight, it is not recommended to reset the ELAC. *Note : · When an ELAC reset is performed on ground the crew must check the pitch trim position.* *· If a reset is performed on ground, the flight crew must then perform a flight control check, as per SOP.*
28	Loss of fuel quantity indication or Simultaneous triggering of FUEL L XFR VALVE CLOSED and FUEL R XFR VALVE CLOSED, although FUEL SD indicates no anomaly.	FQIC	On ground, or in flight : – Pull the C/B of the affected channel : · Channel 1 . . . . A13 on 49VU · Channel 2 . . . . M27 on 121VU – Wait 5 seconds, before pushing both C/B. *Note : 1. The fuel quantity indication will be re-established within one minute.* *2. The fuel leak detection function will be lost for the remainder of the flight. The flight crew must monitor the fuel quantity according to FCOM 3.03.15.*

ATA	System malfunction or ECAM warning/caution	Affected system	REMARKS
30	ANTI ICE L(R)/WINDSHIELD (WINDOW)	WHC	Refer to the FCOM 3.02.30, if applicable.
31	FWS FWC 1(2) FAULT	FWC	On ground : Pull, then push, the C/B of the affected FWC : – FWC 1 . . . . F01 on 49VU – FWC 2 . . . . Q7 on 121VU Wait 50 seconds after pushing the C/Bs. In flight : Pull, then push, the C/B of the affected FWC : – FWC 1 . . . . F01 on 49VU – FWC 2 . . . . Q7 on 121VU
32	Braking malfunction	BSCU	Refer to 3.04.32.
	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.
34	NAV TCAS FAULT	TCAS	On ground only : – Pull C/B K10 on 121VU. – Wait 5 seconds, then push the C/B.
	ISIS malfunction	ISIS	On ground only : With aircraft not moving : – Pull C/B F12 on 49VU – Wait 5 seconds, then push the C/B – Normal operation is expected after approximately 2 minutes. *Note : In the case of small aircraft motion during the C/B reset (refueling, cargo loading conditions, etc.), the ATT red flag may appear on the ISIS. In this case, press the RST P/B for 2 seconds. Wait 2 additional minutes to recover normal operation.*
46	ATSU malfunction	ATSU	An ATSU reset should be attempted, if : key selection has no effect on any of the MCDU ATSU DATALINK submenus. On ground, or in flight : – Pull the C/Bs in the following order : L16, L15 on 121VU. – Wait 5 seconds, then : – Push the C/Bs in the following order : L15, L16.

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R

ATA	System malfunction or ECAM warning/caution	Affected system	Reset
NO CHANGE			
32	Braking malfunction	BSCU	Refer to 3.04.32
	L/G LGCIU 1(2) FAULT	LGCIU 1(2)	On ground only : The flight crew must reset the LGCIU after depressurizing the green hydraulic system. – ENG MASTER switch 1 . . . . OFF – PTU . . . . OFF . When there is no green hydraulic pressure : . To reset LGCIU 1 : – Pull C/B Q34 on 121VU, then C09 on 49VU – Wait for 15 seconds, then push the C/Bs . To reset LGCIU 2 : – Pull C/B Q35 on 121VU – Wait for 15 seconds, then push the C/B

NO CHANGE

ATA	System malfunction or ECAM warning/caution	Affected system	Reset
70	ENG IGN A+B FAULT	FADEC and EIU	Refer to the FCOM 3.02.70, if applicable.
	ENG 1(2) FADEC A(B) FAULT	FADEC	Refer to the FCOM 3.02.70, if applicable.

R **GENERAL**

R The secured cockpit door operation is controlled by a toggle switch, located on the
R COCKPIT DOOR central pedestal.

R **DOOR OPENING FROM THE COCKPIT**

R To allow access the cockpit, the COCKPIT DOOR toggle switch has to be pulled and
R maintained in the UNLOCK position until the door is fully opened (once the door is fully
R opened it can be released to the NORM position).

R **DOOR CLOSING**

R Close the door and check that the OPEN indicator goes off. If the toggle switch is in the
R NORM position the door is locked and emergency access is possible for the cabin crew.
R If the toggle switch is in the LOCK position the door is locked and the emergency access,
R the buzzer and the keypad are inhibited for a preselected time (5 to 20 minutes).

R *Note : If the OPEN indicator is on with the door closed, the door may be unlocked. Repeat*
R *the above opening/closing sequence.*

COCKPIT DOOR OPERATION

This procedure should be applied, if local Airworthiness Authorities require that the cockpit door remain closed throughout the entire flight.

BEFORE PUSHBACK OR ENGINE START

R – **COCKPIT DOOR . . . . CLOSE**

AFTER ENGINE START

● **If ROUTINE ACCESS is requested from the cabin :**
The buzzer sounds in the cockpit for 1 to 9 seconds (3 seconds by default).

– **CAMERA 1 DISPLAY . . . . CHECK**
Camera 1 is automatically displayed upon entry request.

– **VIDEO CAMERA pushbutton . . . . PRESS**

– **CAMERA 2 and 3 DISPLAY . . . . CHECK**
Prior to unlocking the door, the flight crew should identify the person requesting entry.

- **If entry is NOT authorized by the flight crew :**

R – **COCKPIT DOOR toggle switch** . . . . **LOCK**

- **If entry is authorized by the flight crew :**

R – **COCKPIT DOOR toggle switch** . . . . **UNLOCK**

<u>Note</u> : If the flight crew does not take any action after a routine cabin request, the cabin crew will be able to open the door by using the emergency access procedure.

- **If EMERGENCY ACCESS is initiated from the cabin :**
The buzzer will sound continuously in the cockpit, and the OPEN light flashes on the center pedestal's cockpit door panel.

<u>Note</u> : If the flight crew does not take any action, the door will unlock after a preselected time between 15 and 120 seconds.

R – **COCKPIT DOOR toggle switch** . . . . **LOCK**

– **CAMERA 1 DISPLAY** . . . . **CHECK**
Camera 1 is automatically displayed upon entry request.

– **VIDEO CAMERA pushbutton** . . . . **PRESS**

– **CAMERA 2 and 3 DISPLAY** . . . . **CHECK**
Prior to unlocking the door, the flight crew should identify the person requesting entry.

- **If entry is authorized by the flight crew :**

R – **COCKPIT DOOR toggle switch** . . . . **UNLOCK**

OPENING THE COCKPIT DOOR FROM THE CABIN

– **CABIN CREW ROUTINE ACCESS . . . . REQUEST ON KEYPAD**

– **CABIN CREW . . . . PRESS #, or N+#**
"N" represents an Operator-defined figure between 0 and 7 digits.

– **CABIN CREW . . . . STAND IN COCKPIT DOOR AXIS**
The cabin crew should stand in the axis of the ckpt door. A buzzer sounds in the ckpt.

● **If entry is NOT authorized by the flight crew :**

R – The flight crew locks the door via the COCKPIT DOOR toggle switch (LOCK position).
R – The keypad's red light comes on steady, and indicates that the door is locked.

● **If entry is authorized by the flight crew :**

– The flight crew unlocks the door via the COCKPIT DOOR toggle switch (UNLOCK
R position).
– The keypad's green light comes on steady, and indicates that the door is unlocked.

R – **CABIN CREW . . . . PUSH DOOR TO OPEN**

● **If there is no reaction from the flight crew :**

– **CABIN CREW SECOND ACCESS . . . . REQUEST ON KEYPAD**
Repeat the above procedure.

● **If there is no reaction from the flight crew, after a second request :**

– **CABIN CREW . . . . CALL THE COCKPIT**
To establish contact with the flight crew and request access to the cockpit.

● **If there is no reaction from the flight crew, after a cabin crew interphone call :**

– **CABIN CREW . . APPLY THE FOLLOWING EMERGENCY ACCESS PROCEDURE**

– **EMERGENCY ENTRY CODE . . . . ENTER and PRESS #**
The emergency entry code is an Operator-defined figure between 2 and 7 digits. A buzzer will sound continuously in the cockpit and the keypad's green light flashes. After a preselected time between 15 and 120 seconds, the keypad's green light comes on steady, and the cabin crew can then push the door open.

– **CABIN CREW . . . . PUSH DOOR TO OPEN**
The cockpit door unlocks for 5 seconds.
The buzzer stops and indicates that the door is unlocked.

GENERAL

The fly-by-wire system has been designed and certificated to make the new generation of aircraft more cost effective and safer and smoother to fly or ride in than a conventional aircraft.

NORMAL OPERATIONS

The pilot uses the sidestick to fly the aircraft in pitch and roll (and indirectly, through turn coordination, in yaw).
The computers interpret the pilot's inputs and move the control surfaces as necessary.
However, regardless of the pilot's inputs the computers will prevent :
R – excessive load factor
– loss of control leading to excursions outside the safe flight envelope.

AIRCRAFT ON THE GROUND

At ground speeds below 70 knots, the sidesticks have full authority over the controls in pitch and roll to permit control checks.
At ground speeds above 70 knots, the authority in pitch is reduced from 30° up to 20° up.
In this ground mode, movements of the control surfaces in pitch and roll correspond directly to the stick inputs.
With the aircraft in the normal configuration and engines running on the ground :
– when the wheel brakes are released, the aircraft usually rolls with no added thrust.
– nose wheel steering is "fly.by.wire", with no mechanical connection between the nose wheel and the steering tiller. The control forces are light : the flight crew should be careful to move the tiller gently to avoid unnecessarily high-rate turns.

The aircraft can make very tight turns, but the flight crew should resist any tendency to overcontrol. When making tight turns at low ground speed, the crew should hold the selected tiller position, even if the turn radius is shorter than intended, so as to maintain a smooth turn.

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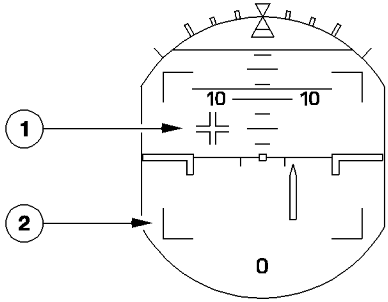

The PFD includes a symbol (1) that is the sum of sidestick positions given to the computers. It permits the PNF to check that the PF is making an appropriate control input
R during takeoff roll.
Small limit marks (2) indicate the limits of stick travel (± 16° in pitch, ± 20° in roll).
They are only displayed with the aircraft on ground. The flight crew must not use this display for control checks, because it does not necessarily indicate the control position in failure cases. The flight crew must use the ECAM flight controls page for making that check.

IN FLIGHT

TAKEOFF MODE

R

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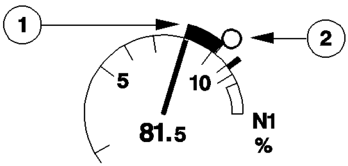


Thrust management is very easy. The pilot selects a FLX thrust by stopping the thrust levers in the FLX/MCT detent, and by checking that the resulting N1 (or EPR) (1) is compatible with N1 (or EPR) target (2). For maximum takeoff thrust, the pilot moves the thrust levers fully forward and performs the same thrust check (N1 or EPR).
To counter the nose-up effect of setting engine takeoff thrust, the pilot should apply half forward stick, until the airspeed reaches 80 knots. Then, he should release the stick
R gradually to reach neutral at 100 knots (Refer to SOP 3.03.12 for additional information).

R Rotation is conventional. It takes about 1/3 to 1/2 back stick. The Pilot Flying (PF) continues
R the rotation in order to bring the all–engine attitude value towards approximately 15
R degrees. During rotation, the PF must not attempt to reach the FD pitch bar, because it does
R not provide a pitch rate order, and may lead to overreaction. As soon as the aircraft
R becomes airborne only, the PF must adjust the pitch attitude using the FD bar, which is then
R representative of the SRS order. 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.

For crosswind takeoffs, routine use of into wind aileron is not recommended. In strong crosswind conditions, some lateral control may be used, but care should be taken to avoid using large deflections, resulting in excessive spoiler deployment which increases the tendency to turn into wind, reduces lift and increases drag. Spoiler deflection starts to become significant with more than one third sidestick deflection. As the aircraft lifts off, 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.

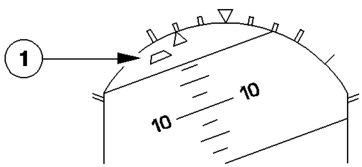
LANDING MODE

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.
Crosswind landings are conventional. 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 (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

NFC5-03-0427-004-A001AA



On the ground the aircraft is conventional. The pilot uses rudder to maintain direction. He should rotate to about 12.5° of pitch and adjust as required. The sideslip indication (1) changes to the engine-out mode (blue). When it is centered, the aircraft is close to the zero aileron position (best drag condition). It is therefore important to zero the slip indication accurately.
Trim the rudder conventionally.

When time permits, the pilot should check the ECAM's FLT CTL page, and refine the rudder trim to give neutral lateral control, and also trim the rudder toward the spoilers that are up or toward the aileron that is farthest up to bring the lateral controls back to neutral.

ENGINE-OUT LANDING

The engine-out landing is basically a conventional landing. The pilot should trim to maintain the slip indication centered. It is yellow, as long as N1 is less than 80%. Between 100 and 50 feet, the pilot he can reset rudder trim to make the landing run easier, and to recover full rudder travel in both directions.

BOUNCE AT LANDING

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 retrims at 50 feet.

STALL WARNING

An aural “STALL”, warning continuously sounds at low speeds in ALTN or DIRECT laws. However, spurious stall warning may sound in NORMAL law, if an Angle-Of-Attack (AoA) is damaged. In any case, upon hearing it, the pilot must return to the normal operating speed by taking conventional actions with the controls :

■ **At lift-off :**

THRUST LEVERS . . . . TOGA
At the same time :
PITCH ATTITUDE . . . . 12.5°
BANK ANGLE . . . . ROLL WINGS LEVEL
SPEEDBRAKES . . . . CHECK RETRACTED

Note : When a safe flight path and speed are achieved and maintained, if stall warning is still activated, consider a spurious stall warning

■ **During any other flight phases after lift-off :**

THRUST LEVERS . . . . TOGA
At the same time :
PITCH ATTITUDE . . . . REDUCE
BANK ANGLE . . . . ROLL WINGS LEVEL
SPEEDBRAKES . . . . CHECK RETRACTED

CAUTION
If a risk of ground contact exists, reduce pitch attitude no more than necessary to allow airspeed to increase

● **After initial recovery :**
Maintain the speed close to V Stall Warning speed (VSW), until it is safe to accelerate

● **If in clean configuration and below 20 000 feet :**
FLAP 1 . . . . SELECT

● **When out of stall and if no threat of ground contact :**
LANDING GEAR . . . . UP
– Recover normal speeds, and select flaps as 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 bank angle, if necessary. When the stall warning stops, the pilot can increase back pressure again, if necessary, to return to the planned trajectory.

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.

MECHANICAL BACKUP

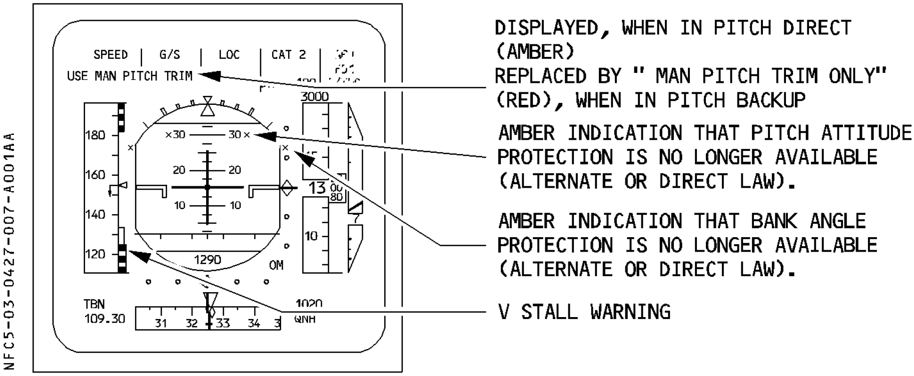
The pilot can use the pitch trim and rudder to control the aircraft for short periods of total loss of fly-by-wire.

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.



At low speed the change in the speed scale is very noticeable. VLS remains, but Vα PROT and Vα MAX disappear, replaced by a single black and red strip the top of which is stall warning speed. Unlike VLS which is stable, VSW is g sensitive so as to give additional margin in turns.
As mentioned above, ALTERNATE reverts to DIRECT law for landing when the flight crew lowers the landing gear.

Roll

Roll control is direct. The rate of roll is generally higher than with normal law and at first the aircraft appears to be very sensitive.
Bank stability and protections are no longer active and the flight crew should take care to stay within normal limits.

DIRECT LAW

Normally direct law in pitch is transitory, due to undetected failures of, for example, a second IRS. Once the flight crew has isolated the failed system, it can reset the ELACs to acquire alternate law in pitch.
When the system goes into direct law, “USE MAN PITCH TRIM” appears on the PFDs. This message flashes for 5 seconds, then becomes steady.
The pilot should use small control inputs when the aircraft is in direct law at high speed, because the controls are powerful. Good trimming in pitch is required.
The pilot should avoid using large thrust changes or sudden speedbrake movements, particularly if the center of gravity is aft. If the speedbrakes are out and the aircraft has been retrimmed, the pilot should retract the speedbrakes gently, giving time to retrim so as to avoid a large nose-down trim change.
The flight crew must fly the aircraft carefully at all times. Control is precise, but there are no protections.
The aural stall warning for alternate law also serves direct law, and the technique for recovery is the same.
Any tendency to roll stick free can be corrected by conventional use of rudder. Residual rudder forces can be trimmed out by using rudder trim in the direction of the applied force.

After trimming, the sideslip index will be slightly displaced from center. With some failure conditions the asymmetric rolling tendency may be increased. It will always be possible to trim the aircraft to fly straight, hands off. There may then be an asymmetry in roll response, but the roll rate achieved is always adequate.
Landing in direct law is like landing a conventional aircraft. Trim changes to compensate for configuration changes are small, as is the trim change with speed change. Trim change with a large thrust change is quite large, so the pilot should make smooth thrust changes.
R The flare height for landing is the same (refer to SOP 3.03.22), 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 according to the same limits as any other large aircraft. The 2.5g limit (2g with flaps extended) enables 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 avoidance factor : The system allows maneuvers that the pilot would not normally be able to safely perform at any altitude, low or high.

EXCEEDING VMO/MMO

During climb, cruise or descent, the aircraft may slightly exceed VMO/MMO with the autopilot engaged. This may occur, when adverse conditions are encountered.
Using the following procedure prevents such an exceedance :

1. In case of turbulence, adapt speed or Mach target. If severe turbulence is known or forecasted, consider use of turbulence speed.
2. 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.
3. 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. Therefore :
   - Make a smooth pitch correction, to recover proper speed.

In all events :
- Speedbrakes may be used if the aircraft exceeds VMO/MMO. However, use speedbrakes with caution when close to the ceiling.
- Check the 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, spiral static stability is introduced to 0° bank angle (instead of 33° in
R normal law), and the bank angle limit is reduced from 67° to 40°.

As the speed increases above VMO/MMO, the sidestick nose-down authority is progressively reduced, and a permanent nose-up order is applied to aid recovery to normal flight conditions.
The High Speed Protection is deactivated when the aircraft speed decreases below VMO/MMO, where the usual normal control laws are recovered.
The flight crew should never deliberately fly the aircraft beyond VMO/MMO, unless absolutely necessary for operational reasons, such as avoiding another aircraft.
The pilot should, as soon as possible, reduce resistance to the High Speed Protection and allow the aircraft to return to a speed below VMO/MMO, by smoothly relaxing the forward stick force to attain a comfortable nose-up pitch rate. It is not usually necessary to apply a pull force to recover. If a quicker recovery is required for operational reasons, the pilot should pull back smoothly and progressively, monitoring the g indication on the ECAM".

HIGH ANGLE OF ATTACK PROTECTION

The aircraft resists attempts by either a pilot or the atmosphere to stall it. If a pilot attempts a stall, he feels the aircraft trying to pitch down as speed approaches the amber and black strip. The pilot can resist this tendency until speed reaches the red band (alpha maximum), and then further nose-up control is not available. Between these two points, αfloor automatically sets go around thrust. The pilot can hold full back stick, if it is needed (see windshear), and the aircraft stabilizes at an angle of attack close to but short of the 1g stall.
WHEN FLYING AT αmax, THE PILOT CAN MAKE GENTLE TURNS, IF NECESSARY.
As the aircraft enters protection at the amber and black strip. (αprot), the system inhibits further nose-up trim beyond the point already reached. Nose-down trim remains available if the pilot pushes the stick forward.
The pilot should not deliberately fly the aircraft in αprot except for brief periods when maximum maneuvering is required. If the pilot enters αprot inadvertently, he should get out of it as quickly as possible by easing forward on the sidestick to reduce the angle of attack while simultaneously adding power (if αfloor has not already been activated or has been cancelled). The system will regain the normal load factor law if the stick is pushed forward of neutral, but it will re-enter αprot if the stick is released with the angle of attack still greater than the value set for αprot. Thus to exit αprot properly, the pilot should reduce angle attack to a value less than the value set for αprot.
The PFD shows this clearly, because the indicated speed is above the black and amber strip.
The pilot should now increase speed above VLS (clear of the amber strip) as soon as other considerations (ground clearance, for example) allow him to do so.
αfloor will usually be triggered just after αprot is entered, and go around thrust will automatically be applied. Thus, if the sidestick is held aft, either inadvertently or deliberately, the aircraft will start to climb at a relatively constant low airspeed. To recover to a normal flight condition, αprot should be exited by easing forward on the sidestick, as described above, and the αfloor should be cancelled by using the disconnect pushbutton on either thrust lever as soon as a safe speed is regained.

The aircraft can also enter αprot at a high level, where it protects the aircraft from the
R buffet boundary. As at low speed or low level, if the sidestick is merely released to neutral, the aircraft maintains the alpha for αprot. (However, this value of alpha is not the same as the value used at low speed : Alpha for αprot is reduced as a function of Mach, so that a typical cruise value is about 3.5° for the A318 and A321 aircraft, or 4.5° for the A319 and A320 aircraft). Therefore, the aircraft may climb, with the sidestick free, when leaving a turn after entering αprot. If the pilot has flown into αprot, he should leave it as soon as other considerations allow, by easing forward on the sidestick to reduce alpha below the value of αprot, while simultaneously increasing thrust or speed as appropriate.

WINDSHEAR

Most of the recommended techniques for flight in windshear also apply to the A320 aircraft 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. The aircraft 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 near to the beginning of the red strip. However, in turbulence, the speed can be temporarily below the red strip without significant effect. As speed begins to recover, the pilot can reduce backstick, while still following SRS orders until well clear of the shear.

ABNORMAL CONFIGURATIONS

In some flight control failure cases, such as loss of control of both elevators, or loss of flaps or slats, the landing configuration is Configuration 3.
With the horizontal stabilizer jammed, control is much easier than it is on a conventional aircraft, because the integrator holds the elevator required to maintain the 1g flight path. The control laws remain normal to touchdown.

AIRCRAFT TRIMMING

When the aircraft is :
- In normal cruise range (around M.77),
- In straight flight,
- With the autopilot engaged,
- With symmetrical engine thrust, and
- With fuel in the wing tanks distributed symmetrically,

the rudder trim should stay between 1° right and 2.3° left.

Note : *This indication corresponds to a true rudder deflection within ± 1.5°, taking into account the permanent offset of rudder trim indication, when the aircraft is in cruise conditions. (average 0.5° right, 0.8° left).*
An indicated, rudder trim above 1° right or 2.3° left is acceptable, if maintenance personnel establishes that the corresponding real rudder position is within 1.5° left, and 1.5° right.

FQI IN DEGRADED MODE

If, on upper ECAM display the FOB indication is displayed with two dashes across the two least significant digits, the FQI is in degraded mode.
In this case, the ECAM FUEL page must be called on ECAM lower display to determine which tank is affected.
The loss of accuracy resulting from the loss of FQI normal mode is as follows :

wing outer cell affected	: + 20 kg (+ 45 lb), – 200 kg (– 440 lb)
wing inner cell affected	: ± 110 kg (240 lb).
center tank affected	: ± 130 kg (290 lb).
all tanks affected	: + 390 kg (+ 860 lb), – 750 kg (– 1660 lb).

ICING CONDITIONS

Icing conditions may be expected when the OAT (on ground and for takeoff), or when the 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. If there is evidence of significant ice accretion and to take into account ice formation on non heated structure, the minimum speed should be :
   - In configuration full, VLS + 5 knots, and the landing distance must be multiplied by 1.1.
   - In configuration lower than FULL, VLS + 10 knots, and the landing distance in CONF 3 must be multiplied by 1.15.
3. R If there is evidence of ice accretion on de-iced parts (WING ANTI ICE inoperative) of the airframe, the minimum speeds should be : R
   - R In clean configuration, VLS + 15 knots.
   - R In CONF 1, 2, 3, FULL, VLS + 10 knots, refer to QRH part 2 or FCOM 3.02.80 for landing distance determination. R

R **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 :**

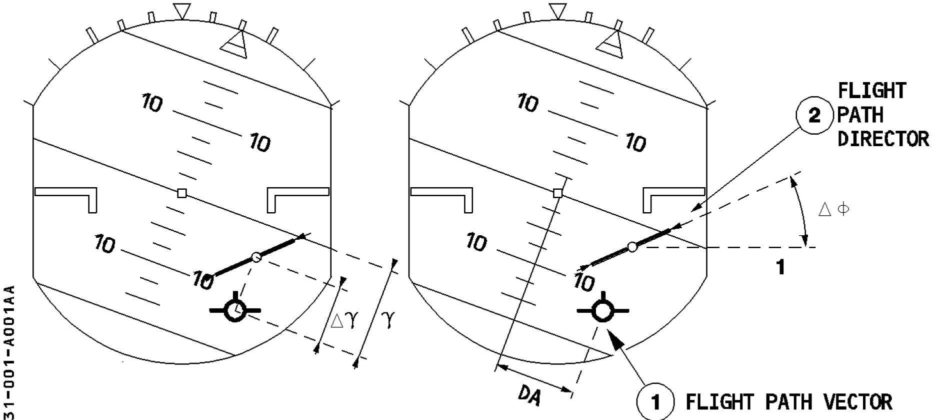
  – **EXTRACT . . . . OVRD**
  This closes the avionics ventilation system, preventing rainwater from entering.

  – **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



γ represents the flight path angle
DA represents the drift angle
$\Delta\gamma$ represents the difference between the ordered flight path angle and the actual one
$\Delta\Phi$ represents the difference between the ordered roll angle and the actual one

The flight path vector (FPV) indicates performance and does not direct or command. Because there is always a slight lag between an attitude change and the change in flight path that results from it, when the pilot uses the FPV he should make an attitude change first, then use the FPV to check the resulting flight path.
Vertically the FPV indicates the aircraft's flight path angle.
The FPV is particularly useful when the aircraft is doing visual circuits. For example, when the aircraft is flying downwind the pilot simply adjusts the aircraft attitude to put the FPV symbol on the horizon. This establishes the aircraft in level flight. On the final approach, the pilot puts the FPV three degrees below the horizon to establish the aircraft at a normal angle of descent. If this results in the aircraft going below the chosen approach path (undershooting the touchdown point), the pilot can reduce the angle of descent by raising the FPV. As soon as the aircraft regains the correct descent path, he should bring the FPV back to –3°.
Laterally, the FPV indicates the aircraft's track and its drift angle. It has the same displacement as the drift diamond on the heading scale and thus appears directly above it. It shows on the PFD the drift the aircraft is experiencing.
The pilot must take care when making a go-around with the FPV selected. There is inevitably some lag between the pilot's raising the nose to commence the go-around and the aircraft's responding by changing its trajectory. For the same reason the pilot does not use the FPV on takeoff: the primary parameter for rotation, either on takeoff or on go-around, is attitude.

The TRK-FPA Flight Director is particularly useful for guiding the aircraft during non-precision approaches, although it can also be used at other times. When using this mode of the FD, the pilot places the FPV symbol in the center of the flight path director (FPD) symbol. This is similar to using the FD in HDG-V/S, 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-V/S 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

A reset of the BSCU is only authorized :

– On ground for :

WHEEL N.W.STEER FAULT or WHEEL N/W STRG FAULT in order to go back to the gate for troubleshooting. Taxi with care, at a taxi speed of 10 kt.

BRAKES SYS 1(2) FAULT or BRAKES BSCU CH 1(2) FAULT.

The BSCU reset should be performed on ground with aircraft stopped and parking brake applied, by setting the A/SKID&N/W STRG selector to OFF then ON.

After any BSCU reset on ground, check the braking efficiency of the normal braking system, as soon as the aircraft starts moving again (the aircraft must slow down when pressing the brake pedals).

Note : *If a BRAKES BSCU CH 1(2) FAULT or SYS 1(2) FAULT cannot be cleared by using the A/SKID&N/W STRG selector, a further reset may be attempted by using the BSCU circuit breakers to clear the fault.*

– In flight for :

BRAKES SYS 1(2) FAULT or BRAKES BSCU CH 1(2) FAULT

The BSCU reset must be performed with landing gear retracted, by setting the A/SKID&N/W STRG selector to OFF then ON.

Note : *Extending the landing gear initiates an automatic test of the main braking components, in order to detect any failures. If the flight crew resets the BSCU with the main landing gear already extended, the failures and associated ECAM indications that are already detected are erased, even if the BSCU reset does not necessarily correct the failure. Therefore, in order to detect any remaining failures, the flight crew must reset the BSCU before landing gear extension.*

If required, rearm the autobrake.

After any BSCU reset, a record in the logbook is mandatory to ensure that troubleshooting is systematically done, in order to investigate the failure before the next flight.

BRAKING IN ALTERNATE MODE

Apply brakes with care, because initial pedal force or displacement produces more braking action in alternate mode than in normal mode. If antiskid is lost, modulate brake pressure at, or below, 1000 psi.

R **THRUST APPLICATION ON BRAKES**

R The braking system is not designed to hold the aircraft in a stationary position when a high
R thrust level is applied on at least one engine.
R The thrust level from which the aircraft starts to move (with parking brake ON, or with
R manual braking applied) depends on several factors such as :
R – Ground surface conditions
R – Environment
R – The aircraft weight
R – Etc...
R During ground procedures that require a thrust increase with braking, the flight crew must
R ensure that the aircraft remains stationary, and one flight crew must keep his hands on the
R thrust levers to be ready to immediately retard the thrust levers to IDLE if the aircraft starts
R to move.

BRAKE TEMPERATURE LIMITATIONS REQUIRING MAINTENANCE ACTIONS

Maintenance action is required 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 average temperature of the left gear brakes and the average temperature of the right gear brakes is 200°C or more, 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. This 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' consecutive 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

R

NWS Offset	Offset ≤ 0.5°	0.5° < Offset ≤ 1.5°	Offset > 1.5°
Rudder trim to taxi straight	Trim ≤ 3°	3° < Trim ≤ 8.8°	Trim > 8.8°
Dispatch	YES	YES	NO
Procedures	No operational limitation	Apply the following procedure : Autoland : – MAX X WIND 10KT	Immediate maintenance action is due

CAUTION

R The tolerance required by maintenance guidelines (± 0.5° NWS offset, corresponding to the ± 3° 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.

TIRE PRESSURE

These charts present the various nominal tire pressures, depending on maximum taxi weight, tire type, and landing gear configuration (shock absorbers extended, or compressed).

	PRESSURE				PRESSURE			
	Unloaded		Loaded		Unloaded		Loaded	
	bar	psi	bar	psi	bar	psi	bar	psi

	DIMENSIONS							
MAXIMUM TAKEOFF WEIGHT	30 × 8.8 R 15 30 × 8.8 - 15				46 × 17 R 20 46 × 16 - 20			
67000 KG / 147708 LB 68000 KG / 149913 LB 70000 KG / 154322 LB	11.0	160	11.4	165	12.3	178	12.8	186
73500 KG / 162038 LB 75500 KG / 166447 LB	11.8	171	12.3	178	13.3	193	13.8	200
77000 KG / 169754 LB	11.8	171	12.3	178	13.8	200	14.4	209

	DIMENSIONS							
MAXIMUM TAKEOFF WEIGHT	49 × 17 - 20				49 × 19 - 20			
67000 KG / 147708 LB 68000 KG / 149913 LB 70000 KG / 154322 LB	10.2	148	10.6	154	9.2	133	9.6	139
73500 KG / 162038 LB 75500 KG / 166447 LB	11.0	160	11.4	165	9.9	144	10.3	149
77000 KG / 169754 LB	11.5	167	12.0	174	10.3	149	10.7	155

	DIMENSIONS							
MAXIMUM TAKEOFF WEIGHT	1270 × 455 R 22				915 × 300 R 16 36 × 11 - 16			
67000 KG / 147708 LB 68000 KG / 149913 LB 70000 KG / 154322 LB	10.5	152	10.9	158	-	-	-	-
73500 KG / 162038 LB	11.3	164	11.8	171	11.7	170	12.2	177
75500 KG / 166447 LB	11.3	164	11.8	171	-	-	-	-
77000 KG / 169754 LB	11.8	171	12.3	178	-	-	-	-

PROCEDURES FOR TUNING STANDBY NAVIGATION RADIOS

CAUTION

Pilots should use these procedures only when both FMGCs or both MCDUs are inoperative.
In this case they must press both RMP NAV keys (lighting the green lights).

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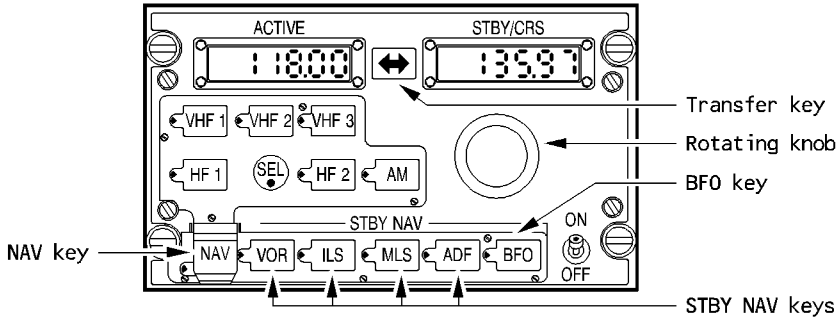


FOR BOTH RMPs

– **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 on the STBY/CRS window.
The receiver is now tuned to the frequency of the new station, and the course is selected.
To select another station, press the transfer key (making both windows display the previously selected frequency) before retuning the VOR (or ILS).

Note : *When the radio-nav standby mode is active (NAV key ON) and VHF or HF tuning is required, select the VHF key or the HF key on the RMP (normal radio communications use). The NAV key, which has no effect on the selection of a radio communication frequency, must remain in the ON position in order to*
R *prevent radio navigation aid tuning from changing NAV receiver frequencies.*

AUTOMATIC IDENTIFICATION OF ADF/VOR/ILS

Although the navigation display automatically identifies the tuned ADF, VOR, or ILS station (auto ident decoded), the flight crew must, in the following cases, confirm the correct tuning of the desired station via the audio system :

— A station has either been autotuned or tuned manually by a crew member's entering the associated ident on the MCDU RAD NAV page, and the decoded ident appearing on the ND is the wrong one.
— A crew member has tuned the station manually on an RMP or by entering the frequency on the MCDU RAD NAV page.

WEATHER RADAR

INTRODUCTION

Airborne weather radar gives the flight crew an efficient tool for detecting bad weather during flight. The digital weather radar with its multicolor navigation display allows the crew to follow the best route to avoid weather problems.
To this end, some operational advice, based upon a general knowledge of the radar capabilities, is given in this chapter.

GENERAL

The radar is nothing more than a precipitation detector. How much weather it detects depends upon the raindrops, their size, composition and number.
The radar does not detect :
· clouds, fog or wind (too small droplets or no precipitation at all)
· clear air turbulence (no precipitation)
· windshear (no precipitation except in microburst)
· lightning.
The radar does detect :
· rainfall
· wet hail and wet turbulence
· ice crystals, dry hail and dry snow (above 30 000 feet) will only give small reflections.

OPERATIONAL FUNCTIONS

TILT, RANGE AND GAIN

The three things that the flight crew must understand in order to take full advantage of the weather radar are :
— antenna tilt, which causes the center of the radar beam to scan above or below the attitude reference plane
— range control which, in coordination with tilt governs the range of the navigation display
— gain control, which adjusts the sensitivity of the receiver (and should normally be set
R to AUTO). The sensitivity of the receiver may vary from one type of radar system to
R another.

COLOR CODE

A color code distinguishes areas according to their precipitation intensity :
- Black, for the lowest intensity (nothing appears on the ND)
- Green, amber, and red for progressively higher intensities.
- Magenta, for saturated areas, in the weather and turbulence mode (WX + T)

GROUND MAPPING AND GCS

Some radars have two additional modes :
- Ground mapping mode permits the radar to produce more returns from less reflective targets on the ground. The associated color codes are : Black for standing water (no returns), green for the ground, amber or red for cities and mountains (strong returns).
- Ground Clutter Suppression (GCS) erases up to 85 % of ground clutter return. The flight crew should only use this mode at shallow tilt angles (0 to 5°) and for short intervals, since it may incorrectly identify stationary weather targets. Steep tilt angles can make it difficult to distinguish between ground and weather targets.

OPERATIONAL USE

CAUTION

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
R centerline.

DETECTION AND INTERPRETATION

General

1. The flight crew should monitor the weather at long range, as well as at shorter ranges, in order to be able to efficiently plan course changes, and to avoid weather-defined blind alleys and box canyons.
2. Ground returns usually appear smaller, sharper, more packed, better-defined, and more angular than weather targets, whereas the latter usually appear larger, have less definite shapes, and tend to remain relatively unchanged.
3. The line-of-sight distance to the horizon is :
   $D(NM) = 1{,}23 \sqrt{\text{(aircraft altitude (feet))}}$.

Red and magenta areas : thunderstorms, tornadoes, hail

The steeper the gradient of rainfall rate, the stronger the turbulence (magenta color) and the possibility of hail.

· To use the radar effectively for avoiding thunderstorms, the flight crew should select the following ranges on the NDs (if possible) :
  – 160 NM on the Pilot Non-Flying (PNF) ND
  – 80 NM on the Pilot Flying (PF) ND

· To avoid a large storm, the flight crew must make decisions while still 40 NM from it. Therefore the flight crew should :
  – Avoid magenta (WX+T mode) and red areas and fringes by at least 20 NM above the FL230 and by 5 to 10 NM below FL230.
  – Avoid single magenta areas of turbulence (not associated with heavy precipitation) by at least 5 NM.

· Flight crew should readjust the tilt frequently in order to monitor storm development and to get the best cell echo.

· Failure to tilt the antenna down periodically may cause a target to disappear.

· The following formula calculates the vertical distance between the top of the cell and the aircraft flight level :

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

Example :
Cell at 40 NM disappearing at less than 3 degrees downtilt
$\Delta h \sim 40 \times 3 \times 100 = 12\ 000$ feet.

· The pilot should not attempt to penetrate a cell or clear its top by less than 5000 vertical feet, because otherwise the aircraft may encounter severe turbulence.
R If the top of cell is at or above 25000 feet, overflying should be avoided due to the
R possibility of encountering turbulence stronger than expected.
In the same way, the pilot should avoid flying under a thunderstorm because of possible windshear, microbursts, severe turbulence, or hail.

Turbulence mode :

· The turbulence detection mode is most effective when the ND is set on 40 NM and the antenna is tilted to avoid ground return.

· When examining areas of heavy rainfall in WX+T mode, the flight crew should adjust antenna tilt frequently, because turbulence areas vary with the altitude.

· Closely spaced (or thin lines between) color gradations are usually associated with severe turbulence.

FLIGHT INSTRUMENT TOLERANCES

The values below apply to aircraft in symmetrical flight (no sideslip), in clean configuration, and in straight and level flight.

ALTITUDE TOLERANCES

– PFD 1 or 2 at ground check : plus or minus 25 feet (8 meters)

MAXIMUM DIFFERENCES BETWEEN ALTITUDE INDICATIONS

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)	ISIS and any ADR 1, or 2, or 3
GND CHECK	20 (6 m)	20 (6 m)	100 (30 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)

MAXIMUM DIFFERENCES BETWEEN SPEED/MACH INDICATIONS

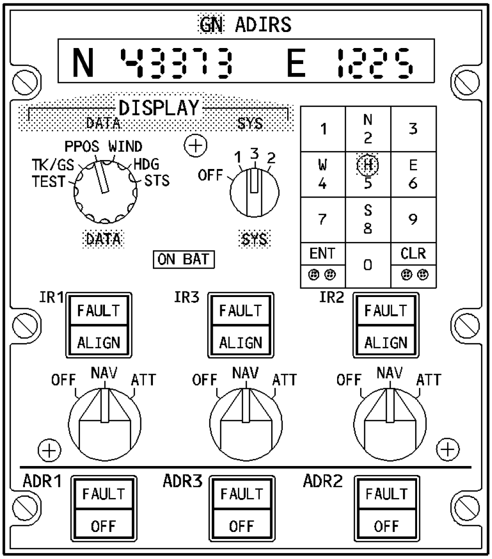
FL/SPEED	SPEED (kt) MACH COMPARISON BETWEEN					
	ADR 1 and ADR 2 (on PFD)		ADR 3 and ADR 1, or ADR 3 and ADR 2		ISIS and any ADR 1, or 2, or 3	
	SPEED	MACH	SPEED	MACH	SPEED	MACH
GND CHECK	6	0.008	6	0.008	6	–
FL50/250 kt	4	0.005	5	0.011	7	–
FL100/250 kt	4	0.005	4	0.011	8	0.032
FL200/300 kt	3	0.007	4	0.008	9	0.033
FL300/0.78	3	0.010	7	0.017	9	0.025
FL390/0.78	3	0.010	6	0.019	8	0.025

Mach values lower than M0.50 in climb, and M0.45 in descent, are not displayed on ISIS.

HEADING TOLERANCES

Maximum differences between magnetic heading indications on the NDs : 4 degrees.

R
ADIRS OPERATION



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R The ADIRS must be aligned : This allows them to operate in NAV mode, to continuously
R provide the aircraft's position. To complete the alignment, the ADIRS must be initialized to
R a navigation starting point, from which the ADIRS determine subsequent aircraft positions
R during flight.
R The pilot may check the ADIRS status, and the ADIRS drift, at any moment on the MCDU
R POSITION MONITOR page.

R
COMPLETE OR FAST ALIGNMENT

R For alignment, the aircraft must be stationary on ground. Any aircraft motion will
R automatically restart the alignment. Avoid alignment during an engine start, or while the
R engines are running.
R The pilot may choose to perform a complete alignment (this takes about 10 minutes) or a
R fast alignment (this takes about 30 seconds). In both cases, the ADIRS must be initialized
R to a navigation starting point.
R During a complete alignment, the ADIRS uses gravity to determine the aircraft attitude. It
R then determines true heading, and estimates the present latitude.
R During a fast alignment, the ADIRS resets the ground speed to 0. Therefore, the ADIRS will
R start the position computation with an accurate initial speed. The ADIRS does not estimate
R the latitude.

R The procedure for ADIRS complete or fast alignment is the following :

R – **All 3 ADIRS Control Panel mode selectors . . . . OFF**
R The ALIGN light remains OFF.

R – **All 3 ADIRS Control Panel mode selectors . . . . NAV**
R If the mode selectors are set back to NAV within 5 seconds, the ADIRS perform a fast
R alignment.
R Otherwise, the ON BAT light comes ON for five seconds, and the ADIRS then start a
R complete alignment.
R The ALIGN light comes ON, and remains steady until the alignment is complete.

R **POSITION INITIALIZATION**

R The alignment phase is completed, when the ADIRS is initialized to an appropriate position.
R Perform this initialization as soon as possible, to prevent delays if an alignment error
R occurs.

R – **MCDU coordinates . . . . CHECK/MODIFY**
R When the pilot enters or modifies the origin airport (FROM) or the CO RTE, the MCDU
R INIT coordinates are reset to the airport reference point (extracted from the FMS
R database). The pilot may also manually modify these coordinates.
R If the MCDU coordinates change, when the ADIRS are already in NAV mode, the RESET
R IRS TO NAV message is triggered on the MCDU : Crosscheck the MCDU INIT
R coordinates against the IRS position on the MCDU POSITION MONITOR page.
R When the GPS is available, or for flights in good radio navigation coverage airspace,
R initialize the ADIRS to the airport reference point extracted from the FMS database. This
R reduces the risk of entering incorrect values.
R If the GPS is not available, and long segments in poor radio navaid coverage airspace
R are expected, initialize the ADIRS to the gate coordinates. This increases the accuracy
R of the ADIRS position computation.
R If the airport reference point is not stored in the FMS database, and the gate coordinates
R are not available, use the airport reference point coordinates from the airport chart.

R – **ALIGN IRS prompt . . . . PRESS**
R The MCDU INIT page coordinates are sent to the ADIRS, and their navigation starting
R point is set.

R **ALIGNMENT/INITIALIZATION ERROR**

R The ADIRS keeps a record of the last position it had the last time it was in NAV mode. It
R is also able to estimate the present latitude after a complete alignment. The ADIRS may use
R this information to detect coarse initialization errors.
R If the ADIRS alignment or initialization is not correct, the ALIGN light will flash. If any of the
R 3 ADIRS indicates an alignment error, the prompt REALIGN IRS appears on the INIT page
R (instead of ALIGN IRS).

R ● **If the IR FAULT light flashes, the affected ADIRS can only be used in ATT**
R **mode.**

R ● **If the ALIGN light flashes before the alignment phase is completed :**

R – **DISPLAY DATA switch . . . . STS**
R If the CDU does not display any message, the position sent to the ADIRS disagrees
R with the last memorized position, or with the ADIRS estimated latitude. Check the
R initialization position, and reenter it.
R If the CDU displays a message, take the appropriate action.

R ● **If the ALIGN light flashes at the end of the alignment phase :**
R – Check the ALIGN IRS prompt on the MCDU. If it is present, press it to initialize the
R ADIRS.

● **If the REALIGN IRS prompt is present :**
The position sent to the ADIRS disagrees with the last memorized position, or with the ADIRS estimated latitude.

R – **ADIRS . . . . PERFORM FAST ALIGNMENT**
R
R – **POSITION INITIALIZATION . . . . CHECK & ENTER AGAIN**
R If the ALIGN light still flashes, perform a complete alignment of the affected
R ADIRS.

R **SHUTDOWN**

R – **Mode selectors . . . . OFF**
R Pull and turn the 3 mode selectors to OFF.
R The message screen displays REALN DESN 5 SEC (realign decision) for 5 seconds, then
R a 5 seconds countdown to off (OFF TIME 5 SEC displayed). Flight crew must not pull
R the circuit breakers until 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.

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 helps the crew to visually situate the intruder. It also prepares the crew for a possible Resolution Advisory. However, not every RA is preceded by a TA.

– **Resolution Advisory (RA)**
If the intruder is considered to be a real collision threat, an aural and visual Resolution Advisory is given.
TCAS determines the optimum vertical maneuver that ensures effective separation, with a minimum change in vertical speed.
Depending on each situation, TCAS generates a :
· Preventive Advisory (i.e. the actual vertical speed may be maintained). It displays the vertical speed range to be avoided.
· Corrective Advisory i.e. the actual vertical speed is within the range to be avoided and a recommended vertical speed (fly to) range is displayed.
· Modified Corrective Advisory, which changes already displayed RA (i.e if the intruder changes their vertical speed).

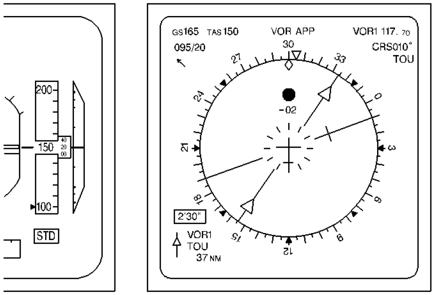
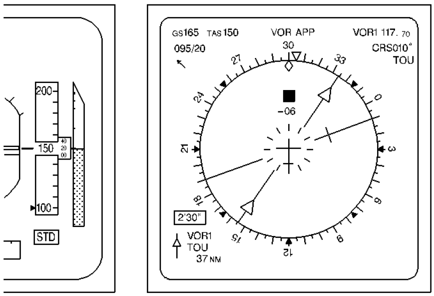
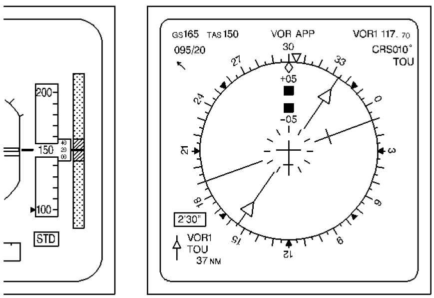
R **OPERATIONAL RECOMMENDATIONS**

● **Avoidance generalities :**
R Always follow the RAs orders, even if they lead to cross the altitude of the intruders,
R as they ensure the best global separation.

CAUTION
R If a pilot does not follow a RA, he should be aware that the intruder may be TCAS
R equipped and may be maneuvering toward his aircraft in response to a
R coordinated RA. This could compromize safe seperation.

Pilots should comply with the vertical speed limitations during the last 2000 feet of 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 PFD / ND	CREW RESPONSE
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: (hatched) : green (dotted) : red

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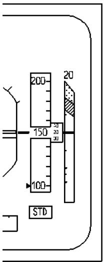
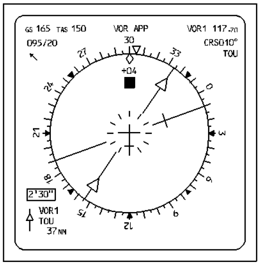
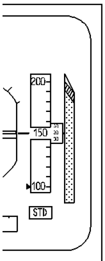
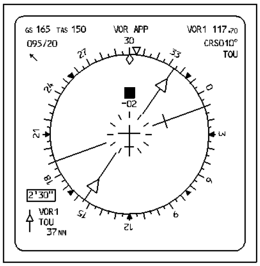
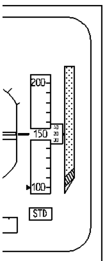
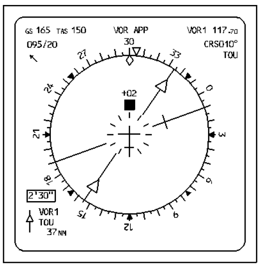
R

<table>
<tr><th rowspan="2">SCENARIO</th><th colspan="2">AURAL WARNING and TYPICAL DISPLAY</th><th rowspan="2">CREW RESPONSE</th></tr>
<tr><th>PFD</th><th>ND</th></tr>
<tr><td rowspan="2">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</td><td colspan="2">"ADJUST VERTICAL SPEED ADJUST"</td><td rowspan="2">- Adjust vertical speed so as to be in the green area of the PFD's speed scale by reducing climb vertical speed as appropriate</td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="2">- The intruder is ahead at 12:00 o'clock, 200 ft below your altitude</td><td colspan="2">"CLIMB, CLIMB"</td><td rowspan="2">- Promptly (within 5 seconds) smoothly establish a climb rate of 1 500 ft/mn</td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="2">- The intruder is ahead at 12:00 o'clock, 200 ft above your altitude</td><td colspan="2">"DESCEND, DESCEND"</td><td rowspan="2">- Promptly (within 5 seconds) and smoothly establish a descent rate of 1 500 ft/mn</td></tr>
<tr><td></td><td></td></tr>
</table>

V/S scale color legend: (hatched) : green (dotted) : red

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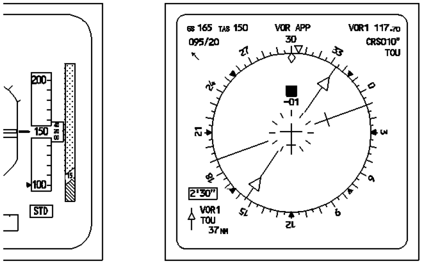
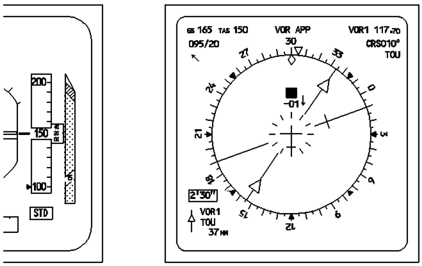
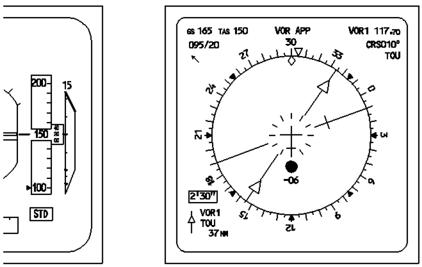
SCENARIO	AURAL WARNING and TYPICAL DISPLAY PFD ND	CREW RESPONSE
RESOLUTION ADVISORY (ADDITIONAL CORRECTIVE) - The intruder ahead has stopped its climb - It is now 100 ft below your altitude	"INCREASE DESCEND INCREASE DESCEND" 	- Immediately (within 2.5 seconds) and smoothly increase your descent rate to 2 500 ft/mn
- The intruder has changed from level flight to a rapid descent after TCAS issued a DESCEND RA - TCAS is now changing that to a CLIMB RA	"CLIMB, CLIMB, NOW CLIMB, CLIMB, NOW" 	- Initiate a change from a descent to a climb maneuver, within 2.5 seconds.
RA CLEARED - The intruder has passed behind and is now 600 ft below your altitude - It is no longer a threat	"CLEAR OF CONFLICT" 	- Return promptly to the previous ATC clearance.

V/S scale color legend: (hatched) : green (dotted) : red

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R **APPROACH ON PAPI OR TVASI**

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) or
R "T"-Visual Approach Slope Indicator (TVASI) guidance below 200 feet when PAPI or TVASI 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 Operators using QFE reference, switching from "QNH only" to QNH/QFE can be done by activating a specific pin program on the two following computers : FMGC, FCU. For various reasons, some Operators may use QNH reference for approach and landing on QNH/QFE pin programmed aircraft. The flight 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 flight crew.

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 Approaches (NPA) :
– Insert the MDA value into the MDH field of the PERF APPR page.

Note : *If the MDA is greater than 5 000 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 callouts.*

– Do not use FINAL APP mode.
– For NPAs other than LOC and LOC B/C :
  Use TRK/FPA or NAV/FPA modes, until visual references are met.
– For LOC (or LOC B/C) approaches :
  Use LOC/FPA (or LOC B/C / FPA) modes, until visual references are met.
– At the correct altitude the color on the PFD altitude scale changes from green to amber.

Procedure for RNP AR approach :
– Insert a barometric decision height in the MDH field of the MDCU. The AP will automatically disconnect at the corresponding DA – 50 ft.
– The “Hundred Above” and “Minimum” callouts must be announced by the PNF.
The autocallout triggering and the altitude scale turning amber, will not occur or will occur too late, depending on the airfield elevation.

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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GROUND PROXIMITY WARNING SYSTEM (GPWS)

The Flight Management System (FMS) provides aircraft position inputs to the GPWS for predictive functions processing purpose.
The TERR pushbutton, located on the overhead panel, enables the activation or de-activation of the GPWS predictive functions.
If the TERR ON ND is not selected, and a terrain alert is generated, the terrain is automatically displayed on the ND.
The brightness of the terrain indication on the ND is controlled via the weather radar brightness control knob. If the weather radar brightness was set to low (due to bad weather) and a terrain alert occurs, then the terrain display brightness will also be low. Thus when a terrain alert occurs, the ND weather/terrain image brightness may need to be adjusted.

ATSU INITIALIZATION

ATSU is automatically initialized, provided a list of Service Providers has been scanned the and following three parameters have been received and validated by the ATSU :

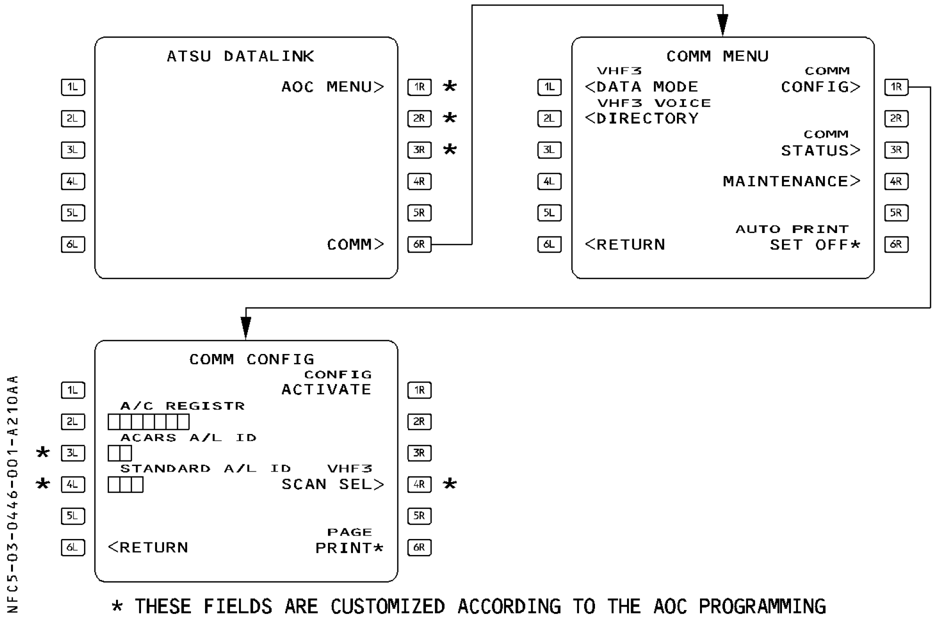
– Aircraft Registration Number (ARN)
– ACARS Airline Identity code (ACARS A/L ID)
– Standard Airline Identity code (STANDARD A/L ID)

If one of the above four conditions is not fulfilled, then ATSU is unavailable and :

– The ECAM displays ATSU FAULT, and
– The MCDU scratchpad displays a message requesting crew action.

A manual entry of the missing parameter followed by its activation, reinitializes the ATSU, and clears the ECAM and MCDU message.

R

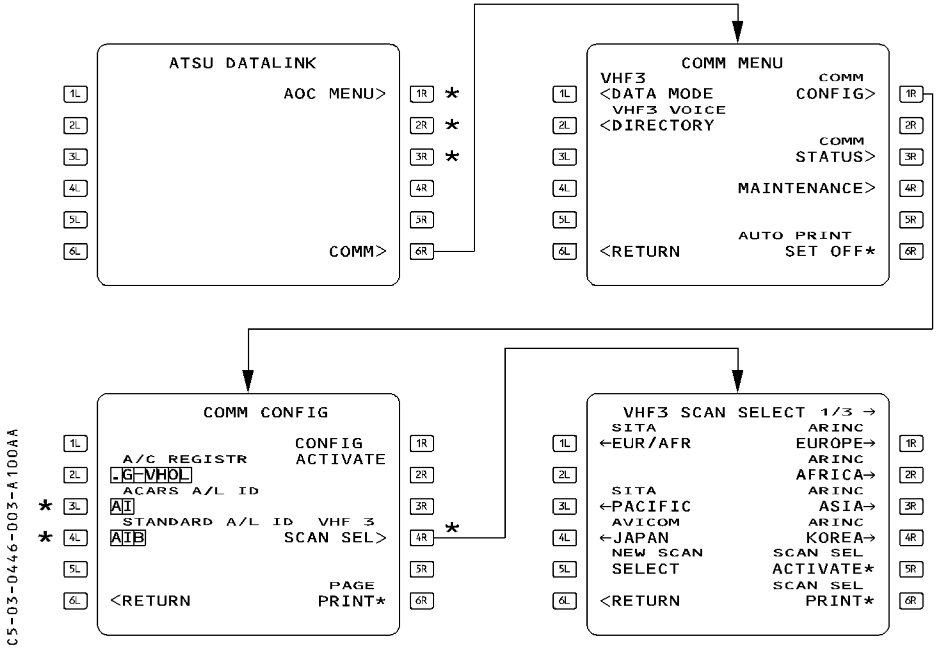


* THESE FIELDS ARE CUSTOMIZED ACCORDING TO THE AOC PROGRAMMING

R **<u>If ARN is not valid :</u>**
R The MCDU scratchpad displays the "ENTER A/C REGISTER" message. After clearing the
R scratchpad, the crew writes the ARN on the scratchpad. Pressing the 2L key on the COMM
R CONFIG page enters the ARN in the 2L field. The flight crew has to press the 1R key to
R activate it.

R **<u>If the A/L ID is not valid :</u>**
R The MCDU scratchpad displays the "ENTER A/L IDENT" message. After clearing the
R scratchpad, enter the two-letter A/L ID code on the scratchpad. Press the 3L key to enter
R the A/L ID code in the 3L field. Repeat the same operation for the three-letter A/L ID code,
R by using the 4L key instead of the 3L key. The flight crew has to press the 1R key to
R activate it.

<u>If the VHF3 SCAN SELECT menu can be accessed, and if no VHF Service Providers have been selected :</u>
The MCDU scratchpad displays the "ENTER VHF3 SCAN SELECT" message.
On the VHF3 SCAN SELECT page, select a Service Providers' list, in the airline priority order, and activate the VHF SCAN SELECT function.
Example : To select Service Providers SITA 725 and ARINC :
1. Press the 5L key : The star next to the ERASE indication disappears, then reappears.
2. Press the 1L key to select SITA 725 : The SELECT indication goes off, and the priority number of selection # 1 appears.
3. Press the 1R key to select ARINC : The SELECT indication goes off, and the priority number of selection # 2 appears.
4. Press the 5R key to activate the VHF SCAN SELECT function : The star next to the SCAN
R SELECT LOAD indication disappears, then reappears.



* THESE FIELDS ARE CUSTOMIZED ACCORDING TO THE AOC PROGRAMMING/ATSU CONFIGURATION

Note : Modification of the SCAN SELECT setting may result in the loss of air-ground VHF datalink communication. Therefore, the SCAN SELECT setting should not be modified by the flight crew, unless they have been instructed to do so.

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 occurs when :

- The A/THR fails, or
- The FCU's A/THR pushbutton is pressed, or
- One thrust lever(s)' instinctive disconnect button is pressed, or
- Both thrust levers are set to IDLE.

1. Disconnection, due to a failure or to the use of the FCU A/THR pushbutton.
   If the thrust levers are in the CL detent (both engines operative), or one thrust lever in the MCT detent (one engine operative), the thrust is locked at its actual value. The FMA displays a "THR LK" pulsing memo. A single chime sounds, and an amber ECAM caution appears, as long as thrust is locked. (For more details, refer to FCOM 1.22.30).
   Movement of the thrust lever(s) unlocks the thrust, and the engine(s) then respond(s) to TLA position.
2. Disconnection, due to the use of instinctive disconnect button.
   When a pilot presses one of the instinctive disconnect button, the engines immediately develop thrust corresponding to the position of their thrust levers.

Instinctive Disconnection procedure

To avoid any confusion for those pilots flying the A318/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 (blue with EIS2 screens) circle is adjacent to the N1 (or EPR) needle.
- Use the instinctive button to disconnect the A/THR.
- Check that "A/THR" memo is displayed on the ECAM, and that the autothrust mode on the first column of the FMA disappears.
- 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 changeover 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/she retards the thrust levers to idle for touchdown. If the pilot is going to make the landing using manual thrust, he/she should disconnect the A/THR by the time he/she has reached 1000 feet on the final approach.
If he/she makes a shallow flare, with A/THR engaged, it will increase thrust to maintain the approach speed until he/she pulls the thrust levers back to idle. Therefore he/she 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/she 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 immediately takes effect 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 use of the 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.
For more information concerning aircraft handling during final approach, refer to the FCOM Bulletin "Aircraft handling in final approach".

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 hot conditions, or at a high-altitude airfields.
  · An engine with a reduced EGT margin, in hot conditions, or at a high-altitude airfields.
  · Marginal performance of the external pneumatic power group.

MANUAL ENGINE START PROCEDURE

– **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 a hazardous situation, if the thrust levers are not at idle.

– **ENG MODE selector . . . . NORM THEN IGN**
The lower ECAM displays the engine page.

– **ENG MAN START . . . . ON**
· Do not set the MAN START pushbutton to ON, before all amber crosses have disappeared on engine parameters (upper ECAM display).
· On the ECAM lower display, check that the START VALVE is inline
· On the ECAM displays, check that the OIL PRESS increases, and N2 increases.

R ● **When N2 reaches the maximum motoring speed :**
The maximum motoring speed is defined as the speed at which N2 acceleration is less than 1 % in approximately 5 seconds.

● **If N2 does not get up to 20 %, check that the pack valve autoclosure is functioning. If the autoclosure is functioning, shed APU loads as follows.**

– **GALLEY . . . . OFF**
If needed, shed also :

– **BLUE ELEC PUMP (ground only) . . . . OFF**

– **FUEL X FEED . . . . ON**

– **FUEL PUMPS except R TK PUMP 2 . . . . OFF**

– **BLOWER . . . . OVRD**

– **CAB FANS . . . . OFF**

R ● **When N2 gets above 20 % :**

– **MASTER switch . . . . ON**
The PNF 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 (maximum) after fuel is on.
If the electrical power supply is interrupted during the start sequence (indicated by loss of ECAM CRTs), abort the start by setting the MASTER switch to OFF. Then perform a 30 second dry crank.

● **When N2 reaches 50 %**

– **ECAM displays** . . . . **CHECK**
R Check : – START VALVE crossline (between 50 and 56 % N2)
– Igniter indication off
– Main and secondary engine idle parameters normal.
Gray 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**

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 :**

  ■ **If external pneumatic power is used to start Engine 1 :**

  – **Start Engine 1**

  – **Request the removal of external pneumatic power unit.**

R – **X BLEED . . . . AUTO**

  – **ENG BLEED (Both engines) . . . . ON**

  – **PACKS 1 and 2 . . . . ON**

■ **If the crossbleed engine start procedure is used for Engine 1 :**

– **Request the removal of external pneumatic power unit**

– **PACKS 1 and 2 . . . . ON**

R – **ENG 2 BLEED . . . . ON**

– **CROSSBLEED ENGINE START PROC for Engine 1 . . . . 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.

INTENTIONALLY LEFT BLANK

INTENTIONALLY LEFT BLANK

PUSHBACK WITH POWER PUSH UNIT VIA THE MAIN LANDING GEAR

GENERAL

At several airports, the pushback is performed using a Power Push Unit (PPU), which pushes the aircraft via the main landing gear, while the flight crew provides steering via the yellow hydraulic system. Steering guidance will be given by ground personnel via interphone communication.
This section provides the flight crew with Airbus operational recommendations in performing such a pushback, and replaces the "BEFORE PUSHBACK or START" standard operating procedure.

PREPARATION

- **LOADSHEET . . . . CHECK**
  The Captain should thoroughly check the load and trim sheet, particularly for gross errors, and ensure that the loadsheet data is correct : Correct flight, correct aircraft, dry operating index, configuration, fuel onboard, etc.
  R Compare ZFWCG/ZFW 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.
    Particular care should be taken to determine the takeoff configuration (refer to 2.02.20).
    Confirm any takeoff weight limitation.
  - The PF checks (or revises) the takeoff data on the MCDU's INIT B and PERF pages.

- **SEATS, SEAT BELTS, HARNESSES, RUDDER PEDALS, ARMRESTS . . . . ADJUST**
  The seat is correctly adjusted when the pilot's eyes are in line with the red and white balls.

- **MCDU . . . . IN TAKEOFF CONFIGURATION**
  It is recommended that the crew display 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 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 ground personnel. Due to the face-to-face position of the flight crew and ground personnel, it is necessary that the flight crew ensure they have clearly and correctly understood the ground personnel's directional phraseology.

– **WINDOWS and DOORS . . . . CHECK CLOSED**
- Check that the cockpit windows are closed and locked (red circle on handle fully visible). Check, on the ECAM lower display, that all doors are closed.
- When required by local Airworthines Authorities, check that the cockpit door is closed and locked (no cockpit door open/fault indication).
  If entry is requested, identify the person requesting entry before unlocking the door. With the cockpit door selector on NORM, the cockpit door is closed and locked. If entry is requested from the cabin, and if no further action is performed by the pilot, the cabin crew will be able to unlock the door by using the emergency access procedure. Except for crew entry/exit, the cockpit door should remain closed until engine shutdown.

– **BEACON . . . . ON**

– **THR LEVERS . . . . IDLE**

> CAUTION
> Engine 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 in idle.

– **ENG 2 . . . . START**
Engine 2 is usually started first, to pressurize the yellow hydraulic system to power the nosewheel steering and maintain 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 the 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.

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

Except in some operational conditions, such as uphill slopes, slippery taxiways, or high gross weight, it may be advisable to taxi on one engine. The flight crew must exercise caution when taxiing on one engine to avoid generating excessive jet blast.

DEPARTURE

The flight crew 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 Engine 1 for taxiing, because it pressurizes the green hydraulic system (normal braking).

– **X BLEED . . . . OPEN**
This supplies both packs from Engine 1.

– **Apply the normal "AFTER START" procedures, but :**
  – Keep the APU running to avoid additional electrical transients and to allow the galley operation.
  APU BLEED should be switched off to avoid ingestion of engine exhaust gases in the air conditioning system.
R – After both engines have been started, perform the ECAM STATUS check, and then
R select and set the engine anti-icing and/or wing anti-icing as required.

• **<u>Before releasing the parking brake :</u>**

  – **Y ELEC PUMP . . . . ON**
  This pressurizes the yellow hydraulic system (nosewheel steering) without using the PTU.

– **Apply the normal "TAXI" procedures, but :**
  · Perform the Flight Controls checks after both engines have been started.
  · Do not arm the Auto Brake system before the Flight Controls checks have been completed.

- **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 3 minutes before takeoff :**

The last engine must be started no less than 3 minutes before takeoff :
· To avoid engine thermal shock
· To ensure that takeoff is not initiated before the center tank pumps test is finished, since takeoff on center tank is prohibited.

– **ENGINE 2 . . . . START**

Note : During engine start, a slight jerk forward may occur, if brakes are applied while the aircraft is moving.

– **APU . . . . AS RQRD**

– **X BLEED . . . . AUTO**

– **Continue with the “AFTER START” procedures :**
After both engines have been started, perform the ECAM STATUS check, and then select and set the engine anti-icing and/or wing anti-icing as required.

– **Proceed with the “AFTER START” checklist.**

– **FLIGHT CONTROLS . . . . CHECK**

– **AUTO BRK . . . . MAX**

ARRIVAL

The flight crew may use the following procedure to taxi in :

– **APU** . . . . **START**
Start the APU before shutting down the engine, in order to avoid additional electrical transient.

• **<u>No less than 3 minutes after high thrust operations, and when taxiing in a straight line :</u>**

R – **ENG 2** . . . . **SHUT DOWN**

R – **Y ELEC PUMP** . . . . **ON**
R This avoids running the PTU.

• **<u>At parking :</u>**

– **Y ELEC PUMP** . . . . **OFF**

– **ENG 1** . . . . **SHUT DOWN**

SEVERE TURBULENCE

GENERAL

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.
Consider requesting a lower flight level to increase margin to buffet onset.
Sufficient buffet margin exists at optimum altitude.
R Severe turbulence is defined as turbulence that causes large, abrupt changes in altitude
R and/or attitude. It usually causes large variations in airspeed. Occupants are forced
R violently against their seat belts and loose objects will move around the aircraft.
R If severe turbulence occurs during a flight, the flight crew must make a logbook entry in
R order to initiate maintenance action.

R *Note : Recommendations for severe turbulence are also applicable to extreme turbulence.*

SIGNS

Before entering an area of known turbulence, the flight crew and the cabin crew must secure all loose equipment and switch the cabin SIGNS to ON.

AUTOPILOT/AUTOTHRUST

- **Keep the autopilot ON.**

- **When thrust changes become excessive : Disconnect Autothrust.**

- **For approach : Use A/THR for managed speed.**

THRUST AND AIRSPEED

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.
Only change thrust in case of an extreme variation in airspeed, and do not chase your Mach or airspeed.
A transient increase is preferable to a loss of speed, that decreases buffet margins and is difficult to recover.

NFC5-03-0491-001AA100AA

THRUST SETTING (N1) FOR RECOMMENDED SPEED

R

SEVERE TURBULENCE										
SPEED AND THRUST SETTING FOR RECOMMENDED TURBULENCE SPEED										
FL	SPD or Mach	GROSS WEIGHT (1000 kg)								
		44	48	52	56	60	64	68	72	76
		N1 %								
390	0.76	80.0	81.0	82.0	83.1	–	–	–	–	–
370	0.76	79.1	79.8	80.7	81.6	82.6	83.6	–	–	–
350	0.76	78.8	79.3	80.0	80.7	81.5	82.4	83.3	84.3	–
330	0.76	78.8	79.3	79.8	80.4	81.0	81.8	82.6	83.4	84.2
310	275	78.1	78.6	79.2	79.8	80.3	80.9	81.5	82.3	83.1
290	275	76.6	77.1	77.6	78.2	78.9	79.6	80.3	81.0	81.7
270	275	75.1	75.6	76.1	76.7	77.3	78.0	78.7	79.6	80.5
250	275	73.5	74.0	74.5	75.1	75.8	76.5	77.2	77.9	78.8
200	275	69.9	70.3	70.7	71.2	71.8	72.4	73.0	73.7	74.4
150	250	61.9	62.6	63.3	64.0	64.9	65.9	66.9	68.0	68.9
100	250	58.3	59.0	59.6	60.2	61.0	61.8	62.6	63.5	64.5
50	250	54.3	54.9	55.6	56.3	57.1	58.0	59.0	60.0	60.8

ALTITUDE

If the crew flies the aircraft manually :
– 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.**

<u>Note</u> : – *When it is using the GS mini-function, associated with managed speed, the system will carry extra speed in strong wind conditions.*
R – *If gusty wind is expected, increase the Vapp that is displayed on the*
R *MCDU to a maximum of VLS + 15 knots.*

RECOVERY TECHNIQUE AT TAKEOFF

- **<u>Before V1 :</u>**

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.

- **<u>After V1 :</u>**

– **Set thrust levers to TOGA**

– **Rotate normally.**

– **Follow SRS orders.**

- **<u>During initial climb :</u>**

– **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).**

<u>Note</u> : *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.**

R *Note : If FD bars are unavailable, use an initial pitch attitude up to 17.5 degrees with*
R *full backstick, if necessary. If needed, to minimize the loss of height, increase this*
R *pitch attitude.*

- **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.

DEICING/ANTI-ICING PROCEDURE ON GROUND

R In all situations, it is the Captain’s responsibility to decide if the ground crew must
R deice/anti-ice the aircraft, and/or if additional deicing/anti-icing treatment is required.
R Before starting the deicing/anti-icing procedure, the flight crew must establish
R communication with the ground crew that will be applying the procedure.

CAUTION

R – Make sure that the low or high-pressure ground connectors do not supply any
R external air to the aircraft.
R – If it is necessary for the ground grew to repeatedly anti-ice the aircraft, they must
R deice the surfaces with a hot fluid mixture before applying a new layer of anti-icing
R fluid.

R Make sure that the ground crew uses the correct de-icing/anti-icing fluids, in accordance
R with the applicable operator requirements and Aircraft Maintenance Manual (AMM)
R instructions.
R The aircraft can be deiced or anti-iced when the APU and engines are either stopped or
R running. However, do not start the engines when the ground crew is spraying fluid on the
R aircraft.

CAUTION

R – The ground crew should take care when spraying deicing fluid, and make sure that
R the engine and APU do not ingest any fluid.
R – Do not move flaps, slats, ailerons, spoilers, or elevators, if they are not free of ice.
R – Always ensure that both the left and right sides of the aircraft receive the same,
R complete, and symmetrical deicing/anti-icing treatment.

BEFORE SPRAYING FLUID :

– **CAB PRESS MODE SEL . . . . CHECK AUTO**

– **ENG BLEED 1 + 2 . . . . OFF**

– **APU BLEED . . . . OFF**

– **DITCHING pushbutton . . . . ON**
Outflow valve, pack valves, and avionic ventilation inlet and extract valves close.

– **GND COOL . . . . OFF**
The ground cool unit valves close to prevent de-icing fluid from entering the aircraft. Avionic ventilation is in closed circuit with both fans running. In view of the low OAT, there is no time limit for this configuration.

Note : If the "VENT AVNCS SYS FAULT" warning appears, reset the AEVC circuit breaker at the end of the aircraft de-icing procedure.
AIR COND/AVNCS VENT/CTL D06 on 49VU.
AIR COND/AVNCS/VENT/MONG Y17 on 122 VU.

– **THRUST LEVERS . . . . CHECK IDLE**

– **"AIRCRAFT PREPARED FOR SPRAYING" . . . . INFORM GROUND CREW**

UPON COMPLETION OF THE SPRAYING OPERATION :

– **DITCHING pushbutton . . . . OFF**

R – **GND COOL . . . . AUTO**

R – **OUTFLOW VALVE . . . . CHECK OPEN**
R On the ECAM PRESS page, confirm that the outflow valve indication reaches the open
R green position to avoid any unexpected aircraft pressurization.

– **ENG BLEED 1 + 2 . . . . ON**

- **At least 60 seconds after APU start, or on completion of spraying operation :**

  – **APU BLEED . . . . ON**

– **PITOTS and STATICS (ground crew) . . . . CHECK**

– **GROUND EQUIPMENT . . . . REMOVE**

– **DE-ICING/ANTI-ICING REPORT . . . . RECEIVED**
The information from ground personnel, who performed the de-icing and post-application check, must include (ANTI-ICING CODE) : Type of fluid used, or the mix ratio of fluid to water (for example 75/25), or 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.

R **SECURING THE AIRCRAFT FOR COLD SOAK**

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

R – **DITCHING pushbutton . . . . ON**
R This closes the outflow valve, the pack valves, and the avionic ventilation inlet and
R extract valves.

R – **PARKING BRAKE . . . . OFF**
R Check chocks in place, and release the parking brake to prevent brakes from freezing.

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

R – **DITCHING pushbutton . . . . OFF**

R – **PROTECTIVE COVERS . . . . INSTALL**
R Install protective covers and plugs to protect the aircraft and engines from snow and
R ice.

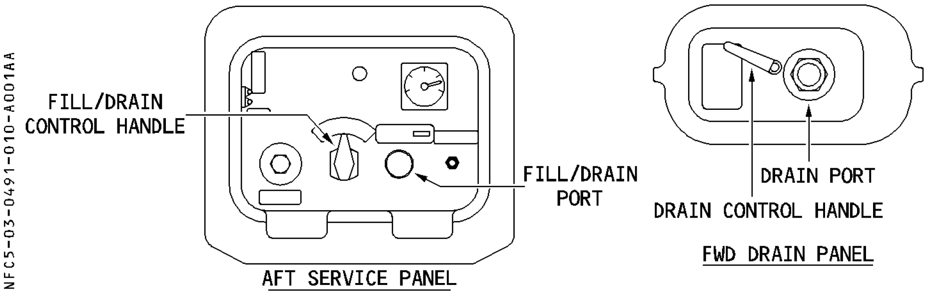
WATER SYSTEM DRAINING

Drain the water system, if the OAT requires it, as shown below :

<table>
<tr><th colspan="3">Configuration</th><th rowspan="2">Exposure time</th><th rowspan="2">Water tank drain</th></tr>
<tr><th>Air Conditioning</th><th>Cabin temperature</th><th>Outside Air Temperature</th></tr>
<tr><td rowspan="2">ON</td><td rowspan="2">Above 10° C (50° F)</td><td>Between 0° C and – 15° C (32° and 5° F)</td><td>None</td><td>Not required</td></tr>
<tr><td>Below – 15° C (5° F)</td><td>1 h 15 min</td><td rowspan="4">Required</td></tr>
<tr><td rowspan="3">OFF</td><td rowspan="3"></td><td>Between 0° C and – 7° C (32° and 19.4° F)</td><td>1 h 30 min</td></tr>
<tr><td>Between – 7° C and – 15° C (19.4° and 5° F)</td><td>0 h 30 min</td></tr>
<tr><td>Below – 15° C (5° F)</td><td>Any</td></tr>
</table>

R **FOR DRAINING WATER PROCEDURE**

R This procedure uses electrical power.
R



R – **ACCESS PLATFORM(S) . . . . PUT IN POSITION**

R – **SHUTOFF VALVE IN GALLEYS/TOILETS . . . . CHECK OPEN**

R – **FWD/AFT ACCESS PANEL DOORS . . . . OPEN**

R – **DRAIN PORT CAPS . . . . REMOVE**
R Remove drain port caps on forward drain and aft service panels.

R – **DRAIN HOSES . . . . CONNECT**
R Connect drain hoses to :
R · the drain port on the forward drain panel.
R · the full/drain port on the aft service panel.

R ■ **On the forward drain panel**

R – **DRAIN CONTROL HANDLE . . . . TURN LEFT**
R Turn the control handle to drain.

R ■ **On the aft service panel**

R – **FILL/DRAIN CONTROL HANDLE . . . . . . TURN TO "DRAIN" AND PULL**
R Turn the handle to the "DRAIN" position and pull it out to its mechanical stop to drain.
R The indicator light comes on.

R ■ **When the water system is drained**
R In freezing conditions, the drain valves must stay open to prevent damage to the
R system. Do not put on the caps and leave the access door open.

R – **DRAIN HOSES . . . . DISCONNECT**

R – **PANELS . . . . CLEAN AND DRY**

– **ACCESS PLATFORM(S) . . . . REMOVE**

R **OPERATIONS IN VOLCANIC ASH, SAND OR DUST**

R The following procedures are recommended for operators that may fly through areas with
R volcanic ash, or to operators that operate to/from airports contaminated with sand or dust.
R Because volcanic ash is composed of very abrasive particles that can significantly damage
R aircraft parts and degrade the operation of the aircraft systems. If possible, operators
R should avoid airports that are covered with volcanic ash deposits. If not possible to avoid
R these airports operators should heed the following recommendations.
R When operation on airport contaminated by sand or dust is expected, based on their
R experience and the amount of contaminant, operators can consider applying most of the
R on-ground recommendations in order to help preventing contamination of aircraft systems.

R **GROUND OPERATIONS ON AIRPORTS COVERED WITH ASH, SAND OR DUST**

Preparation of the cockpit

– **APU . . . . DO NOT USE**
Use the APU only to start the engines, and then only if ground power is not available,
R particularly in case of volcanic ash. Request ground supply for air conditioning and for
electricity.

– **WINDSHIELD WIPERS . . . . DO NOT USE**
Do not use windshield wipers to remove ash, or for anything else.

R – **BRAKE PERFORMANCE . . . . CONSIDER PENALTY**
R A layer of volcanic ash on the runway may degrade braking efficiency. Treat takeoff
R performance as if it is similar to that on a wet runway (dry ash) or on slush (wet ash).

Exterior inspection

R – **SURFACES AND EQUIPMENT . . . . CHECK FREE OF DEPOSITS**
R Ground maintenance should remove ash, sand or dust that has settled on exposed
lubricated surfaces and could penetrate seals or enter the engine gas path, air
R conditioning system, air data probes, access doors and panels and other orifices on the
aircraft.

R – **ENGINE/APU INLETS . . . . CHECK FREE OF DEPOSITS**
R Inspect the inlets and order them cleaned of deposit. Have the area within 25 feet of the
engine inlet cleaned of volcanic ash (as mush as practical).

Engine start

Use external pneumatic supply for starting the engines, if it is available. (Refer 3.04.70).

– **ENGINE . . . . CRANK**
Before starting the engines, ventilate them by dry cranking at maximum motoring speed
R for two minutes. This will blow out any contaminant that may have entered the booster area.

Taxi

After releasing the brakes :

– **THRUST LEVERS .. ADVANCE SMOOTHLY THEN MOVE TO IDLE WHEN ROLLING**
Advance the levers smoothly to the minimum required for breakaway.
Avoid making sharp or high-speed turns.

– **ENG 1, ENG 2 BLEED . . . . OFF**
R Keep bleed valves closed for taxiing, particularly in volcanic ash.

R – **In case of crosswind when performing a 180° turn on the runway, initiate this turn**
R **with the nose down wind in order to prevent ash, sand or dust ingestion.**

Takeoff

R – **Allow ash, sand and dust (if present) to settle on runway before starting the takeoff roll.**

– **Use the rolling takeoff technique if possible.**

– **Adjust progressively engine power as for normal takeoff procedures.**

R – **To prevent contamination of air conditioning system, consider a takeoff with packs**
R **OFF.**

Landing

– **REVERSERS . . . . USE AS LIGHTLY AS FEASIBLE**
If it appears that maximum reverse thrust will be needed, apply reverse thrust when the main landing gear touches down. Limit the use of reverse thrust as much as possible,
R because reverse flow may throw up ash, sand, dust and impair visibility.

<u>Note</u> : *The abrasive effect of volcanic ash on windshields and landing lights may reduce the pilot's visibility for approach and landing significantly. Consider diverting to an airfield where it is possible to use AUTOLAND.*

– **BRAKE PERFORMANCE . . . . CONSIDER PENALTY**

R A layer of volcanic ash on the runway may degrade braking efficiency. Treat landing performance as if it is similar to that on a wet runway (dry ash) or on slush (wet ash).

Securing the aircraft

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

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

– **DITCHING pushbutton . . . . ON**
This closes the outflow valve, pack valves and avionic ventilation inlet and extract valves.

● **After switching off the batteries :**

– **DITCHING pushbutton . . . . OFF**

R – **PROTECTIVE COVERS . . . . INSTALL**
R Install protective covers/plugs, to protect the aircraft/engines from volcanic ash.

R **FLIGHT OPERATIONS WITH VOLCANIC ASH**

Avoid flight into areas of known volcanic activity.
If a volcanic eruption is reported while the aircraft is in flight, reroute the flight to remain well clear of the affected area (volcanic dust may spread over several hundred miles). If possible, stay on the upwind side of the volcano (at least 20 NM upwind of it if it is erupting).
In hours of darkness or in meteorological conditions that obscure volcanic dust, one or several of the following phenomena indicate that the aircraft may be flying into ash cloud:
· smoke or dust in the cockpit,
· acrid odor similar to that of electrical smoke,
· at night, the appearance of St. Elmo's fire and static discharges around the windshield,
· bright white or orange glow appearing in the engine inlets,
· sharp, distinct beams from the landing lights,
· multiple engine malfunctions, such as rising EGT, decreasing power, stall, or flame out.

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

– **ESCAPE MANEUVER (terrain permitting) . . . . INITIATE**
Because the lateral dimensions of ash cloud are not known, the pilot should if possible turn 180°.

– **ATC . . . . NOTIFY**

– **A/THR . . . . OFF**
This will prevent thrust variations.

– **THRUST (terrain permitting) . . . . DECREASE**
This helps to maintain the engine stall margin by reducing the amount of ash ingestion and limiting the EGT. It also holds the accumulation of molten volcanic ash on turbine vanes to a minimum. Do not climb, since this increases EGT.

– **CREW OXYGEN . . . . ON/100 %**

– **CABIN CREW . . . . NOTIFY**

– **PASSENGER OXYGEN . . . . AS RQRD**
Depending on contamination.

– **ENG ANTI ICE . . . . ON**

– **WING ANTI ICE . . . . ON**

– **PACK FLOW . . . . HI**
Maximum airbleed gives the engines additional stall margin.

<u>Note</u> : *If the aircraft has a cargo ventilation system, switch off the CARGO ISOL valves to prevent a cargo smoke warning from being triggered.*

– **APU (if available) . . . . START**
This prepares the aircraft for a starter-assisted engine relight.

– **ENGINE PARAMETERS . . . . MONITOR**
Monitor the EGT carefully to see that it does not go over its limit.

<u>Note</u> : *To prevent the engines from exceeding EGT limits it may become necessary to use a precautionary engine shut-down.*
· Restart when clear of the volcanic ash cloud.
· Upon restart, the engine may accelerate very slowly. Do not misinterpret this as a failure to start.
· Consider that the compressor and turbine blades have been eroded and avoid sudden changes in thrust. Fuel flow and EGT may increase.

– **AIRSPEED INDICATIONS . . . . MONITOR**
Volcanic ash may clog the pitot probes. If the airspeed indication is lost or becomes unreliable, see the abnormal procedure “UNRELIABLE SPEED INDICATION/ADR CHECK PROC” (Refer to 3.02.34).

<u>Note</u> : *Electrostatic conditions may cause communication problems.*

R **Reporting**

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

INTRODUCTION

The Less Paper Cockpit (LPC) concept consists of a complete set of software tools, designed to :
- Improve access to pilot's operational information, and simplify some of their tasks.
- Reduce the quantity of paper documents in the cockpit, and replace them with electronic ones, enabling quicker and easier updates, while improving information retrieval.

The applicable areas include Performance and Weight and Balance computations, in addition to technical operational documentation (FCOM, MEL, Operations Policy Manual..).
This section addresses the procedures corresponding to the modules which are already available.
The various modules are linked via F.O.V.E. (Flight Operations Versatile Environment), which is designed to provide an interface between the various modules by enabling :
- Inter-module communication
- Software compatibility management
- Software version management
- Integrity control between data and the software versions
- Update management
- Context management

Each airline may choose to install one or several modules, each of which is able to work independently.

GENERAL

LPC PROGRAM AND REFERENCE VERSION NUMBER UPDATING

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

R Pilot PCs should be unplugged and 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)

R – **ZFWCG/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.

– **LPC/MCDU GREEN DOT . . . . COMPARE**
The PNF compares Green Dot speed computed by the FMGS and Green Dot speed computed by the LPC. A discrepancy indicates a difference in the TOW used in both systems (LPC/FMGS).

BEFORE PUSHBACK or START

– **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

R – **PILOT PC . . . . UNPLUGGED and STOWED**

ILS (or NON PRECISION) APPROACH

● **When the landing gear is down :**

R – **PILOT PC . . . . UNPLUGGED and STOWED**

LPC WEIGHT AND BALANCE MODULE

The Weight and Balance (W & B) module provides a computerized loadsheet and trim sheet. This facilitates computation of the ZFW/ZFCG and TOW/TOCG, and enables last-minute changes to the passenger/cargo/fuel distribution.
The following procedure applies to operators only using the W&B module. Operators using both the W&B module and the Takeoff module should refer to the LPC TAKEOFF MODULE section.

WEIGHT & BALANCE 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.

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)

R – **ZFWCG/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

R – **PILOT PC . . . . UNPLUGGED and STOWED**

ILS (or NON PRECISION) APPROACH

● **When the landing gear is down :**

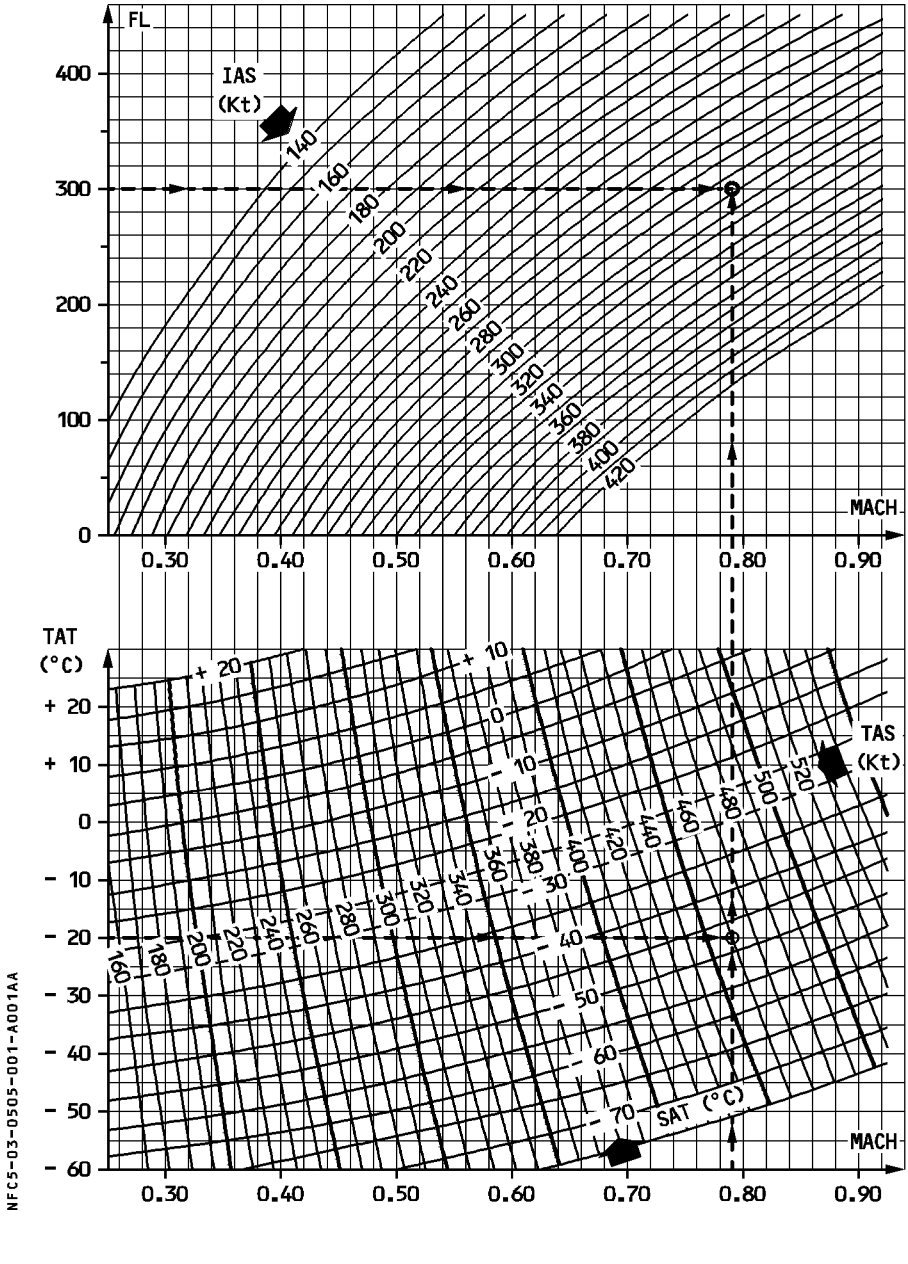
R – **PILOT PC . . . . UNPLUGGED and STOWED**

LPC MEL MODULE

TBD

05.00 CONTENTS

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

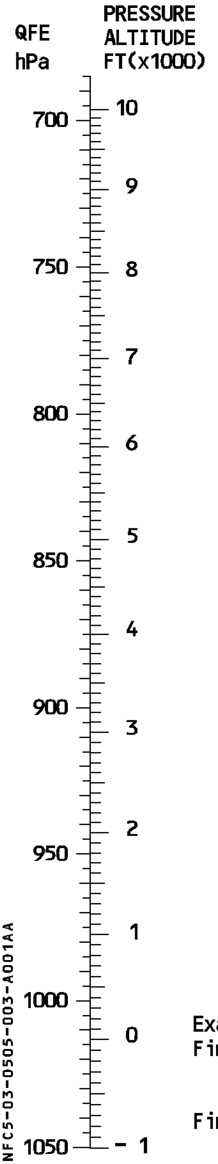


INTERNATIONAL STANDARD ATMOSPHERE (ISA)

R

ALTITUDE (Feet)	TEMP. (°C)	PRESSURE hPa	PRESSURE P.S.I.	PRESSURE in. Hg.	PRESSURE RATIO $\delta = P / Po$	DENSITY $\sigma = \rho / \rho o$	SPEED OF SOUND (a) (kt)	ALTITUDE (meters)
40,000	– 56.5	188	2.72	5.54	0.1851	0.2462	573	12.192
39,000	– 56.5	197	2.85	5.81	0.1942	0.2583	573	11.887
38,000	– 56.5	206	2.99	6.10	0.2038	0.2710	573	11.582
37,000	– 56.5	217	3.14	6.40	0.2138	0.2844	573	11.278
36,000	– 56.3	227	3.30	6.71	0.2243	0.2981	573	10.973
35,000	– 54.3	238	3.46	7.04	0.2353	0.3099	576	10.668
34,000	– 52.4	250	3.63	7.38	0.2467	0.3220	579	10.363
33,000	– 50.4	262	3.80	7.74	0.2586	0.3345	581	10.058
32,000	– 48.4	274	3.98	8.11	0.2709	0.3473	584	9.754
31,000	– 46.4	287	4.17	8.49	0.2837	0.3605	586	9.449
30,000	– 44.4	301	4.36	8.89	0.2970	0.3741	589	9.144
29,000	– 42.5	315	4.57	9.30	0.3107	0.3881	591	8.839
28,000	– 40.5	329	4.78	9.73	0.3250	0.4025	594	8.534
27,000	– 38.5	344	4.99	10.17	0.3398	0.4173	597	8.230
26,000	– 36.5	360	5.22	10.63	0.3552	0.4325	599	7.925
25,000	– 34.5	376	5.45	11.10	0.3711	0.4481	602	7.620
24,000	– 32.5	393	5.70	11.60	0.3876	0.4642	604	7.315
23,000	– 30.6	410	5.95	12.11	0.4046	0.4806	607	7.010
22,000	– 28.6	428	6.21	12.64	0.4223	0.4976	609	6.706
21,000	– 26.6	446	6.47	13.18	0.4406	0.5150	611	6.401
20,000	– 24.6	466	6.75	13.75	0.4595	0.5328	614	6.096
19,000	– 22.6	485	7.04	14.34	0.4791	0.5511	616	5.791
18,000	– 20.7	506	7.34	14.94	0.4994	0.5699	619	5.406
17,000	– 18.7	527	7.65	15.57	0.5203	0.5892	621	5.182
16,000	– 16.7	549	7.97	16.22	0.5420	0.6090	624	4.877
15,000	– 14.7	572	8.29	16.89	0.5643	0.6292	626	4.572
14,000	– 12.7	595	8.63	17.58	0.5875	0.6500	628	4.267
13,000	– 10.8	619	8.99	18.29	0.6113	0.6713	631	3.962
12,000	– 8.8	644	9.35	19.03	0.6360	0.6932	633	3.658
11,000	– 6.8	670	9.72	19.79	0.6614	0.7156	636	3.353
10,000	– 4.8	697	10.10	20.58	0.6877	0.7385	638	3.048
9,000	– 2.8	724	10.51	21.39	0.7148	0.7620	640	2.743
8,000	– 0.8	753	10.92	22.22	0.7428	0.7860	643	2.438
7,000	+ 1.1	782	11.34	23.09	0.7716	0.8106	645	2.134
6,000	+ 3.1	812	11.78	23.98	0.8014	0.8359	647	1.829
5,000	+ 5.1	843	12.23	24.90	0.8320	0.8617	650	1.524
4,000	+ 7.1	875	12.69	25.84	0.8637	0.8881	652	1.219
3,000	+ 9.1	908	13.17	26.82	0.8962	0.9151	654	914
2,000	+ 11.0	942	13.67	27.82	0.9298	0.9428	656	610
1,000	+ 13.0	977	14.17	28.86	0.9644	0.9711	659	305
0	+ 15.0	1013	14.70	29.92	1.0000	1.0000	661	0
– 1.000	+ 17.0	1050	15.23	31.02	1.0366	1.0295	664	– 305

CONVERSIONS - QNH - QFE - PRESSURE ALTITUDE



QNH (hPa)	CORRECTION (ft)	QNH (in Hg)
949 – 951	+ 1900	28.01 – 28.10
952 – 955	+ 1800	28.11 – 28.20
956 – 958	+ 1700	28.21 – 28.30
959 – 961	+ 1600	28.31 – 28.40
962 – 964	+ 1500	28.41 – 28.45
965 – 968	+ 1400	28.46 – 28.56
969 – 971	+ 1300	28.57 – 28.66
972 – 974	+ 1200	28.68 – 28.77
975 – 978	+ 1100	28.78 – 28.86
979 – 981	+ 1000	28.87 – 28.95
982 – 984	+ 900	28.96 – 29.05
985 – 988	+ 800	29.06 – 29.15
989 – 991	+ 700	29.16 – 29.25
992 – 994	+ 600	29.26 – 29.35
995 – 997	+ 500	29.36 – 29.45
998 – 1001	+ 400	29.46 – 29.54
1002 – 1004	+ 300	29.55 – 29.64
1005 – 1007	+ 200	29.65 – 29.74
1008 – 1011	+ 100	29.75 – 29.84
1012 – 1014	0	29.85 – 29.94
1015 – 1018	– 100	29.95 – 30.04
1019 – 1021	– 200	30.05 – 30.14
1022 – 1025	– 300	30.15 – 30.24
1026 – 1028	– 400	30.25 – 30.34
1029 – 1031	– 500	30.35 – 30.44
1032 – 1035	– 600	30.45 – 30.54
1036 – 1038	– 700	30.55 – 30.65
1039 – 1042	– 800	30.66 – 30.75
1043 – 1045	– 900	30.76 – 30.85
1046 – 1050	– 1000	30.86 – 30.95

Examples : 1) Elevation: 2500 ft QNH = 1020 hPa
Find : correction: -200 ft
Pressure altitude = 2300 ft QFE = 933 hPa
2) Elevation: 1500 ft QFE = 980 hPa
Find : Pressure altitude: 920 ft
Correction = - 580 ft QNH = 1032 hPa

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CONVERSIONS QFE hPa – in. Hg – ft

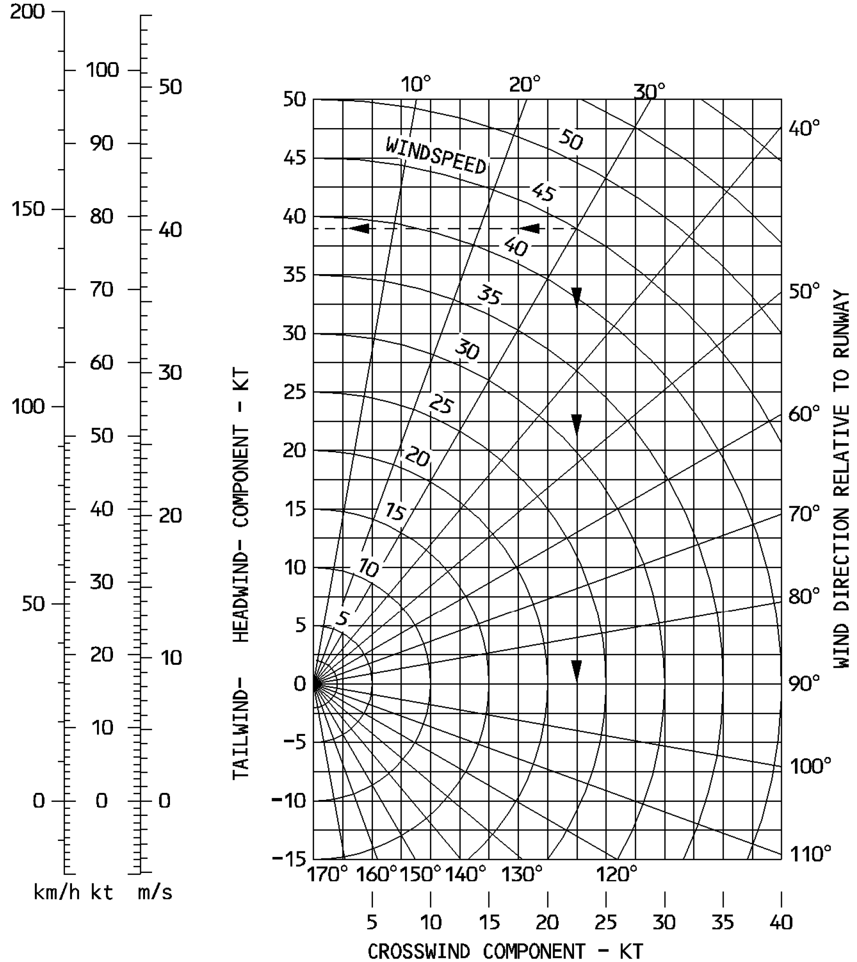
QFE hPa	in. Hg	PRESS. ALT. ft	QFE hPa	in. Hg	PRESS. ALT. ft	QFE hPa	in. Hg	PRESS. ALT. ft
1050	31.01	– 989	960	28.35	1486	870	25.69	4157
1048	30.95	– 936	958	28.29	1543	868	25.63	4219
1046	30.89	– 883	956	28.23	1601	866	25.57	4281
1044	30.83	– 830	954	28.17	1658	864	25.51	4343
1042	30.77	– 776	952	28.11	1715	862	25.45	4405
1040	30.71	– 723	950	28.05	1773	860	25.40	4468
1038	30.65	– 669	948	27.99	1831	858	25.34	4531
1036	30.59	– 615	946	27.94	1889	856	25.28	4593
1034	30.53	– 562	944	27.88	1947	854	25.22	4656
1032	30.47	– 508	942	27.82	2005	852	25.16	4718
1030	30.42	– 454	940	27.76	2062	850	25.10	4781
1028	30.36	– 400	938	27.70	2120	848	25.04	4844
1026	30.30	– 346	936	27.64	2178	846	24.98	4907
1024	30.24	– 292	934	27.58	2236	844	24.92	4970
1022	30.18	– 238	932	27.52	2294	842	24.86	5033
1020	30.12	– 184	930	27.46	2353	840	24.81	5097
1018	30.06	– 129	928	27.40	2412	838	24.75	5161
1016	30.00	– 74	926	27.34	2471	836	24.69	5225
1014	29.94	– 20	924	27.29	2530	834	24.63	5289
1012	29.88	34	922	27.23	2589	832	24.57	5353
1010	29.83	89	920	27.17	2647	830	24.51	5417
1008	29.77	144	918	27.11	2707	828	24.45	5481
1006	29.71	199	916	27.05	2767	826	24.39	5545
1004	29.65	254	914	26.99	2826	824	24.33	5610
1002	29.59	309	912	26.93	2885	822	24.27	5675
1000	29.53	364	910	26.87	2944	820	24.21	5740
998	29.47	419	908	26.81	3004	818	24.16	5805
996	29.41	475	906	26.75	3064	816	24.10	5870
994	29.35	530	904	26.70	3124	814	24.04	5935
992	29.29	586	902	26.64	3183	812	23.98	6000
990	29.23	641	900	26.58	3243	810	23.92	6065
988	29.18	697	898	26.52	3303	808	23.86	6131
986	29.12	753	896	26.46	3363	806	23.80	6197
984	29.06	809	894	26.40	3424	804	23.74	6263
982	29.00	865	892	26.34	3484	802	23.68	6329
980	28.94	921	890	26.28	3545	800	23.62	6394
978	28.88	977	888	26.22	3606	798	23.56	6461
976	28.82	1033	886	26.16	3667	796	23.51	6528
974	28.76	1089	884	26.10	3728	794	23.45	6595
972	28.70	1145	882	26.05	3789	792	23.39	6661
970	28.64	1202	880	25.99	3850	790	23.33	6727
968	28.59	1259	878	25.93	3911	788	23.27	6794
966	28.53	1316	876	25.87	3973	786	23.21	6861
964	28.47	1373	874	25.81	4034	784	23.15	6928
962	28.41	1430	872	25.75	4096	782	23.09	6995

WIND COMPONENTS (FOR TAKEOFF AND LANDING)

R

MULTIPLY	BY	TO GET
kt	1.852	km/h
kt	0.5144	m/s
m/s	3.6	km/h
m/s	1.9438	kt
km/h	0.5396	kt
km/h	0.2778	m/s

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



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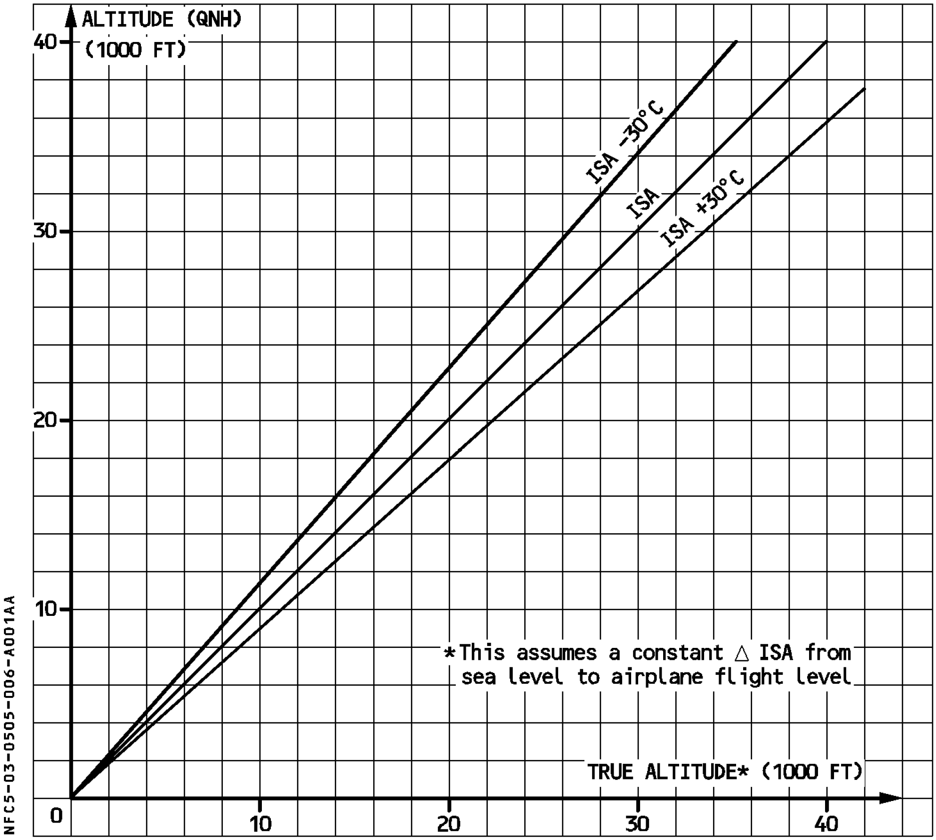
ALTITUDE TEMPERATURE CORRECTION

FOR HIGH ALTITUDE USE



FOR LOW ALTITUDE USE

R Values to be added by the pilot to minimum promulgated heights/altitude (ft)

R

Airport Temperature °C	Height above the elevation of the altimeter setting source (feet)								
	200	300	400	500	1000	2000	3000	4000	5000
0	20	20	30	30	60	120	170	230	280
– 10	20	30	40	50	100	200	290	390	490
– 20	30	50	60	70	140	280	420	570	710
– 30	40	60	80	100	190	380	570	760	950
– 40	50	80	100	120	240	480	720	970	1210
– 50	60	90	120	150	300	590	890	1190	1500

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.

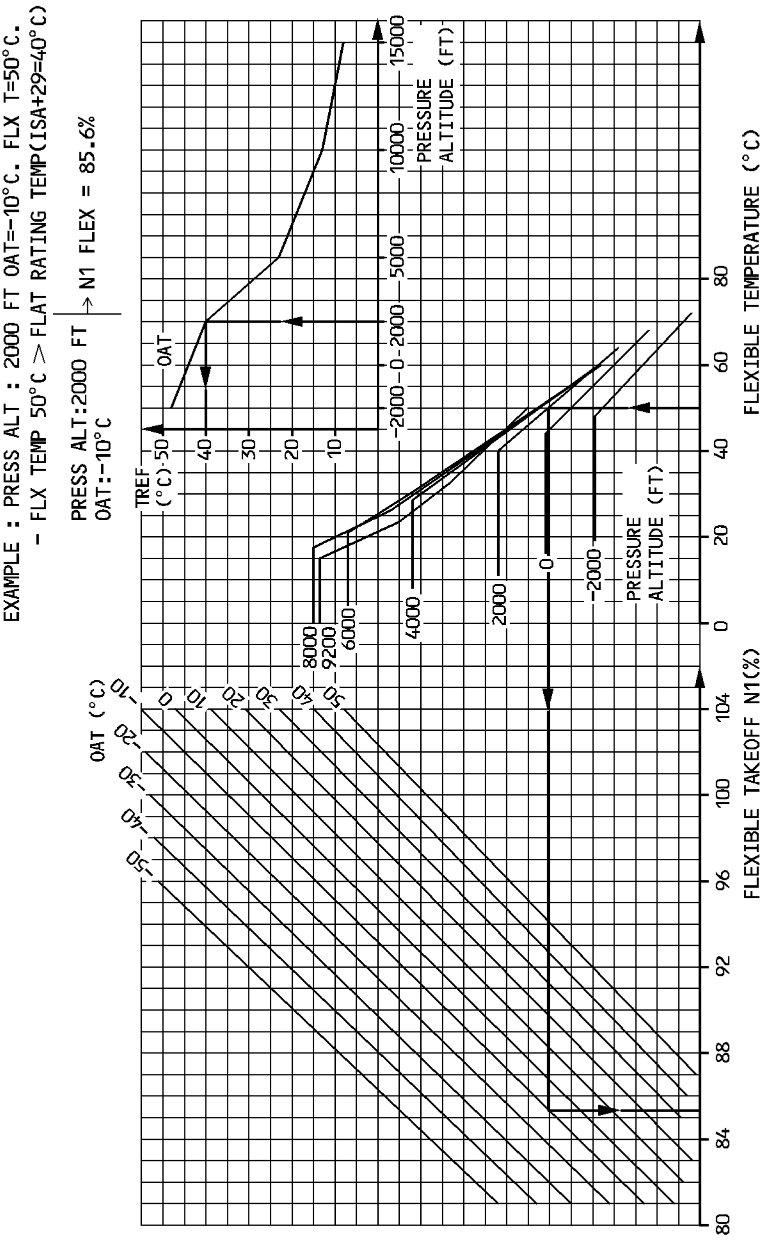
– **Flexible takeoff**
It is a reduced takeoff thrust as compared to the maximum permissible. The related N1 is calculated as a function of the flexible temperature entered in the FMGS MCDU. The flexible temperature is a function of the aircraft weight and environmental conditions. It guarantees that 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
R that is equal to the displayed maximum climb N1 minus 1.9 %.

FLEXIBLE TAKEOFF N1



CFM56-5B4	N1 CORRECTIONS FOR AIR BLEED	
FLEX TAKEOFF N1 MACH = .000	AIR CONDITIONING ON	- .7
	ENGINE ANTI ICE ON	0.0
	ENGINE AND WING ANTI ICE ON	0.0

NFC5-03-0506-002-A070AC

TAKEOFF

R

CFM56-5B4	N1 CORRECTIONS FOR AIR BLEED	OAT < CORNER POINT	OAT ≥ CORNER POINT
TAKE OFF N1 NO AIR BLEED MACH=.000	AIR CONDITIONING ON	–.7	–.7
	ENGINE ANTI ICE ON	0.0	–1.6
	ENGINE ANTI ICE AND WING ANTI ICE ON	0.0	–2.4

OAT (°C)	PRESSURE ALTITUDE (FT) –2000.	–1000.	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.	8000.	9000.	9200.
–54.0	76.2	77.2	78.2	79.2	80.3	82.3	84.0	85.8	86.7	87.6	88.2	88.0	88.0
–50.0	76.9	77.9	78.9	79.9	81.0	83.0	84.7	86.5	87.5	88.3	88.9	88.8	88.7
–46.0	77.5	78.6	79.6	80.6	81.7	83.7	85.4	87.3	88.2	89.0	89.7	89.5	89.5
–42.0	78.2	79.2	80.2	81.3	82.4	84.4	86.1	88.0	88.9	89.8	90.4	90.2	90.2
–38.0	78.8	79.9	80.9	82.0	83.0	85.1	86.8	88.7	89.6	90.5	91.1	90.9	90.9
–34.0	79.5	80.5	81.5	82.6	83.7	85.7	87.5	89.4	90.3	91.2	91.8	91.6	91.6
–30.0	80.1	81.2	82.2	83.3	84.3	86.4	88.2	90.1	91.0	91.9	92.5	92.3	92.3
–26.0	80.7	81.8	82.8	83.9	85.0	87.1	88.8	90.7	91.7	92.5	93.2	93.0	93.0
–22.0	81.4	82.4	83.5	84.6	85.6	87.7	89.5	91.4	92.4	93.2	93.9	93.7	93.7
–18.0	82.0	83.1	84.1	85.2	86.3	88.4	90.2	92.1	93.1	93.9	94.6	94.4	94.4
–14.0	82.6	83.7	84.8	85.9	87.0	89.1	90.9	92.8	93.8	94.6	95.3	95.1	95.1
–10.0	83.2	84.3	85.4	86.5	87.6	89.7	91.5	93.4	94.4	95.3	95.9	95.7	95.7
–6.0	83.8	84.9	86.0	87.1	88.2	90.3	92.2	94.1	95.1	95.9	96.6	96.4	96.4
–2.0	84.4	85.5	86.6	87.7	88.8	90.9	92.8	94.7	95.7	96.6	97.3	97.1	97.0
2.0	85.0	86.1	87.2	88.3	89.4	91.6	93.4	95.4	96.4	97.2	97.9	97.7	97.7
6.0	85.6	86.7	87.8	88.9	90.0	92.2	94.1	96.0	97.0	97.9	98.6	98.4	98.3
10.0	86.2	87.3	88.4	89.5	90.7	92.8	94.7	96.7	97.7	98.5	99.2	99.0	99.0
14.0	86.8	87.9	89.0	90.2	91.3	93.5	95.3	97.3	98.3	99.2	99.9	99.7	99.6
18.0	87.4	88.5	89.6	90.8	91.9	94.1	95.9	97.9	98.9	99.8	*100.1*	*99.1*	*98.8*
22.0	88.0	89.1	90.2	91.3	92.5	94.7	96.6	98.6	*99.3*	*99.4*	*99.1*	*97.9*	*97.7*
26.0	88.5	89.7	90.7	91.9	93.1	95.3	97.2	*98.3*	*98.5*	*98.5*	*98.0*	*96.8*	*96.6*
30.0	89.1	90.2	91.3	92.5	93.6	95.9	*97.4*	*97.6*	*97.7*	*97.6*	*97.3*	*96.5*	*96.4*
34.0	89.7	90.8	91.9	93.1	94.2	96.5	*96.8*	*97.0*	*97.1*	*97.1*	*97.0*	*96.2*	*96.1*
38.0	90.2	91.4	92.5	93.7	94.8	*96.1*	*96.3*	*96.4*	*96.6*	*96.7*	*96.6*		
42.0	90.8	91.9	93.1	94.2	*94.9*	*95.6*	*95.7*	*95.8*	*96.0*				
46.0	91.4	*92.5*	*93.2*	*93.9*	*94.5*								
50.0	*91.5*	*92.2*	*92.9*	*93.6*	*94.1*								
54.0	*91.2*	*92.0*	*92.7*										

OAT < CORNER POINT

OAT ≥ CORNER POINT

TAKEOFF

CFM56-5B4 TAKE OFF N1 NO AIR BLEED MACH=.000	N1 CORRECTIONS FOR AIR BLEED	OAT < CORNER POINT	OAT > CORNER POINT
	AIR CONDITIONING ON	–.7	–.7
	ENGINE ANTI-ICE ON	0.0	–1.6
	ENGINE ANTI-ICE AND WING ANTI-ICE ON	0.0	–2.4

OAT (C)	PRESSURE ALTITUDE (FT) 7000.	8000.	9000.	9200.	10000.	11000.	12000.	13000.	14000.	14500.
–54.0	87.6	88.2	88.0	88.0	87.8	88.2	88.4	88.6	88.6	88.5
–50.0	88.3	88.9	88.8	88.7	88.6	88.9	89.2	89.3	89.3	89.3
–46.0	89.0	89.7	89.5	89.5	89.3	89.7	89.9	90.1	90.1	90.0
–42.0	89.8	90.4	90.2	90.2	90.0	90.4	90.7	90.8	90.8	90.8
–38.0	90.5	91.1	90.9	90.9	90.7	91.1	91.4	91.5	91.5	91.5
–34.0	91.2	91.8	91.6	91.6	91.4	91.8	92.1	92.2	92.2	92.2
–30.0	91.9	92.5	92.3	92.3	92.1	92.5	92.8	92.9	92.9	92.9
–26.0	92.5	93.2	93.0	93.0	92.8	93.2	93.5	93.6	93.6	93.6
–22.0	93.2	93.9	93.7	93.7	93.5	93.9	94.1	94.3	94.3	94.3
–18.0	93.9	94.6	94.4	94.4	94.2	94.6	94.8	95.0	95.0	95.0
–14.0	94.6	95.3	95.1	95.1	94.9	95.3	95.5	95.7	95.7	95.7
–10.0	95.3	95.9	95.7	95.7	95.6	95.9	96.2	96.3	96.3	96.3
–6.0	95.9	96.6	96.4	96.4	96.2	96.6	96.9	97.0	97.0	97.0
–2.0	96.6	97.3	97.1	97.0	96.9	97.3	97.5	97.6	97.7	97.6
2.0	97.2	97.9	97.7	97.7	97.5	97.9	98.2	98.3	98.3	98.3
6.0	97.9	98.6	98.4	98.3	98.2	98.6	98.8	99.0	99.0	98.9
10.0	98.5	99.2	99.0	99.0	98.8	99.2	99.5	99.6	*99.2*	*98.8*
14.0	99.2	99.9	99.7	99.6	*99.1*	*99.0*	*98.6*	*98.0*	*97.1*	*96.6*
18.0	99.8	*100.1*	*99.1*	*98.8*	*97.9*	*97.6*	*97.0*	*96.1*	*95.7*	*95.6*
22.0	*99.4*	*99.1*	*97.9*	*97.7*	*96.7*	*96.2*	*95.9*	*95.7*	*95.4*	*95.2*
26.0	*98.5*	*98.0*	*96.8*	*96.6*	*96.0*	*95.9*	*95.6*	*95.3*	*95.0*	*94.8*
30.0	*97.6*	*97.3*	*96.5*	*96.4*	*95.8*	*95.7*	*95.4*			
34.0	*97.1*	*97.0*	*96.2*	*96.1*	*95.6*					
38.0	*96.7*	*96.6*								
42.0										
46.0										
50.0										
54.0										

OAT < CORNER POINT
OAT > CORNER POINT

GO AROUND

R

CFM56-5B4 GO AROUND N1 AIR CONDITIONING ON MACH=.225	N1 CORRECTIONS FOR AIR BLEED	OAT < CORNER POINT	OAT ≥ CORNER POINT
	AIR CONDITIONING OFF	0.7	0.7
	ENGINE ANTI ICE ON	0.0	–1.6
	ENGINE ANTI ICE AND WING ANTI ICE ON	0.0	–2.4

TAT (°C)	PRESSURE ALTITUDE (FT) –2000.	–1000.	0.	1000.	2000.	3000.	4000.	5000.	6000.	7000.
–54.0	77.7	78.7	79.6	80.2	80.9	82.1	83.4	84.8	86.2	86.8
–50.0	78.4	79.4	80.3	80.9	81.6	82.8	84.2	85.5	86.9	87.6
–46.0	79.1	80.1	81.0	81.6	82.3	83.5	84.9	86.2	87.6	88.3
–42.0	79.8	80.7	81.7	82.3	83.0	84.2	85.6	87.0	88.4	89.0
–38.0	80.4	81.4	82.3	83.0	83.6	84.9	86.3	87.6	89.1	89.7
–34.0	81.1	82.0	83.0	83.6	84.3	85.5	86.9	88.3	89.7	90.4
–30.0	81.7	82.7	83.6	84.3	85.0	86.2	87.6	89.0	90.4	91.1
–26.0	82.4	83.3	84.3	85.0	85.6	86.9	88.3	89.7	91.1	91.8
–22.0	83.0	84.0	84.9	85.6	86.3	87.5	89.0	90.4	91.8	92.5
–18.0	83.7	84.6	85.6	86.3	86.9	88.2	89.6	91.1	92.5	93.2
–14.0	84.3	85.3	86.2	86.9	87.6	88.9	90.3	91.7	93.2	93.9
–10.0	84.9	85.9	86.8	87.5	88.2	89.5	90.9	92.4	93.8	94.5
–6.0	85.5	86.5	87.5	88.2	88.8	90.1	91.6	93.0	94.5	95.2
–2.0	86.1	87.1	88.1	88.8	89.5	90.8	92.2	93.7	95.1	95.8
2.0	86.7	87.7	88.7	89.4	90.1	91.4	92.9	94.3	95.8	96.5
6.0	87.3	88.3	89.3	90.0	90.7	92.0	93.5	94.9	96.4	97.1
10.0	87.9	88.9	89.9	90.6	91.3	92.6	94.1	95.6	97.1	97.8
14.0	88.5	89.6	90.5	91.3	91.9	93.3	94.8	96.2	97.7	98.4
18.0	89.1	90.1	91.1	91.8	92.5	93.9	95.4	96.8	98.3	99.0
22.0	89.7	90.7	91.7	92.4	93.1	94.5	96.0	97.4	*99.0*	*99.6*
26.0	90.3	91.3	92.3	93.0	93.7	95.1	96.6	*98.1*	*99.0*	*99.0*
30.0	90.8	91.9	92.9	93.6	94.3	95.7	97.2	97.7	98.5	98.4
34.0	91.4	92.5	93.5	94.2	94.9	96.3	*97.2*	*97.4*	*97.9*	*97.7*
38.0	92.0	93.0	94.0	94.8	95.5	*96.7*	*96.9*	*96.9*	*97.2*	*97.0*
42.0	92.6	93.6	94.6	95.4	*96.1*	*96.3*	*96.2*	*96.0*	*96.3*	*96.2*
46.0	93.1	*94.2*	*95.2*	*95.7*	*95.7*	*95.5*	*95.3*	*95.2*	*95.4*	
50.0	*93.7*	*94.5*	*94.8*	*94.8*	*94.8*	*94.6*	*94.4*			
54.0	*93.3*	*93.6*	*93.9*	*94.0*	*93.9*					
58.0	*92.4*	*92.8*	*93.1*							
62.0	*91.6*									

OAT < CORNER POINT

OAT ≥ CORNER POINT

GO AROUND

CFM56-5B4 GO AROUND N1 AIR CONDITIONING ON MACH=.225	N1 CORRECTIONS FOR AIR BLEED	OAT < CORNER POINT	OAT > CORNER POINT
	AIR CONDITIONING OFF	0.7	0.7
	ENGINE ANTI-ICE ON	0.0	–1.6
	ENGINE ANTI-ICE AND WING ANTI-ICE ON	0.0	–2.4

TAT (C)	PRESSURE ALTITUDE (FT)									
	7000.	8000.	9000.	9200.	10000.	11000.	12000.	13000.	14000.	14500.
–54.0	86.8	87.3	87.0	87.0	86.7	87.0	87.3	87.4	87.4	87.4
–50.0	87.6	88.1	87.8	87.7	87.5	87.8	88.0	88.1	88.2	88.2
–46.0	88.3	88.8	88.5	88.4	88.2	88.5	88.8	88.9	88.9	88.9
–42.0	89.0	89.6	89.2	89.2	88.9	89.3	89.5	89.6	89.7	89.6
–38.0	89.7	90.2	89.9	89.9	89.6	89.9	90.2	90.3	90.3	90.3
–34.0	90.4	90.9	90.6	90.6	90.3	90.6	90.9	91.0	91.0	91.0
–30.0	91.1	91.6	91.3	91.2	91.0	91.3	91.6	91.7	91.7	91.7
–26.0	91.8	92.3	92.0	91.9	91.7	92.0	92.3	92.4	92.4	92.4
–22.0	92.5	93.0	92.7	92.6	92.4	92.7	93.0	93.1	93.1	93.1
–18.0	93.2	93.7	93.4	93.3	93.1	93.4	93.6	93.8	93.8	93.8
–14.0	93.9	94.4	94.1	94.0	93.8	94.1	94.3	94.5	94.5	94.5
–10.0	94.5	95.1	94.7	94.7	94.4	94.7	95.0	95.1	95.2	95.1
–6.0	95.2	95.7	95.4	95.3	95.1	95.4	95.6	95.8	95.8	95.8
–2.0	95.8	96.4	96.0	96.0	95.7	96.0	96.3	96.4	96.5	96.4
2.0	96.5	97.0	96.7	96.6	96.4	96.7	96.9	97.1	97.1	97.1
6.0	97.1	97.7	97.3	97.3	97.0	97.3	97.6	97.7	97.8	97.7
10.0	97.8	98.3	98.0	97.9	97.7	98.0	98.2	98.4	*98.4*	*98.4*
14.0	98.4	99.0	98.6	98.6	*98.3*	*98.6*	*98.9*	*98.6*	*98.0*	*97.7*
18.0	99.0	*99.6*	*99.3*	*99.1*	*98.2*	*98.1*	*97.7*	*97.2*	*96.4*	*95.9*
22.0	*99.6*	*99.5*	*98.5*	*98.2*	*97.4*	*97.0*	*96.5*	*95.9*	*95.6*	*95.4*
26.0	*99.0*	*98.7*	*97.6*	*97.4*	*96.5*	*96.1*	*95.8*	*95.5*	*95.1*	*94.9*
30.0	*98.4*	*97.9*	*96.9*	*96.7*	*95.9*	*95.7*	*95.4*	*95.0*	*94.6*	
34.0	*97.7*	*97.3*	*96.3*	*96.2*	*95.5*	*95.3*	*95.0*			
38.0	*97.0*	*96.6*	*95.8*	*95.6*	*95.1*					
42.0	*96.2*	*95.9*								
46.0										
50.0										
54.0										

OAT < CORNER POINT

OAT > CORNER POINT

MAXIMUM CONTINUOUS

R

CFM56-5B4	N1 CORRECTIONS FOR AIR BLEED	OAT < ISA + 10	OAT ≥ ISA + 10
MAXIMUM CONTINUOUS N1 AIR CONDITIONING ON* IAS=230 KT	AIR CONDITIONING OFF	0.9	0.9
	ENGINE ANTI ICE ON	0.0	–1.4
	ENGINE ANTI ICE AND WING ANTI ICE ON	0.0	–3.2

TAT (°C)	PRESSURE ALTITUDE (FT) –1000.	3000.	7000.	11000.	15000.	19000.	23000.	27000.	31000.	35000.	39000.
–54.0	75.6	77.6	79.2	81.1	85.2	87.3	87.0	83.2	84.3	85.1	84.1
–50.0	76.2	78.3	79.9	81.8	85.9	88.0	87.7	84.0	85.0	85.8	84.9
–46.0	76.9	79.0	80.6	82.6	86.6	88.8	88.5	84.7	85.7	86.6	85.6
–42.0	77.6	79.6	81.2	83.3	87.4	89.5	89.2	85.4	86.4	87.3	86.3
–38.0	78.2	80.3	81.9	83.9	88.0	90.2	89.9	86.1	87.1	88.0	87.0
–34.0	78.8	80.9	82.5	84.6	88.7	90.9	90.6	86.7	87.8	88.6	87.7
–30.0	79.5	81.6	83.2	85.2	89.4	91.6	91.3	87.4	88.5	89.3	88.3
–26.0	80.1	82.2	83.8	85.9	90.1	92.3	92.0	88.1	89.2	90.0	89.0
–22.0	80.7	82.8	84.5	86.6	90.8	93.0	92.7	88.7	89.8	*90.5*	89.7
–18.0	81.4	83.5	85.1	87.2	91.5	93.7	93.4	89.4	90.5	*90.3*	*89.6*
–14.0	82.0	84.1	85.8	87.9	92.1	94.3	94.0	90.1	*90.4*	*90.0*	*89.3*
–10.0	82.6	84.7	86.4	88.5	92.8	95.0	94.7	*90.3*	*90.1*	*89.6*	*89.0*
–6.0	83.2	85.3	87.0	89.1	93.4	95.6	*95.3*	*90.0*	*89.7*	*89.0*	*88.2*
–2.0	83.8	85.9	87.6	89.8	94.1	96.3	*94.6*	*89.7*	*89.0*	*88.4*	*87.5*
2.0	84.4	86.5	88.3	90.4	94.7	*96.3*	*93.9*	*89.0*	*88.4*	*87.7*	*86.9*
6.0	85.0	87.1	88.9	91.0	95.4	*95.6*	*93.3*	*88.4*	*87.8*	*87.0*	*86.3*
10.0	85.5	87.8	89.5	91.6	*94.8*	*94.8*	*92.8*	*87.8*	*87.2*	*86.2*	*85.7*
14.0	86.1	88.4	90.1	*92.0*	*94.0*	*94.2*	*92.4*	*87.1*	*86.5*		
18.0	86.7	88.9	90.7	*91.5*	*93.3*	*93.6*	*91.9*	*86.5*			
22.0	87.3	89.5	*90.7*	*91.0*	*92.8*	*93.1*	*91.3*				
26.0	87.8	90.1	*90.2*	*90.5*	*92.2*	*92.5*					
30.0	88.4	*89.8*	*89.7*	*90.0*	*91.5*	*92.0*					
34.0	*89.0*	*89.3*	*89.5*	*89.4*	*90.9*						
38.0	*88.5*	*88.9*	*89.1*	*88.8*							
42.0	*88.0*	*88.7*	*88.7*	*88.1*							
46.0	*87.4*	*88.3*	*88.2*								
50.0	*86.8*	*87.9*	*87.7*								
54.0	*86.2*	*87.5*									

OAT < ISA + 10
OAT ≥ ISA + 10

* One engine inoperative – 1 pack operative on remaining engine.

MAXIMUM CLIMB

R

CFM56-5B4	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	–1.3
	ENGINE ANTI ICE AND WING ANTI ICE ON	0.0	–2.4

TAT (°C)	PRESSURE ALTITUDE (FT) –1000.	3000.	7000.	11000.	15000.	19000.	23000.	27000.	31000.	35000.	39000.
–54.0	73.5	75.4	77.0	77.8	78.8	79.8	80.7	81.5	82.5	83.9	83.9
–50.0	74.2	76.1	77.6	78.4	79.5	80.5	81.4	82.2	83.3	84.6	84.6
–46.0	74.8	76.8	78.3	79.1	80.2	81.2	82.1	82.9	84.0	85.3	85.3
–42.0	75.5	77.4	79.0	79.8	80.9	81.9	82.8	83.6	84.7	86.0	86.0
–38.0	76.1	78.1	79.6	80.5	81.5	82.5	83.5	84.3	85.3	86.7	86.7
–34.0	76.7	78.7	80.3	81.1	82.2	83.2	84.1	84.9	86.0	87.4	87.4
–30.0	77.3	79.3	80.9	81.7	82.8	83.8	84.8	85.6	86.7	88.1	88.1
–26.0	77.9	80.0	81.5	82.4	83.5	84.5	85.4	86.2	87.4	88.7	88.7
–22.0	78.6	80.6	82.2	83.0	84.1	85.1	86.1	86.9	88.0	89.4	89.4
–18.0	79.2	81.2	82.8	83.7	84.8	85.8	86.7	87.6	88.7	90.1	*89.9*
–14.0	79.8	81.8	83.5	84.3	85.4	86.4	87.4	88.2	89.4	*90.3*	*89.6*
–10.0	80.4	82.4	84.1	84.9	86.0	87.1	88.0	88.9	90.0	*90.1*	*89.4*
–6.0	81.0	83.0	84.7	85.5	86.6	87.7	88.7	89.5	*90.3*	*90.0*	*88.8*
–2.0	81.5	83.6	85.3	86.1	87.2	88.3	89.3	90.1	*90.1*	*89.5*	*88.0*
2.0	82.1	84.2	85.9	86.7	87.9	88.9	89.9	*90.1*	*90.0*	*88.8*	*87.4*
6.0	82.7	84.8	86.5	87.3	88.5	89.5	*90.0*	*89.9*	*89.6*	*88.2*	*86.8*
10.0	83.3	85.4	87.1	87.9	89.1	*89.8*	*89.8*	*89.7*	*89.0*	*87.5*	*86.2*
14.0	83.9	86.0	87.7	88.6	89.7	*89.6*	*89.7*	*89.2*	*88.4*	*86.8*	*85.6*
18.0	84.4	86.6	88.2	89.1	*89.4*	*89.3*	*89.2*	*88.6*	*87.7*		
22.0	85.0	87.1	*88.7*	*89.2*	*89.0*	*89.0*	*88.6*	*87.9*	*87.0*		
26.0	85.5	87.7	*88.3*	*88.9*	*88.7*	*88.5*	*88.0*	*87.2*	*86.3*		
30.0	86.1	*87.8*	*87.9*	*88.5*	*88.2*	*87.8*	*87.2*	*86.6*			
34.0	86.6	*87.4*	*87.3*	*87.8*	*87.5*	*87.1*	*86.5*				
38.0	*86.4*	*86.9*	*86.6*	*87.1*	*86.8*	*86.4*					
42.0	*85.9*	*86.2*	*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*	*84.0*									

OAT < ISA + 10
OAT ≥ ISA + 10

MAXIMUM CRUISE

R

CFM56-5B4
MAXIMUM CRUISE N1
AIR CONDITIONING ON
250/300/.78

N1 CORRECTIONS FOR AIR BLEED	OAT < ISA+10	OAT ≥ ISA+10
AIR CONDITIONING OFF	0.8	0.8
NACELLE ANTI ICE ON	0.0	–1.3
NACELLE ANTI ICE AND WING ANTI ICE ON	0.0	–2.4

TAT (°C)	PRESSURE ALTITUDE (FT) –1000.	3000.	7000.	11000.	15000.	19000.	23000.	27000.	31000.	35000.	39000.
–54.0	71.6	73.5	75.1	75.9	76.9	77.9	78.8	79.6	80.6	82.0	82.0
–50.0	72.3	74.2	75.7	76.5	77.6	78.6	79.5	80.3	81.4	82.7	82.7
–46.0	72.9	74.9	76.4	77.2	78.3	79.3	80.2	81.0	82.1	83.4	83.4
–42.0	73.6	75.5	77.1	77.9	79.0	80.0	80.9	81.7	82.8	84.1	84.1
–38.0	74.2	76.2	77.7	78.6	79.6	80.6	81.6	82.4	83.4	84.8	84.8
–34.0	74.8	76.8	78.4	79.2	80.3	81.3	82.2	83.0	84.1	85.5	85.5
–30.0	75.4	77.4	79.0	79.8	80.9	81.9	82.9	83.7	84.8	86.2	86.2
–26.0	76.0	78.1	79.6	80.5	81.6	82.6	83.5	84.3	85.5	86.8	86.8
–22.0	76.7	78.7	80.3	81.1	82.2	83.2	84.2	85.0	86.1	87.5	87.5
–18.0	77.3	79.3	80.9	81.8	82.9	83.9	84.8	85.7	86.8	88.2	*88.0*
–14.0	77.9	79.9	81.6	82.4	83.5	84.5	85.5	86.3	87.5	*88.4*	*87.7*
–10.0	78.5	80.5	82.2	83.0	84.1	85.2	86.1	87.0	88.1	*88.2*	*87.5*
–6.0	79.1	81.1	82.8	83.6	84.7	85.8	86.8	87.6	*88.4*	*88.1*	*86.9*
–2.0	79.6	81.7	83.4	84.2	85.3	86.4	87.4	88.2	*88.2*	*87.6*	*86.1*
2.0	80.2	82.3	84.0	84.8	86.0	87.0	88.0	*88.2*	*88.1*	*86.9*	*85.5*
6.0	80.8	82.9	84.6	85.4	86.6	87.6	*88.1*	*88.0*	*87.7*	*86.3*	*84.9*
10.0	81.4	83.5	85.2	86.0	87.2	*87.9*	*87.9*	*87.8*	*87.1*	*85.6*	*84.3*
14.0	82.0	84.1	85.8	86.7	87.8	*87.7*	*87.8*	*87.3*	*86.5*	*84.9*	*83.7*
18.0	82.5	84.7	86.3	87.2	*87.5*	*87.4*	*87.3*	*86.7*	*85.8*		
22.0	83.1	85.2	*86.8*	*87.3*	*87.1*	*87.1*	*86.7*	*86.0*	*85.1*		
26.0	83.6	85.8	*86.4*	*87.0*	*86.8*	*86.6*	*86.1*	*85.3*	*84.4*		
30.0	84.2	*85.9*	*86.0*	*86.6*	*86.3*	*85.9*	*85.3*	*84.7*			
34.0	84.7	*85.5*	*85.4*	*85.9*	*85.6*	*85.2*	*84.6*				
38.0	*84.5*	*85.0*	*84.7*	*85.2*	*84.9*	*84.5*					
42.0	*84.0*	*84.3*	*84.0*	*84.5*	*84.1*						
46.0	*83.4*	*83.5*	*83.3*	*83.8*	*83.4*						
50.0	*82.6*	*82.8*	*82.5*	*83.1*							
54.0	*81.8*	*82.1*									

OAT < ISA + 10
OAT ≥ ISA + 10

INTENTIONALLY LEFT 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 NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=33.0%	**FROM BRAKE RELEASE** **TIME (MIN) FUEL (KG)** **DISTANCE (NM) TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)						
	52	**54**	**56**	**58**	**60**	**62**	**64**
390	18 1326 118 387	19 1400 126 388	21 1478 134 389	22 1563 143 390	23 1657 153 392	25 1763 165 393	27 1884 179 396
370	16 1240 104 380	17 1304 110 381	18 1371 116 381	19 1442 122 382	20 1517 129 383	21 1598 137 384	23 1685 146 385
350	15 1168 93 373	16 1226 98 374	16 1287 103 375	17 1351 108 375	18 1417 114 376	19 1487 120 377	20 1560 127 377
330	14 1102 84 366	14 1156 88 367	15 1212 92 367	16 1270 97 368	17 1331 102 368	17 1394 107 369	18 1459 112 370
310	13 1038 75 358	13 1088 79 359	14 1140 83 359	14 1193 87 360	15 1249 91 360	16 1306 95 361	17 1366 100 361
290	11 970 66 348	12 1016 70 349	13 1063 73 349	13 1112 77 350	14 1163 80 350	14 1215 84 351	15 1270 88 351
270	10 887 57 335	11 928 59 336	11 971 62 336	12 1015 65 336	12 1060 68 337	13 1107 71 337	13 1155 74 337
250	9 811 48 322	9 849 51 323	10 887 53 323	10 927 56 323	11 968 58 324	11 1010 61 324	12 1053 63 324
240	9 776 45 316	9 811 47 316	9 848 49 317	10 886 51 317	10 925 54 317	11 965 56 318	11 1006 58 318
220	8 709 38 303	8 741 40 304	8 774 42 304	9 808 44 304	9 843 46 305	9 879 48 305	10 916 50 305
200	7 645 33 291	7 674 34 291	7 704 36 291	8 735 37 292	8 767 39 292	8 799 41 292	9 833 42 292
180	6 585 28 278	6 611 29 278	7 638 30 278	7 666 32 279	7 695 33 279	7 724 34 279	8 754 36 279
160	5 528 23 264	6 551 24 264	6 576 25 265	6 601 27 265	6 626 28 265	7 653 29 265	7 679 30 266
140	5 473 19 250	5 494 20 250	5 516 21 251	5 538 22 251	6 561 23 251	6 585 24 251	6 609 25 251
120	4 421 16 234	4 440 17 235	4 459 17 235	5 479 18 236	5 499 19 236	5 520 20 236	5 542 21 236
100	3 336 11 207	3 351 12 207	3 367 12 208	4 383 13 208	4 399 13 208	4 416 14 208	4 433 14 209
50	2 220 6 169	2 229 6 169	2 239 6 169	2 250 7 170	2 260 7 170	3 271 7 170	3 282 8 171
15	1 138 3 120	1 144 3 120	1 150 3 120	2 156 3 120	2 163 3 121	2 170 3 121	2 177 3 121

LOW AIR CONDITIONING	**HIGH AIR CONDITIONING**	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
ΔFUEL = – 0.6 %	ΔFUEL = + 0.6 %	ΔFUEL = + 2.5 %	ΔFUEL = + 5 %

11.0-08F0A320-214 CFM56-5B4/P SA21100000C5KG330 0 018590 0 0 2 1.0 500.0 300.00 1 03250.000300.000 .780 0 FCOM-N0-03-05-10-002-170

R

CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG=33.0%	**FROM BRAKE RELEASE** **TIME (MIN)** **FUEL (KG)** **DISTANCE (NM)** **TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)													
	66		**68**		**70**		**72**		**74**		**76**		**78**	
390														
370	24	1779	26	1884	27	2003								
	155	387	166	388	179	391								
350	21	1638	22	1721	24	1811	25	1910	27	2019	28	2142	30	2282
	134	378	141	380	150	381	159	383	170	384	183	387	197	389
330	19	1528	20	1600	21	1677	22	1759	23	1847	25	1942	26	2045
	118	371	124	371	131	373	138	374	146	375	154	377	164	378
310	17	1428	18	1492	19	1560	20	1632	21	1708	22	1788	23	1874
	105	362	110	363	115	364	121	365	127	366	134	367	141	368
290	16	1326	16	1384	17	1445	18	1509	19	1576	20	1646	20	1720
	92	352	96	352	101	353	106	354	111	355	116	356	122	357
270	14	1205	14	1256	15	1310	16	1365	16	1423	17	1484	18	1547
	78	338	81	339	85	339	89	340	93	341	97	342	101	343
250	12	1098	13	1143	13	1191	14	1240	14	1291	15	1344	16	1399
	66	325	69	325	72	326	75	327	78	327	82	328	85	329
240	11	1048	12	1091	12	1136	13	1182	13	1230	14	1280	15	1331
	61	318	64	319	66	319	69	320	72	321	75	322	78	322
220	10	954	11	993	11	1033	11	1074	12	1117	12	1161	13	1207
	52	306	54	306	56	307	59	307	61	308	64	309	66	309
200	9	866	9	901	10	937	10	974	11	1012	11	1052	11	1092
	44	293	46	293	48	294	50	294	52	295	54	296	56	296
180	8	784	8	816	9	848	9	881	9	915	10	950	10	986
	37	280	39	280	40	281	42	281	44	282	45	283	47	283
160	7	707	7	735	8	764	8	793	8	823	8	855	9	887
	31	266	33	267	34	267	35	268	37	268	38	269	40	270
140	6	633	6	658	7	684	7	710	7	737	7	765	8	794
	26	252	27	252	28	253	29	254	31	254	32	255	33	256
120	5	563	6	586	6	608	6	632	6	656	7	680	7	705
	22	237	22	237	23	238	24	239	25	239	26	240	27	241
100	4	450	4	468	5	486	5	505	5	524	5	544	5	564
	15	209	16	210	16	211	17	211	17	212	18	213	19	214
50	3	293	3	304	3	316	3	328	3	340	3	352	3	364
	8	171	8	172	8	173	9	174	9	174	9	176	10	177
15	2	184	2	191	2	198	2	205	2	212	2	219	2	227
	4	122	4	122	4	123	4	124	4	125	4	126	4	127

LOW AIR CONDITIONING	**HIGH AIR CONDITIONING**	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.6 %	△FUEL = + 0.6 %	△FUEL = + 2.5 %	△FUEL = + 5 %

11.0-08F0A320-214 CFM56-5B4/P SA21100000C5KG330 0 018590 0 0 2 1.0 500.0 300.00 1 03250.000300.000 .780 0 FCOM-N0-03-05-10-003-170

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CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+10 CG=33.0%	**FROM BRAKE RELEASE** **TIME (MIN) FUEL (KG)** **DISTANCE (NM) TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)						
	52	**54**	**56**	**58**	**60**	**62**	**64**
390	19 1392	20 1470	21 1552	23 1642	24 1742	26 1853	
	124 396	132 397	141 398	150 400	161 401	173 403	
370	17 1301	18 1369	19 1440	20 1514	21 1594	22 1679	23 1770
	109 389	115 390	122 391	129 392	136 392	144 393	153 395
350	15 1225	16 1287	17 1351	18 1418	19 1487	20 1561	21 1639
	98 382	103 383	108 384	114 384	120 385	126 386	133 387
330	14 1156	15 1213	15 1272	16 1333	17 1396	18 1462	19 1532
	88 375	92 376	97 376	102 377	107 378	113 378	118 379
310	13 1088	14 1140	14 1195	15 1251	16 1309	16 1370	17 1433
	79 367	83 368	87 368	91 369	96 369	100 370	105 370
290	12 1015	12 1063	13 1113	13 1165	14 1218	15 1273	15 1330
	70 357	73 357	77 358	80 358	84 359	88 359	92 360
270	10 927	11 971	11 1016	12 1062	12 1109	13 1158	14 1209
	59 343	62 344	65 344	68 345	71 345	75 345	78 346
250	9 847	10 887	10 927	11 969	11 1012	11 1056	12 1101
	51 330	53 331	56 331	58 332	61 332	64 332	66 332
240	9 810	9 847	10 886	10 925	10 966	11 1008	11 1051
	47 324	49 324	51 325	54 325	56 325	59 326	61 326
220	8 739	8 773	8 808	9 844	9 880	10 918	10 957
	40 311	42 312	44 312	46 312	48 313	50 313	52 313
200	7 673	7 703	8 735	8 767	8 800	9 834	9 869
	34 298	36 299	37 299	39 299	41 300	43 300	44 300
180	6 609	6 637	7 665	7 694	7 724	8 755	8 786
	29 285	30 285	32 286	33 286	34 286	36 287	37 287
160	5 549	6 574	6 600	6 626	6 652	7 680	7 708
	24 271	25 272	27 272	28 272	29 273	30 273	31 273
140	5 492	5 514	5 537	5 560	6 584	6 609	6 634
	20 257	21 257	22 258	23 258	24 258	25 259	26 259
120	4 437	4 457	5 477	5 498	5 519	5 541	5 564
	17 242	18 242	18 243	19 243	20 243	21 243	22 244
100	3 349	3 365	4 381	4 398	4 415	4 432	4 450
	12 214	12 214	13 215	13 215	14 216	14 216	15 216
50	2 227	2 237	2 248	2 259	2 270	3 281	3 293
	6 176	6 177	7 177	7 178	7 178	8 178	8 179
15	1 142	1 148	1 155	2 161	2 168	2 175	2 183
	3 128	3 128	3 129	3 129	3 130	4 130	4 130

LOW AIR CONDITIONING	**HIGH AIR CONDITIONING**	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.6 %	△FUEL = + 0.6 %	△FUEL = + 2.5 %	△FUEL = + 5 %

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CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+10 CG=33.0%	**FROM BRAKE RELEASE** **TIME (MIN)** **FUEL (KG)** **DISTANCE (NM)** **TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)													
	66		**68**		**70**		**72**		**74**		**76**		**78**	
390														
370	25	1870	26	1981	28	2106								
	163	396	175	398	189	400								
350	22	1721	23	1809	24	1904	26	2008	27	2124	29	2254	31	2403
	141	388	149	389	158	390	168	392	179	394	192	396	208	399
330	20	1604	21	1680	22	1761	23	1848	24	1941	25	2042	27	2152
	124	380	131	381	138	382	145	383	153	384	163	386	173	388
310	18	1498	19	1566	20	1638	20	1714	21	1794	22	1879	24	1970
	110	371	116	372	121	373	127	374	134	375	141	376	149	377
290	16	1389	17	1451	18	1515	18	1582	19	1653	20	1728	21	1806
	97	360	101	361	106	362	111	363	116	364	122	365	128	366
270	14	1261	15	1315	15	1372	16	1430	17	1491	17	1555	18	1622
	82	346	85	347	89	348	93	348	97	349	102	350	106	351
250	12	1148	13	1196	14	1246	14	1297	15	1351	15	1407	16	1465
	69	333	72	334	75	334	79	335	82	336	86	337	89	337
240	12	1095	12	1140	13	1188	13	1236	14	1287	14	1339	15	1394
	64	326	67	327	69	328	72	328	76	329	79	330	82	331
220	10	996	11	1037	11	1079	12	1123	12	1168	13	1214	13	1263
	54	313	57	314	59	315	61	315	64	316	67	317	69	318
200	9	904	10	941	10	979	10	1018	11	1058	11	1099	12	1142
	46	301	48	301	50	302	52	302	54	303	56	304	59	305
180	8	818	8	851	9	885	9	920	9	955	10	992	10	1031
	39	287	41	288	42	288	44	289	46	290	48	291	49	291
160	7	737	7	766	8	797	8	828	8	860	9	893	9	927
	33	274	34	274	36	275	37	275	38	276	40	277	41	278
140	6	660	7	686	7	713	7	741	7	769	8	799	8	829
	27	259	28	260	30	261	31	261	32	262	33	263	35	264
120	6	586	6	610	6	634	6	659	6	684	7	710	7	737
	23	244	23	245	24	246	25	246	26	247	27	248	28	249
100	4	468	5	487	5	506	5	526	5	546	5	567	5	588
	16	217	16	218	17	218	18	219	18	220	19	221	20	222
50	3	304	3	316	3	328	3	341	3	354	3	367	3	380
	8	180	9	180	9	182	9	183	10	184	10	185	10	186
15	2	190	2	198	2	205	2	213	2	221	2	229	2	237
	4	131	4	132	4	133	4	134	4	136	5	137	5	139

LOW AIR CONDITIONING	**HIGH AIR CONDITIONING**	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.6 %	△FUEL = + 0.6 %	△FUEL = + 2.5 %	△FUEL = + 5 %

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CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+15 CG=33.0%	**FROM BRAKE RELEASE** **TIME (MIN) FUEL (KG)** **DISTANCE (NM) TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)													
	52		**54**		**56**		**58**		**60**		**62**		**64**	
390	22	1518	23	1607	24	1704	26	1812	28	1933				
	145	404	155	405	165	406	178	408	193	410				
370	19	1412	20	1488	21	1569	23	1654	24	1746	25	1846	27	1956
	126	396	134	397	142	398	150	399	160	400	170	402	182	403
350	17	1326	18	1395	19	1467	20	1543	21	1623	23	1707	24	1797
	113	390	119	390	126	391	133	392	140	393	148	394	157	395
330	16	1248	17	1311	18	1377	18	1446	19	1518	20	1593	21	1673
	101	383	107	383	112	384	118	385	125	385	131	386	138	387
310	15	1170	15	1229	16	1289	17	1352	18	1417	18	1485	19	1557
	90	374	95	375	100	375	105	376	111	377	116	377	122	378
290	13	1087	14	1140	14	1195	15	1252	16	1311	17	1373	17	1437
	80	364	84	364	88	365	92	365	97	366	101	366	106	367
270	12	988	12	1035	13	1084	13	1135	14	1187	15	1241	15	1297
	67	350	71	350	74	351	78	351	81	352	85	352	89	352
250	10	899	11	942	11	986	12	1031	12	1077	13	1126	13	1175
	57	336	60	337	63	337	66	338	69	338	72	338	75	339
240	10	858	10	898	11	940	11	983	11	1027	12	1072	13	1119
	53	330	55	330	58	331	61	331	63	331	66	332	69	332
220	9	780	9	816	9	854	10	892	10	932	11	972	11	1014
	45	317	47	317	49	318	52	318	54	318	56	318	59	319
200	8	707	8	740	8	773	9	808	9	843	9	880	10	917
	38	303	40	304	42	304	44	305	46	305	48	305	50	305
180	7	639	7	668	7	698	8	729	8	761	8	793	9	827
	32	290	34	290	35	291	37	291	38	291	40	291	42	292
160	6	574	6	600	6	627	7	655	7	683	7	712	8	742
	27	276	28	276	29	276	31	277	32	277	33	277	35	278
140	5	513	5	536	6	560	6	585	6	610	6	636	7	663
	22	261	23	261	24	262	25	262	27	262	28	263	29	263
120	4	454	5	475	5	496	5	518	5	541	6	564	6	587
	18	245	19	246	20	246	21	246	22	247	23	247	24	247
100	3	361	4	378	4	395	4	412	4	430	4	448	4	467
	13	216	13	217	14	217	14	218	15	218	16	219	16	219
50	2	234	2	245	2	256	3	267	3	278	3	290	3	302
	7	178	7	179	7	179	8	180	8	180	8	180	9	181
15	1	146	1	152	2	159	2	166	2	173	2	180	2	188
	3	128	3	128	3	128	3	129	4	129	4	130	4	130

LOW AIR CONDITIONING	HIGH AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.6 %	△FUEL = + 0.6 %	△FUEL = + 2.5 %	△FUEL = + 5 %

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CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST	ISA+15	**FROM BRAKE RELEASE**
NORMAL AIR CONDITIONING	CG=33.0%	**TIME (MIN)** **FUEL (KG)**
ANTI-ICING OFF		**DISTANCE (NM)** **TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG)													
	66		**68**		**70**		**72**		**74**		**76**		**78**	
390														
370	29	2077	31	2216										
	195	405	211	407										
350	25	1894	27	1999	28	2115	30	2245	32	2393				
	166	396	177	397	189	399	202	401	218	403				
330	23	1756	24	1846	25	1941	26	2045	28	2159	30	2285	32	2425
	146	388	154	389	163	390	173	392	184	393	196	395	210	397
310	20	1631	21	1710	22	1793	24	1882	25	1978	26	2080	28	2191
	128	379	135	380	142	381	150	382	158	383	168	385	178	386
290	18	1503	19	1573	20	1646	21	1724	22	1806	23	1893	24	1986
	112	368	117	368	123	369	129	370	136	371	143	373	151	374
270	16	1355	17	1416	17	1479	18	1545	19	1614	20	1688	21	1765
	93	353	98	354	102	354	107	355	112	356	118	357	124	358
250	14	1227	15	1280	15	1335	16	1393	16	1453	17	1516	18	1582
	79	339	82	340	86	341	90	341	94	342	98	343	103	344
240	13	1167	14	1218	14	1270	15	1324	15	1380	16	1439	17	1500
	72	333	76	333	79	334	82	334	86	335	90	336	94	337
220	12	1058	12	1102	12	1149	13	1196	14	1246	14	1298	15	1352
	61	319	64	320	67	320	70	321	73	322	76	322	79	323
200	10	956	11	996	11	1037	11	1079	12	1123	12	1169	13	1217
	52	306	54	306	56	307	59	308	61	308	64	309	66	310
180	9	861	9	897	10	934	10	971	10	1010	11	1051	11	1093
	43	292	45	293	47	293	49	294	51	294	53	295	55	296
160	8	773	8	805	8	838	9	871	9	906	9	941	10	979
	36	278	38	279	39	279	41	280	43	280	44	281	46	282
140	7	690	7	719	7	747	8	777	8	808	8	840	9	872
	30	263	31	264	33	265	34	265	35	266	37	267	38	267
120	6	612	6	637	6	662	7	689	7	716	7	744	7	773
	25	248	26	248	27	249	28	250	29	250	30	251	31	252
100	5	487	5	506	5	527	5	548	5	570	6	592	6	615
	17	220	18	220	18	221	19	222	20	223	21	224	22	225
50	3	315	3	327	3	340	3	354	3	367	3	381	4	396
	9	182	9	183	10	183	10	184	10	186	11	187	11	188
15	2	195	2	203	2	211	2	219	2	228	2	236	2	245
	4	131	4	132	4	133	5	134	5	135	5	137	5	138

LOW AIR CONDITIONING	HIGH AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.6 %	△FUEL = + 0.6 %	△FUEL = + 2.5 %	△FUEL = + 5 %

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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)

FL	WEIGHT AT BRAKE RELEASE (1000KG) 52	54	56	58	60	62	64
390	25 1691	27 1799	29 1920				
	174 412	187 413	202 415				
370	22 1558	24 1648	25 1743	27 1845	28 1957	30 2081	33 2221
	150 404	159 405	169 406	181 407	193 408	207 410	224 412
350	20 1458	21 1538	22 1622	24 1711	25 1806	27 1907	28 2018
	133 397	141 398	149 399	158 400	168 401	178 402	190 403
330	18 1367	19 1440	20 1516	21 1596	23 1680	24 1769	25 1864
	119 390	126 391	133 391	140 392	148 393	157 394	166 395
310	17 1277	18 1343	18 1412	19 1484	20 1559	21 1639	23 1723
	106 381	112 382	118 383	124 383	131 384	138 385	145 386
290	15 1178	16 1238	17 1300	17 1364	18 1431	19 1502	20 1575
	92 370	97 371	102 371	107 372	113 373	119 373	125 374
270	13 1062	14 1115	14 1169	15 1226	16 1284	17 1345	17 1408
	77 355	81 356	85 356	89 357	94 357	99 358	103 358
250	11 962	12 1008	13 1057	13 1106	14 1158	14 1211	15 1267
	65 341	68 342	72 342	75 343	79 343	83 344	86 344
240	11 915	11 959	12 1005	12 1052	13 1100	13 1151	14 1202
	60 334	63 335	66 335	69 336	72 336	76 337	79 337
220	9 829	10 868	10 909	11 950	11 994	12 1038	12 1084
	51 321	53 321	56 322	58 322	61 322	64 323	67 323
200	8 748	9 783	9 819	10 856	10 895	10 934	11 975
	43 307	45 307	47 308	49 308	51 308	53 309	56 309
180	7 673	8 704	8 736	8 769	9 804	9 839	9 875
	36 293	37 293	39 293	41 294	43 294	44 294	46 295
160	6 602	7 630	7 659	7 689	8 719	8 750	8 783
	30 278	31 278	32 279	34 279	35 279	37 280	39 280
140	6 537	6 561	6 587	6 613	7 640	7 668	7 696
	24 263	26 263	27 263	28 264	29 264	31 264	32 265
120	5 474	5 496	5 518	6 542	6 565	6 590	6 615
	20 246	21 246	22 247	23 247	24 247	25 248	26 248
100	4 375	4 392	4 410	4 429	4 448	5 467	5 487
	14 216	14 217	15 217	16 217	16 218	17 218	18 219
50	2 243	3 254	3 265	3 277	3 289	3 302	3 314
	7 176	7 177	8 177	8 177	8 178	9 178	9 179
15	2 150	2 157	2 164	2 172	2 179	2 187	2 195
	3 123	3 124	3 124	4 124	4 125	4 125	4 126

LOW AIR CONDITIONING	HIGH AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.6 %	△FUEL = + 0.6 %	△FUEL = + 2.5 %	△FUEL = + 5 %

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CLIMB - 250KT/300KT/M.78

MAX. CLIMB THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+20 CG=33.0%	**FROM BRAKE RELEASE** **TIME (MIN) FUEL (KG)** **DISTANCE (NM) TAS (KT)**

FL	WEIGHT AT BRAKE RELEASE (1000KG) 66	68	70	72	74	76	78
390							
370							
350	30 2138 203 405	32 2271 218 406	34 2423 235 409				
330	27 1966 176 396	28 2075 187 398	30 2195 199 399	32 2328 213 401	34 2478 229 403	37 2650 248 405	
310	24 1811 154 387	25 1906 162 388	27 2007 172 389	28 2118 183 391	30 2238 194 392	32 2370 207 394	34 2517 222 396
290	21 1653 132 375	22 1734 139 376	23 1821 146 377	25 1914 154 378	26 2014 163 379	27 2121 173 380	29 2237 184 382
270	18 1474 109 359	19 1543 114 360	20 1616 120 361	21 1692 126 361	22 1774 132 362	23 1860 139 363	24 1952 147 364
250	16 1324 91 345	16 1384 95 345	17 1447 99 346	18 1512 104 347	19 1581 109 347	20 1654 114 348	21 1731 120 349
240	15 1256 83 338	15 1313 87 338	16 1371 91 339	17 1432 95 339	18 1496 100 340	18 1564 104 341	19 1635 109 342
220	13 1132 70 324	13 1181 73 324	14 1233 76 325	15 1286 79 325	15 1342 83 326	16 1400 87 326	17 1461 91 327
200	11 1017 58 309	12 1061 61 310	12 1106 63 310	13 1153 66 311	13 1202 69 311	14 1253 72 312	14 1306 75 313
180	10 912 48 295	10 951 51 295	11 991 53 296	11 1033 55 296	12 1075 57 297	12 1120 60 297	13 1166 62 298
160	9 816 40 280	9 850 42 281	9 886 44 281	10 922 46 282	10 960 47 282	11 999 49 283	11 1040 52 283
140	8 726 33 265	8 756 35 265	8 788 36 266	8 820 38 266	9 853 39 267	9 888 41 267	10 924 42 268
120	7 641 27 249	7 668 28 249	7 696 29 250	7 724 31 250	8 753 32 251	8 784 33 251	8 816 35 252
100	5 508 19 219	5 529 19 220	5 551 20 220	6 574 21 221	6 597 22 222	6 621 23 223	6 646 24 223
50	3 327 10 179	3 341 10 180	3 355 10 181	4 369 11 182	4 384 11 182	4 399 12 183	4 415 12 184
15	2 203 4 127	2 211 4 127	2 220 5 128	2 229 5 129	2 238 5 130	2 247 5 131	2 257 5 132

LOW AIR CONDITIONING	HIGH AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = − 0.6 %	ΔFUEL = + 0.6 %	ΔFUEL = + 2.5 %	ΔFUEL = + 5 %

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GENERAL

Cruise tables are established :
- for ISA, ISA + 10, ISA + 15 and ISA + 20
- with normal air conditioning and anti ice OFF
- from FL290 to FL390 at M.78
- from FL100 to FL390 at long range speed
- with a 33 % center of gravity.

OPTIMUM MACH NUMBER

Seven tables give the optimum Mach number versus cost index, altitude and wind as calculated by the FMGC.

COST INDEX = 0 (MAXIMUM RANGE)

WEIGHT/WIND 1000kg	kt	FLIGHT LEVEL 290	310	330	350	370	390
50	100	.571	.597	.625	.653	.684	.716
	50	.586	.612	.637	.664	.694	.724
	0	.604	.631	.653	.678	.707	.734
	–50	.626	.650	.670	.695	.722	.745
	–100	.658	.675	.694	.717	.742	.759
55	100	.599	.626	.654	.684	.715	.735
	50	.613	.638	.665	.694	.723	.741
	0	.632	.654	.679	.707	.733	.749
	–50	.650	.671	.695	.722	.745	.758
	–100	.675	.694	.717	.742	.759	.770
60	100	.625	.652	.682	.713	.733	.746
	50	.637	.663	.692	.721	.740	.751
	0	.653	.677	.705	.731	.748	.758
	–50	.670	.693	.720	.743	.757	.767
	–100	.693	.715	.740	.758	.769	.776
65	100	.649	.677	.709	.730	.743	
	50	.660	.688	.717	.737	.749	
	0	.674	.701	.728	.745	.756	
	–50	.690	.716	.740	.755	.765	
	–100	.711	.736	.755	.768	.775	
70	100	.672	.704	.727	.741	.751	
	50	.683	.713	.733	.747	.756	
	0	.696	.724	.742	.754	.763	
	–50	.711	.736	.752	.763	.770	
	–100	.731	.752	.765	.774	.778	
75	100	.696	.722	.738	.749		
	50	.706	.729	.744	.754		
	0	.718	.738	.751	.761		
	–50	.730	.749	.760	.769		
	–100	.747	.762	.772	.777		

COST INDEX = 10 kg/min

WEIGHT 1000kg	WIND kt	FL 290	FL 310	FL 330	FL 350	FL 370	FL 390
50	100	.611	.638	.661	.687	.716	.741
	50	.629	.653	.675	.700	.728	.750
	0	.652	.672	.693	.717	.744	.762
	–50	.678	.695	.715	.738	.760	.773
	–100	.711	.729	.746	.760	.774	.781
55	100	.636	.658	.684	.713	.738	.753
	50	.651	.672	.697	.725	.748	.761
	0	.669	.689	.714	.740	.759	.771
	–50	.692	.711	.734	.757	.771	.778
	–100	.723	.742	.758	.772	.780	.783
60	100	.655	.680	.708	.734	.751	.761
	50	.668	.693	.721	.744	.759	.768
	0	.685	.709	.736	.756	.768	.775
	–50	.706	.729	.753	.769	.777	.780
	–100	.736	.754	.770	.778	.782	.783
65	100	.675	.703	.730	.747	.758	
	50	.687	.715	.739	.755	.765	
	0	.703	.730	.751	.765	.773	
	–50	.723	.747	.765	.775	.779	
	–100	.748	.767	.776	.781	.782	
70	100	.696	.724	.743	.755	.763	
	50	.708	.734	.751	.762	.769	
	0	.722	.746	.761	.771	.776	
	–50	.740	.760	.772	.778	.780	
	–100	.761	.774	.779	.782	.782	
75	100	.716	.738	.751	.760		
	50	.727	.746	.758	.767		
	0	.739	.756	.767	.774		
	–50	.754	.768	.776	.779		
	–100	.770	.778	.781	.782		

COST INDEX = 20 kg/min

WEIGHT 1000kg	WIND kt	FL 290	FL 310	FL 330	FL 350	FL 370	FL 390
50	100	.649	.671	.692	.718	.745	.763
	50	.671	.689	.710	.734	.758	.773
	0	.691	.711	.733	.754	.771	.779
	–50	.725	.740	.754	.768	.780	.784
	–100	.749	.762	.772	.780	.786	.788
55	100	.665	.687	.712	.740	.759	.771
	50	.684	.704	.728	.753	.770	.777
	0	.703	.725	.747	.768	.777	.781
	–50	.735	.749	.764	.777	.783	.785
	–100	.756	.769	.777	.784	.787	.787
60	100	.681	.706	.733	.754	.767	.775
	50	.698	.721	.747	.765	.775	.779
	0	.717	.740	.762	.775	.780	.782
	–50	.744	.759	.773	.781	.784	.784
	–100	.763	.775	.782	.786	.787	.786
65	100	.698	.726	.748	.763	.772	
	50	.714	.740	.759	.772	.778	
	0	.732	.755	.771	.778	.781	
	–50	.754	.770	.778	.782	.784	
	–100	.770	.780	.784	.786	.786	
70	100	.717	.742	.758	.768	.774	
	50	.731	.753	.767	.775	.778	
	0	.747	.766	.775	.780	.781	
	–50	.765	.776	.781	.783	.783	
	–100	.776	.783	.785	.785	.784	
75	100	.734	.752	.764	.772		
	50	.746	.762	.772	.777		
	0	.759	.772	.778	.780		
	–50	.772	.779	.782	.783		
	–100	.780	.784	.785	.785		

COST INDEX = 40 kg/min

WEIGHT 1000kg	WIND kt	FL 290	FL 310	FL 330	FL 350	FL 370	FL 390
50	100	.715	.736	.751	.767	.780	.784
	50	.735	.751	.766	.777	.784	.787
	0	.754	.766	.776	.784	.788	.790
	–50	.769	.778	.784	.789	.792	.792
	–100	.781	.787	.791	.794	.795	.795
55	100	.724	.745	.761	.775	.782	.784
	50	.744	.758	.772	.782	.785	.786
	0	.761	.771	.780	.786	.788	.788
	–50	.773	.781	.787	.790	.791	.790
	–100	.783	.789	.792	.794	.794	.793
60	100	.734	.755	.771	.780	.783	.784
	50	.751	.766	.778	.784	.785	.785
	0	.766	.776	.784	.787	.788	.787
	–50	.777	.784	.788	.790	.790	.788
	–100	.786	.790	.793	.793	.792	.791
65	100	.745	.766	.776	.781	.783	
	50	.759	.774	.781	.784	.785	
	0	.772	.781	.785	.787	.786	
	–50	.780	.787	.789	.789	.788	
	–100	.788	.791	.792	.791	.790	
70	100	.757	.773	.779	.782	.782	
	50	.768	.778	.783	.784	.783	
	0	.777	.783	.786	.786	.785	
	–50	.784	.787	.788	.788	.786	
	–100	.789	.791	.791	.790	.788	
75	100	.766	.776	.780	.782		
	50	.774	.780	.783	.783		
	0	.781	.784	.785	.785		
	–50	.785	.787	.787	.786		
	–100	.790	.790	.789	.788		

COST INDEX = 60 kg/min

WEIGHT 1000kg	WIND kt	FL 290	FL 310	FL 330	FL 350	FL 370	FL 390
50	100	.758	.769	.778	.785	.790	.791
	50	.768	.778	.785	.790	.792	.793
	0	.778	.785	.790	.794	.795	.795
	–50	.786	.791	.795	.797	.797	.797
	–100	.793	.796	.799	.800	.800	.799
55	100	.764	.773	.782	.788	.789	.789
	50	.772	.781	.787	.791	.791	.791
	0	.781	.788	.791	.794	.793	.793
	–50	.788	.793	.795	.796	.796	.795
	–100	.794	.797	.799	.799	.798	.798
60	100	.768	.778	.785	.788	.788	.787
	50	.776	.784	.789	.790	.790	.788
	0	.784	.789	.792	.793	.792	.791
	–50	.790	.793	.795	.795	.794	.793
	–100	.795	.797	.797	.797	.797	.797
65	100	.773	.782	.786	.787	.787	
	50	.780	.786	.789	.789	.788	
	0	.786	.790	.791	.791	.790	
	–50	.791	.794	.794	.793	.792	
	–100	.795	.796	.796	.796	.796	
70	100	.778	.784	.786	.786	.785	
	50	.783	.787	.788	.788	.786	
	0	.788	.790	.790	.789	.787	
	–50	.792	.793	.792	.791	.788	
	–100	.795	.795	.795	.794	.788	
75	100	.781	.785	.785	.785		
	50	.785	.787	.787	.786		
	0	.788	.789	.789	.787		
	–50	.792	.792	.791	.790		
	–100	.795	.794	.793	.793		

COST INDEX = 80 kg/min

WEIGHT 1000kg	WIND kt	FL 290	FL 310	FL 330	FL 350	FL 370	FL 390
50	**100**	.777	.784	.790	.793	.795	.794
	50	.784	.789	.794	.796	.797	.796
	0	.790	.794	.797	.799	.799	.798
	–50	.795	.798	.800	.800	.800	.800
	–100	.800	.800	.800	.800	.800	.800
55	**100**	.780	.786	.791	.793	.793	.792
	50	.786	.791	.794	.795	.795	.794
	0	.791	.795	.797	.797	.797	.797
	–50	.796	.799	.800	.800	.799	.799
	–100	.800	.800	.800	.800	.800	.800
60	**100**	.782	.788	.791	.792	.791	.790
	50	.788	.792	.794	.794	.793	.792
	0	.793	.795	.796	.796	.795	.795
	–50	.797	.798	.799	.798	.798	.797
	–100	.800	.800	.800	.800	.800	.800
65	**100**	.785	.789	.791	.791	.789	
	50	.789	.792	.793	.792	.791	
	0	.793	.795	.795	.794	.794	
	–50	.797	.797	.797	.797	.797	
	–100	.800	.800	.800	.799	.799	
70	**100**	.787	.789	.790	.789	.787	
	50	.790	.792	.792	.790	.788	
	0	.793	.794	.793	.793	.788	
	–50	.796	.796	.796	.796	.788	
	–100	.799	.799	.798	.798	.788	
75	**100**	.788	.789	.788	.787		
	50	.790	.791	.790	.789		
	0	.793	.793	.792	.791		
	–50	.795	.795	.794	.794		
	–100	.798	.797	.797	.795		

COST INDEX = 100 kg/min

WEIGHT 1000kg	WIND kt	FL 290	FL 310	FL 330	FL 350	FL 370	FL 390
50	**100**	.787	.793	.796	.798	.798	.798
	50	.792	.796	.799	.800	.800	.800
	0	.796	.800	.800	.800	.800	.800
	–50	.800	.800	.800	.800	.800	.800
	–100	.800	.800	.800	.800	.800	.800
55	**100**	.789	.793	.796	.797	.796	.796
	50	.793	.797	.798	.799	.798	.798
	0	.797	.800	.800	.800	.800	.799
	–50	.800	.800	.800	.800	.800	.800
	–100	.800	.800	.800	.800	.800	.800
60	**100**	.791	.794	.795	.795	.795	.794
	50	.794	.796	.797	.797	.797	.796
	0	.798	.799	.799	.799	.799	.798
	–50	.800	.800	.800	.800	.800	.800
	–100	.800	.800	.800	.800	.800	.800
65	**100**	.791	.794	.794	.793	.793	
	50	.795	.796	.796	.795	.795	
	0	.797	.798	.798	.798	.797	
	–50	.800	.800	.800	.799	.799	
	–100	.800	.800	.800	.800	.800	
70	**100**	.792	.793	.792	.792	.788	
	50	.794	.795	.794	.794	.788	
	0	.797	.797	.796	.796	.788	
	–50	.799	.799	.799	.798	.788	
	–100	.800	.800	.800	.800	.788	
75	**100**	.792	.792	.791	.790		
	50	.794	.793	.793	.792		
	0	.796	.795	.795	.795		
	–50	.798	.798	.798	.795		
	–100	.800	.800	.800	.795		

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 the 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 (n = 1.4 g) curve indicates the buffet margin.

R **OPTIMUM WEIGHT FOR 4000 FEET STEP CLIMB**

R

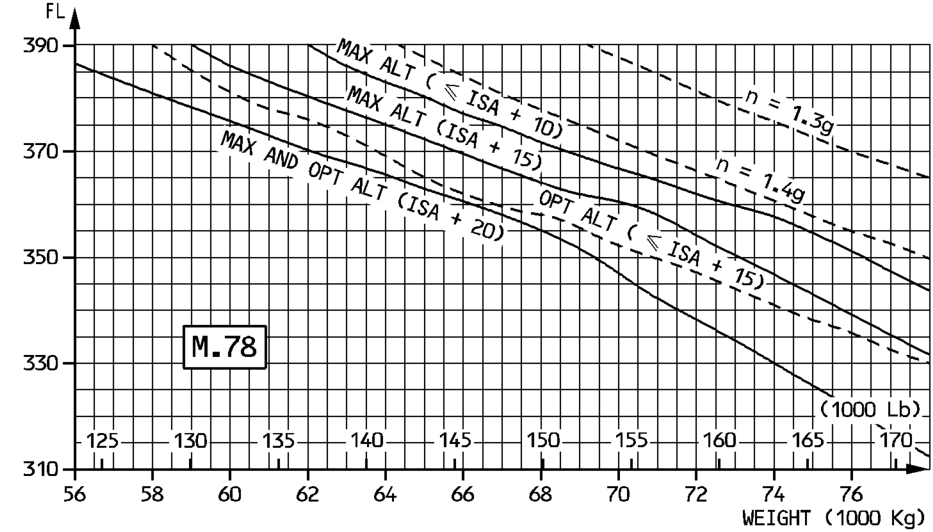
STEP CLIMB FROM/TO	WEIGHT (1000 kg/1000 lb)					
	≤ ISA + 10		ISA + 15		ISA + 20	
	LR	M.78	LR	M.78	LR	M.78
310/350	76/167	76/167	73/160	73/160	69/152	69/152
330/370	69/152	69/152	66/145	66/145	62/136	62/136
350/390	62/136	62/136	59/130	59/130	55/121	55/121

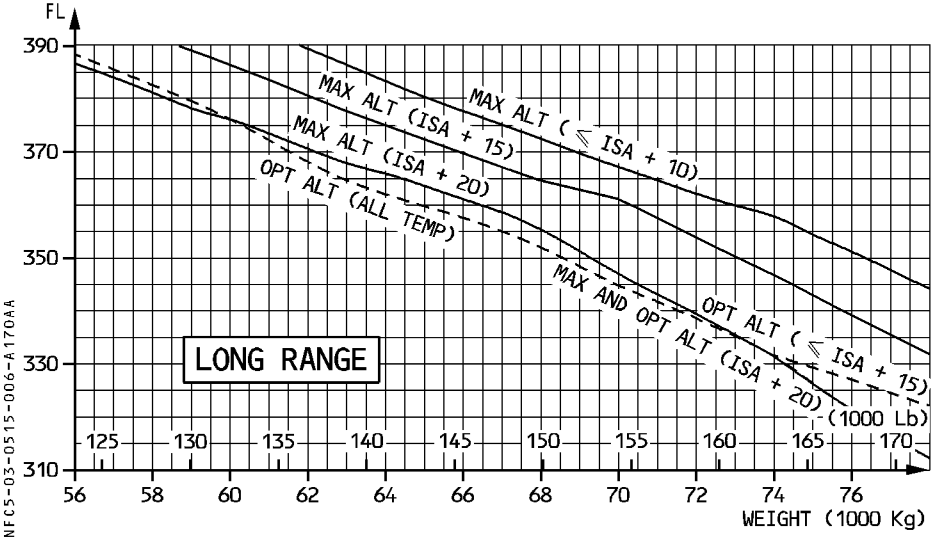
BLEED CORRECTIONS

R

	ENGINE ANTI ICE	TOTAL ANTI ICE
ISA	Max Alt. : – 200 ft Opt Alt. : – 200 ft	Max Alt. : – 500 ft Opt Alt. : – 300 ft
ISA + 10	Max Alt. : – 1500 ft Opt Alt. : – 400 ft	Max Alt. : – 4200 ft Opt Alt. : – 3100 ft
ISA + 15	Max Alt. : – 3500 ft Opt Alt. : – 3500 ft	Max. Alt. : – 4800 ft Opt Alt. : – 4300 ft
ISA + 20	Max Alt. : – 5300 ft Opt Alt. : – 3800 ft	Max Alt. : – 6500 ft Opt Alt. : – 6200 ft

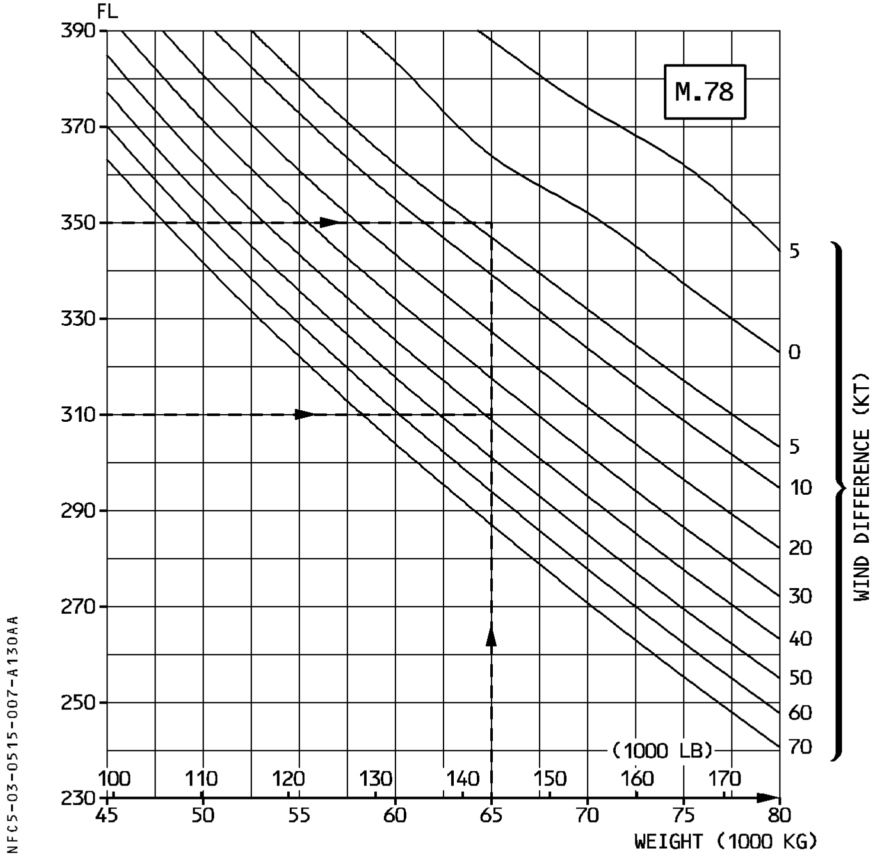
R


FL
390
370
350
330
310
MAX ALT (≤ ISA + 10)
MAX ALT (ISA + 15)
MAX AND OPT ALT (ISA + 20)
OPT ALT (≤ ISA + 15)
n = 1.3g
n = 1.4g
M.78
(1000 Lb)
125 130 135 140 145 150 155 160 165 170
56 58 60 62 64 66 68 70 72 74 76
WEIGHT (1000 Kg)


FL
390
370
350
330
310
MAX ALT (≤ ISA + 10)
MAX ALT (ISA + 15)
MAX ALT (ISA + 20)
OPT ALT (ALL TEMP)
MAX AND OPT ALT (ISA + 20)
OPT ALT (≤ ISA + 15)
LONG RANGE
(1000 Lb)
125 130 135 140 145 150 155 160 165 170
56 58 60 62 64 66 68 70 72 74 76
WEIGHT (1000 Kg)
NFC5-03-0515-006-A170AA

WIND ALTITUDE TRADE FOR CONSTANT SPECIFIC RANGE

R



GIVEN	:	Weight : 65000 kg (143 300 lb)
R		Wind at FL350 : 10 kt head
R FIND	:	Minimum wind difference to descend to FL310 : (40 – 4)= 36 kt
R RESULTS	:	Descent to FL310 may be considered provided the tail wind at this
R		altitude is more than (36 – 10) = 26 kt.

OPTIMUM ALTITUDE ON SHORT STAGE

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

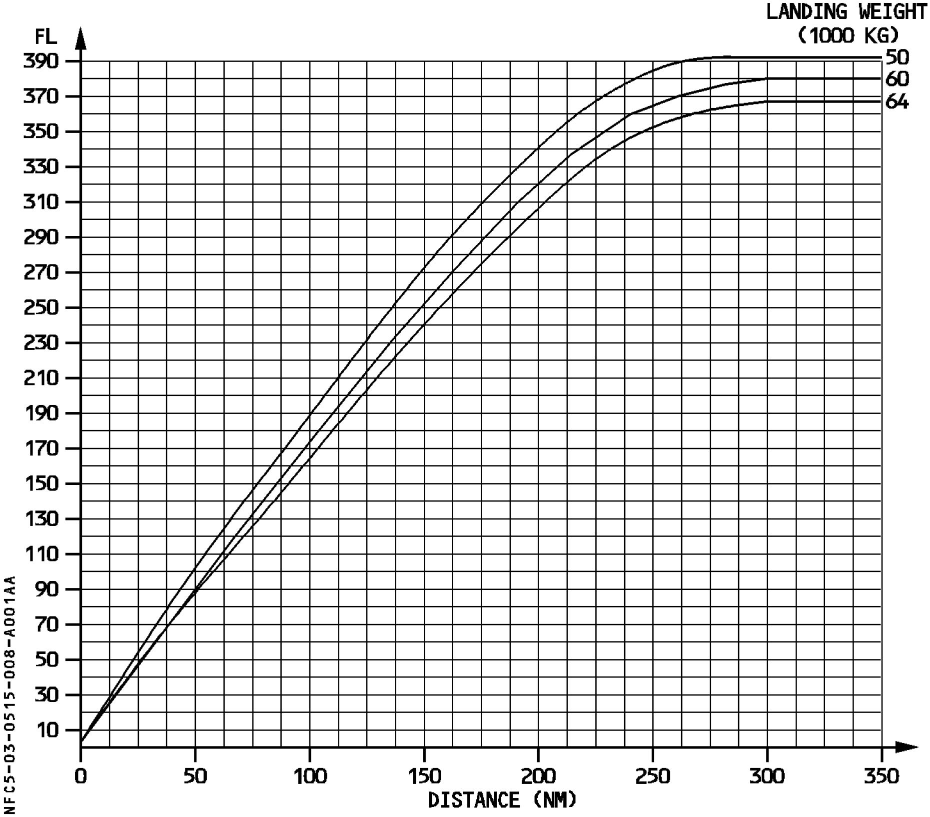
It includes the following profiles:

- Takeoff
- Climb: 250kt/300kt/M.78
- Long range cruise (during at least 5 minutes)
- Descent: M.78/300kt/250kt
- Approach and landing

and it is established for:

- ISA
- CG = 33 %
- R Normal air conditioning
- Anti ice OFF

R



R

CRUISE - M.78

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%

N1 (%) MACH
KG/H/ENG IAS (KT)
NM/1000KG TAS (KT)

WEIGHT (1000KG)	FL290		FL310		FL330		FL350		FL370		FL390	
50	80.8	.780	80.6	.780	80.4	.780	80.4	.780	80.9	.780	82.0	.780
	1305	302	1211	289	1127	277	1053	264	994	252	954	241
	176.9	462	188.9	458	201.3	454	213.5	450	225.0	447	234.6	447
52	80.9	.780	80.7	.780	80.6	.780	80.7	.780	81.3	.780	82.5	.780
	1315	302	1222	289	1139	277	1066	264	1011	252	975	241
	175.6	462	187.3	458	199.2	454	210.8	450	221.2	447	229.3	447
54	81.1	.780	80.9	.780	80.9	.780	81.0	.780	81.7	.780	82.9	.780
	1324	302	1232	289	1152	277	1082	264	1030	252	1000	241
	174.3	462	185.7	458	196.8	454	207.8	450	217.2	447	223.6	447
56	81.2	.780	81.1	.780	81.1	.780	81.3	.780	82.1	.780	83.5	.780
	1335	302	1244	289	1166	277	1098	264	1051	252	1030	241
	173.0	462	184.0	458	194.6	454	204.7	450	212.9	447	217.1	447
58	81.4	.780	81.3	.780	81.4	.780	81.7	.780	82.5	.780	84.1	.780
	1345	302	1257	289	1180	277	1116	264	1074	252	1063	241
	171.6	462	182.1	458	192.2	454	201.5	450	208.3	447	210.5	447
60	81.6	.780	81.6	.780	81.7	.780	82.1	.780	83.0	.780	84.7	.780
	1356	302	1271	289	1196	277	1135	264	1099	252	1097	241
	170.2	462	180.1	458	189.6	454	198.1	450	203.6	447	203.9	447
62	81.8	.780	81.8	.780	82.0	.780	82.5	.780	83.5	.780	85.4	.780
	1368	302	1284	289	1213	277	1157	264	1129	252	1133	241
	168.7	462	178.2	458	187.0	454	194.4	450	198.1	447	197.4	447
64	82.0	.780	82.0	.780	82.3	.780	82.9	.780	84.0	.780		
	1382	302	1299	289	1231	277	1180	264	1162	252		
	167.1	462	176.2	458	184.3	454	190.5	450	192.6	447		
66	82.2	.780	82.3	.780	82.7	.780	83.3	.780	84.6	.780		
	1396	302	1315	289	1250	277	1205	264	1196	252		
	165.4	462	174.0	458	181.4	454	186.5	450	187.1	447		
68	82.4	.780	82.6	.780	83.1	.780	83.7	.780	85.2	.780		
	1409	302	1332	289	1272	277	1235	264	1232	252		
	163.8	462	171.8	458	178.3	454	182.1	450	181.6	447		
70	82.6	.780	82.9	.780	83.4	.780	84.2	.780	85.9	.780		
	1424	302	1350	289	1296	277	1267	264	1269	252		
	162.1	462	169.5	458	175.1	454	177.4	450	176.3	447		
72	82.9	.780	83.2	.780	83.8	.780	84.7	.780				
	1441	302	1370	289	1321	277	1301	264				
	160.2	462	167.1	458	171.7	454	172.8	450				
74	83.1	.780	83.6	.780	84.2	.780	85.3	.780				
	1458	302	1391	289	1348	277	1337	264				
	158.4	462	164.5	458	168.2	454	168.2	450				
76	83.4	.780	83.9	.780	84.6	.780	85.9	.780				
	1475	302	1414	289	1380	277	1374	264				
	156.5	462	161.8	458	164.3	454	163.7	450				
78	83.7	.780	84.3	.780	85.1	.780	86.5	.780				
	1495	302	1439	289	1414	277	1411	264				
	154.4	462	159.0	458	160.5	454	159.3	450				

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = –0.5 %	△FUEL = +2.0 %	△FUEL = +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	82.6	.780	82.4	.780	82.2	.780	82.2	.780	82.7	.780	83.9	.780
	1340	302	1244	289	1157	277	1082	264	1022	252	980	241
	176.0	472	187.9	468	200.4	464	212.5	460	223.9	458	233.5	458
52	82.7	.780	82.5	.780	82.4	.780	82.5	.780	83.1	.780	84.3	.780
	1350	302	1255	289	1170	277	1096	264	1039	252	1002	241
	174.7	472	186.4	468	198.2	464	209.8	460	220.2	458	228.2	458
54	82.9	.780	82.7	.780	82.7	.780	82.8	.780	83.6	.780	84.8	.780
	1360	302	1266	289	1183	277	1112	264	1058	252	1028	241
	173.4	472	184.7	468	195.9	464	206.8	460	216.2	458	222.5	458
56	83.0	.780	82.9	.780	82.9	.780	83.2	.780	84.0	.780	85.4	.780
	1370	302	1278	289	1197	277	1129	264	1080	252	1059	241
	172.0	472	183.0	468	193.7	464	203.7	460	211.9	458	216.0	458
58	83.2	.780	83.1	.780	83.2	.780	83.5	.780	84.4	.780	86.0	.780
	1381	302	1291	289	1212	277	1147	264	1103	252	1093	241
	170.7	472	181.1	468	191.3	464	200.5	460	207.4	458	209.4	458
60	83.4	.780	83.4	.780	83.5	.780	83.9	.780	84.9	.780	86.6	.780
	1393	302	1305	289	1229	277	1166	264	1130	252	1128	241
	169.3	472	179.1	468	188.7	464	197.1	460	202.5	458	202.9	458
62	83.5	.780	83.6	.780	83.8	.780	84.3	.780	85.4	.780	87.3	.780
	1405	302	1319	289	1246	277	1188	264	1161	252	1165	241
	167.8	472	177.3	468	186.1	464	193.4	460	197.1	458	196.3	458
64	83.8	.780	83.9	.780	84.2	.780	84.7	.780	85.9	.780		
	1419	302	1334	289	1264	277	1213	264	1194	252		
	166.2	472	175.2	468	183.4	464	189.6	460	191.6	458		
66	84.0	.780	84.1	.780	84.5	.780	85.1	.780	86.5	.780		
	1433	302	1351	289	1284	277	1239	264	1230	252		
	164.5	472	173.0	468	180.6	464	185.6	460	186.1	458		
68	84.2	.780	84.4	.780	84.9	.780	85.6	.780	87.1	.780		
	1447	302	1369	289	1307	277	1269	264	1267	252		
	162.9	472	170.8	468	177.4	464	181.1	460	180.6	458		
70	84.4	.780	84.7	.780	85.3	.780	86.1	.780	87.8	.780		
	1462	302	1387	289	1331	277	1303	264	1305	252		
	161.2	472	168.6	468	174.2	464	176.5	460	175.3	458		
72	84.7	.780	85.1	.780	85.7	.780	86.6	.780				
	1479	302	1407	289	1357	277	1338	264				
	159.4	472	166.2	468	170.9	464	171.9	460				
74	84.9	.780	85.4	.780	86.1	.780	87.2	.780				
	1497	302	1430	289	1386	277	1374	264				
	157.5	472	163.6	468	167.3	464	167.3	460				
76	85.2	.780	85.8	.780	86.5	.780	87.8	.780				
	1515	302	1453	289	1418	277	1412	264				
	155.6	472	160.9	468	163.5	464	162.8	460				
78	85.5	.780	86.1	.780	87.0	.780	88.4	.780				
	1535	302	1479	289	1453	277	1451	264				
	153.6	472	158.1	468	159.6	464	158.5	460				

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = +2.0 %	△FUEL = +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	83.4	.780	83.2	.780	83.1	.780	83.1	.780	83.7	.780	84.8	.780
	1358	302	1261	289	1173	277	1097	264	1035	252	993	241
	175.5	476	187.4	473	199.8	469	211.9	465	223.4	463	232.8	463
52	83.6	.780	83.4	.780	83.3	.780	83.4	.780	84.1	.780	85.3	.780
	1368	302	1272	289	1185	277	1110	264	1053	252	1016	241
	174.2	476	185.8	473	197.7	469	209.3	465	219.7	463	227.6	463
54	83.7	.780	83.6	.780	83.6	.780	83.7	.780	84.5	.780	85.8	.780
	1378	302	1283	289	1199	277	1127	264	1073	252	1043	241
	172.9	476	184.2	473	195.4	469	206.3	465	215.7	463	221.8	463
56	83.9	.780	83.8	.780	83.8	.780	84.1	.780	84.9	.780	86.3	.780
	1389	302	1295	289	1213	277	1144	264	1094	252	1074	241
	171.5	476	182.5	473	193.1	469	203.1	465	211.4	463	215.4	463
58	84.1	.780	84.0	.780	84.1	.780	84.5	.780	85.3	.780	86.9	.780
	1399	302	1308	289	1228	277	1162	264	1118	252	1108	241
	170.2	476	180.6	473	190.8	469	200.0	465	206.9	463	208.8	463
60	84.2	.780	84.3	.780	84.4	.780	84.9	.780	85.8	.780	87.6	.780
	1411	302	1323	289	1245	277	1182	264	1145	252	1144	241
	168.8	476	178.6	473	188.2	469	196.6	465	202.0	463	202.2	463
62	84.4	.780	84.5	.780	84.7	.780	85.3	.780	86.3	.780		
	1424	302	1337	289	1263	277	1205	264	1177	252		
	167.3	476	176.8	473	185.6	469	192.9	465	196.5	463		
64	84.6	.780	84.7	.780	85.1	.780	85.6	.780	86.8	.780		
	1438	302	1352	289	1281	277	1229	264	1211	252		
	165.7	476	174.7	473	182.9	469	189.1	465	191.0	463		
66	84.8	.780	85.0	.780	85.5	.780	86.1	.780	87.4	.780		
	1452	302	1369	289	1302	277	1255	264	1247	252		
	164.0	476	172.5	473	180.0	469	185.1	465	185.6	463		
68	85.1	.780	85.3	.780	85.8	.780	86.5	.780				
	1466	302	1387	289	1324	277	1287	264				
	162.5	476	170.3	473	176.9	469	180.6	465				
70	85.3	.780	85.6	.780	86.2	.780	87.0	.780				
	1482	302	1406	289	1349	277	1321	264				
	160.7	476	168.1	473	173.7	469	175.9	465				
72	85.6	.780	86.0	.780	86.6	.780	87.5	.780				
	1499	302	1426	289	1375	277	1356	264				
	158.9	476	165.7	473	170.4	469	171.4	465				
74	85.8	.780	86.3	.780	87.0	.780	88.1	.780				
	1517	302	1449	289	1405	277	1393	264				
	157.0	476	163.1	473	166.8	469	166.8	465				
76	86.1	.780	86.7	.780	87.4	.780						
	1535	302	1472	289	1438	277						
	155.2	476	160.5	473	163.0	469						
78	86.4	.780	87.0	.780	87.9	.780						
	1556	302	1499	289	1473	277						
	153.1	476	157.7	473	159.1	469						

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = +2.0 %	△FUEL = +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	84.3	.780	84.1	.780	84.0	.780	84.0	.780	84.6	.780	85.7	.780
	1376	302	1278	289	1188	277	1112	264	1049	252	1007	241
	174.9	481	186.8	477	199.3	474	211.3	470	222.8	468	232.2	468
52	84.4	.780	84.3	.780	84.2	.780	84.3	.780	85.0	.780	86.2	.780
	1386	302	1288	289	1201	277	1126	264	1067	252	1030	241
	173.6	481	185.3	477	197.1	474	208.7	470	219.1	468	227.0	468
54	84.6	.780	84.5	.780	84.5	.780	84.6	.780	85.4	.780	86.7	.780
	1396	302	1300	289	1216	277	1142	264	1087	252	1057	241
	172.3	481	183.7	477	194.8	474	205.6	470	215.1	468	221.1	468
56	84.8	.780	84.7	.780	84.7	.780	85.0	.780	85.8	.780	87.2	.780
	1407	302	1312	289	1230	277	1160	264	1109	252	1089	241
	171.0	481	181.9	477	192.6	474	202.5	470	210.8	468	214.7	468
58	84.9	.780	84.9	.780	85.0	.780	85.4	.780	86.2	.780		
	1418	302	1326	289	1245	277	1178	264	1133	252		
	169.7	481	180.0	477	190.2	474	199.4	470	206.3	468		
60	85.1	.780	85.1	.780	85.3	.780	85.8	.780	86.7	.780		
	1430	302	1340	289	1262	277	1198	264	1161	252		
	168.3	481	178.1	477	187.7	474	196.0	470	201.4	468		
62	85.3	.780	85.4	.780	85.6	.780	86.2	.780	87.2	.780		
	1443	302	1355	289	1280	277	1221	264	1193	252		
	166.8	481	176.2	477	185.0	474	192.3	470	196.0	468		
64	85.5	.780	85.6	.780	86.0	.780	86.5	.780				
	1457	302	1370	289	1299	277	1246	264				
	165.1	481	174.2	477	182.3	474	188.5	470				
66	85.7	.780	85.9	.780	86.4	.780	87.0	.780				
	1472	302	1388	289	1319	277	1273	264				
	163.5	481	172.0	477	179.5	474	184.5	470				
68	85.9	.780	86.2	.780	86.7	.780	87.4	.780				
	1486	302	1406	289	1342	277	1305	264				
	161.9	481	169.8	477	176.4	474	180.0	470				
70	86.2	.780	86.5	.780	87.1	.780	87.9	.780				
	1502	302	1425	289	1367	277	1339	264				
	160.2	481	167.6	477	173.2	474	175.4	470				
72	86.4	.780	86.9	.780	87.5	.780						
	1519	302	1445	289	1394	277						
	158.4	481	165.2	477	169.9	474						
74	86.7	.780	87.2	.780	87.9	.780						
	1537	302	1468	289	1424	277						
	156.5	481	162.6	477	166.3	474						
76	87.0	.780	87.6	.780								
	1556	302	1492	289								
	154.7	481	160.0	477								
78	87.3	.780	87.9	.780								
	1576	302	1519	289								
	152.6	481	157.2	477								

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = +2.0 %	△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)	**FL100**		**FL150**		**FL200**		**FL230**		**FL250**		**FL270**	
50	58.3	.439	64.1	.513	67.8	.557	68.9	.571	70.3	.590	72.2	.620
	1028	242	1065	259	1014	255	964	246	951	244	957	247
	136.2	280	151.0	321	168.8	342	179.8	347	186.6	355	193.5	370
52	59.5	.450	65.0	.522	68.1	.558	69.7	.579	71.2	.600	73.6	.640
	1075	249	1099	263	1029	255	995	249	987	248	1007	255
	133.7	287	148.7	327	166.6	343	176.5	351	183.0	361	189.7	382
54	61.9	.482	66.4	.536	68.6	.561	70.6	.588	72.3	.615	75.0	.657
	1171	267	1145	270	1050	257	1029	253	1030	255	1055	262
	131.3	308	146.6	336	164.1	345	173.3	357	179.6	370	186.0	392
56	63.6	.502	67.7	.549	69.4	.568	71.5	.597	73.6	.633	75.7	.666
	1240	278	1189	277	1082	260	1065	258	1081	263	1086	266
	129.1	320	144.5	344	161.3	349	170.2	362	176.3	381	182.9	397
58	64.6	.513	68.5	.555	70.1	.575	72.4	.609	74.9	.650	76.2	.669
	1283	284	1219	280	1113	263	1105	263	1130	270	1110	267
	127.5	327	142.7	348	158.6	353	167.2	370	173.1	391	180.0	400
60	65.6	.521	68.8	.557	70.8	.582	73.5	.624	75.9	.663	76.6	.672
	1321	289	1236	281	1145	267	1152	270	1172	276	1131	268
	126.0	333	141.1	349	156.0	357	164.4	379	170.2	399	177.3	401
62	66.5	.530	69.1	.558	71.5	.590	74.7	.640	76.4	.667	77.3	.679
	1358	294	1252	282	1180	270	1202	277	1198	278	1164	272
	124.6	338	139.6	349	153.5	362	161.6	389	167.7	402	174.2	405
64	67.3	.538	69.4	.559	72.3	.598	75.8	.654	76.9	.670	78.0	.687
	1393	298	1268	282	1216	274	1249	284	1220	279	1199	275
	123.2	343	138.0	350	151.1	367	159.0	397	165.3	404	171.1	410
66	68.2	.545	69.7	.560	73.2	.610	76.6	.665	77.3	.673	78.7	.696
	1427	302	1285	283	1259	280	1288	289	1242	280	1235	279
	121.9	348	136.5	351	148.8	374	156.6	404	163.0	405	168.1	415
68	68.8	.550	70.3	.565	74.1	.623	77.1	.669	77.9	.680	79.4	.704
	1453	305	1315	285	1306	286	1314	290	1276	284	1273	282
	120.7	351	134.6	354	146.5	383	154.5	406	160.3	409	165.2	420
70	69.4	.554	70.9	.571	75.2	.637	77.5	.672	78.5	.688	80.1	.713
	1479	307	1347	288	1356	293	1337	292	1312	287	1312	286
	119.6	354	132.7	358	144.3	391	152.5	408	157.7	414	162.4	426
72	69.8	.557	71.5	.577	76.2	.650	77.9	.674	79.2	.695	80.8	.722
	1500	309	1381	292	1404	299	1359	293	1349	290	1350	290
	118.4	355	130.9	361	142.2	399	150.5	409	155.1	419	159.6	431
74	70.1	.558	72.1	.583	77.0	.661	78.4	.681	79.8	.703	81.2	.729
	1518	310	1413	295	1448	305	1394	296	1386	294	1386	293
	117.3	356	129.1	365	140.2	406	148.2	413	152.6	423	157.0	435
76	70.3	.559	72.7	.589	77.6	.667	79.0	.687	80.5	.712	81.7	.737
	1535	310	1449	298	1480	308	1428	299	1426	298	1424	296
	116.3	357	127.4	369	138.5	410	146.0	417	150.2	429	154.3	440
78	70.6	.560	73.4	.596	78.0	.671	79.6	.693	81.1	.720	82.2	.744
	1551	311	1485	302	1506	309	1463	302	1465	301	1463	299
	115.2	357	125.7	373	136.8	412	143.8	421	147.9	433	151.8	444

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = +2.5 %	△FUEL = +5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG=33.0%

N1 (%) / **MACH**
KG/H/ENG / **IAS (KT)**
NM/1000KG / **TAS (KT)**

WEIGHT (1000KG)	FL290		FL310		FL330		FL350		FL370		FL390	
50	74.8	.662	75.5	.671	76.9	.694	78.4	.722	79.9	.749	81.8	.771
	976	253	941	246	933	244	932	243	935	242	939	238
	200.6	392	209.3	394	216.4	404	223.4	416	229.9	430	235.7	442
52	75.3	.666	76.3	.680	77.8	.706	79.1	.733	80.6	.759	82.4	.778
	1000	255	974	249	970	248	969	247	970	245	972	240
	197.2	394	204.9	399	211.6	410	218.1	423	224.3	435	229.5	446
54	75.8	.669	77.1	.690	78.7	.718	79.8	.745	81.3	.768	83.1	.783
	1022	256	1009	253	1009	253	1008	251	1007	248	1007	242
	193.9	396	200.6	405	207.0	418	213.0	429	218.7	441	222.9	449
56	76.5	.676	77.9	.699	79.3	.727	80.5	.754	82.0	.775	83.6	.783
	1051	259	1043	257	1044	256	1043	255	1041	251	1038	242
	190.4	400	196.5	410	202.6	423	208.3	434	213.4	445	216.3	449
58	77.2	.685	78.8	.710	80.0	.738	81.2	.763	82.5	.781	84.3	.786
	1086	263	1082	261	1083	260	1080	258	1075	253	1076	243
	186.6	406	192.6	417	198.2	429	203.6	440	208.2	448	209.3	451
60	78.0	.694	79.5	.721	80.6	.747	81.8	.771	83.1	.784	85.0	.788
	1122	266	1121	266	1119	264	1116	261	1109	254	1116	244
	183.0	411	188.7	423	194.1	434	199.0	444	202.8	450	202.5	452
62	78.7	.703	80.1	.730	81.2	.755	82.4	.777	83.6	.784	85.8	.789
	1158	270	1157	269	1155	267	1150	263	1140	254	1156	244
	179.6	416	185.0	428	190.1	439	194.7	448	197.2	450	195.8	453
64	79.5	.713	80.7	.739	81.8	.764	82.9	.781	84.2	.786	86.1	.780
	1197	274	1197	273	1194	270	1182	265	1179	255	1170	241
	176.3	422	181.3	434	186.1	444	190.3	450	191.4	451	191.1	447
66	80.2	.723	81.3	.748	82.5	.771	83.4	.784	84.9	.788		
	1235	278	1233	276	1231	273	1217	266	1218	255		
	173.1	428	177.9	439	182.2	449	185.8	452	185.6	452		
68	80.7	.730	81.8	.755	83.0	.776	83.9	.784	85.6	.789		
	1272	281	1270	279	1264	275	1247	266	1258	256		
	170.0	432	174.5	443	178.6	452	181.3	452	180.0	453		
70	81.3	.739	82.4	.764	83.5	.780	84.4	.786	86.2	.789		
	1311	285	1309	283	1296	277	1285	267	1296	256		
	166.8	437	171.1	448	175.0	454	176.3	453	174.7	453		
72	81.8	.747	83.0	.771	83.9	.783	85.0	.788	86.4	.772		
	1348	288	1346	285	1331	278	1324	267	1291	250		
	163.9	442	167.9	452	171.2	456	171.6	454	171.5	443		
74	82.3	.753	83.5	.776	84.4	.784	85.6	.789				
	1384	291	1382	288	1362	278	1363	268				
	161.1	446	164.8	455	167.5	456	166.8	455				
76	82.8	.761	84.0	.780	84.8	.785	86.2	.789				
	1423	294	1415	289	1398	279	1402	268				
	158.3	450	161.8	458	163.4	457	162.3	455				
78	83.4	.768	84.4	.782	85.4	.787	86.5	.782				
	1462	297	1446	290	1436	279	1417	265				
	155.5	455	158.7	459	159.4	458	159.0	451				

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = –0.5 %	△FUEL = +2.5 %	△FUEL = +5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+10
CG=33.0%

N1 (%) — MACH
KG/H/ENG — IAS (KT)
NM/1000KG — TAS (KT)

WEIGHT (1000KG)	FL100		FL150		FL200		FL230		FL250		FL270	
50	59.4	.439	66.3	.525	69.1	.555	70.3	.569	71.8	.588	73.6	.618
	1053	242	1116	265	1029	254	979	245	968	243	973	246
	135.4	285	150.1	335	169.0	348	180.0	352	186.7	361	193.5	377
52	61.1	.457	67.3	.535	69.5	.556	71.1	.577	72.7	.598	75.1	.637
	1119	253	1152	270	1045	254	1012	249	1003	247	1024	254
	132.9	297	148.1	341	166.7	348	176.6	357	183.1	367	189.6	388
54	63.9	.493	68.3	.543	70.0	.559	72.0	.586	73.7	.612	76.5	.654
	1227	273	1186	274	1068	256	1046	252	1046	253	1072	261
	130.5	320	146.2	347	164.2	351	173.3	363	179.6	376	185.9	399
56	65.7	.513	69.1	.549	70.7	.566	72.9	.594	75.0	.629	77.2	.663
	1299	284	1214	277	1100	259	1081	256	1096	261	1106	265
	128.5	334	144.5	351	161.3	355	170.2	368	176.2	386	182.7	404
58	66.5	.520	69.8	.554	71.5	.574	73.8	.606	76.4	.646	77.8	.667
	1331	288	1238	280	1134	263	1122	262	1148	269	1131	266
	127.1	338	142.8	354	158.6	360	167.2	375	173.0	397	179.8	407
60	67.3	.526	70.1	.555	72.2	.581	74.8	.621	77.5	.661	78.2	.670
	1361	292	1256	280	1167	266	1170	268	1194	275	1153	267
	125.7	342	141.2	354	155.9	364	164.3	384	170.0	406	177.0	408
62	68.0	.532	70.4	.557	73.0	.588	76.1	.637	78.0	.666	78.9	.678
	1390	295	1273	281	1201	270	1222	276	1222	277	1189	271
	124.5	346	139.6	355	153.5	369	161.4	395	167.4	409	173.8	413
64	68.7	.538	70.7	.557	73.8	.597	77.3	.651	78.5	.669	79.6	.686
	1419	298	1289	281	1238	274	1271	282	1246	279	1225	274
	123.2	349	138.0	356	151.0	374	158.8	403	165.0	411	170.6	418
66	69.4	.543	71.1	.559	74.5	.605	78.1	.662	78.9	.672	80.3	.694
	1447	301	1308	282	1276	278	1312	287	1270	280	1262	278
	121.9	353	136.4	357	148.7	379	156.3	410	162.5	413	167.6	423
68	70.0	.548	71.6	.564	75.5	.619	78.6	.666	79.5	.679	81.0	.701
	1475	304	1339	285	1325	284	1338	289	1305	283	1298	281
	120.7	356	134.5	360	146.3	388	154.2	413	159.8	417	164.7	427
70	70.7	.553	72.2	.570	76.5	.633	79.0	.669	80.2	.686	81.7	.711
	1502	306	1372	288	1376	291	1363	291	1341	286	1339	285
	119.6	359	132.6	364	144.1	397	152.1	414	157.2	422	161.8	433
72	71.1	.555	72.8	.575	77.6	.647	79.4	.672	80.8	.694	82.4	.720
	1524	308	1405	291	1427	298	1386	292	1379	290	1381	289
	118.4	361	130.8	367	142.0	405	150.1	416	154.6	426	159.0	439
74	71.4	.556	73.4	.581	78.5	.658	80.0	.678	81.5	.701	82.9	.727
	1542	309	1438	294	1474	303	1422	295	1415	293	1418	292
	117.3	362	129.0	371	139.9	412	147.8	420	152.1	431	156.4	443
76	71.6	.557	74.1	.587	79.2	.665	80.6	.685	82.1	.709	83.5	.736
	1559	309	1473	297	1509	307	1459	298	1456	297	1459	296
	116.2	362	127.3	375	138.1	417	145.5	425	149.7	436	153.7	448
78	71.9	.558	74.7	.594	79.6	.668	81.2	.692	82.8	.718	84.0	.743
	1577	310	1509	300	1535	308	1496	301	1496	300	1499	299
	115.1	363	125.6	379	136.4	419	143.3	429	147.3	441	151.1	453

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = –0.5 %	△FUEL = +2.5 %	△FUEL = +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	.660	77.1	.669	78.6	.692	80.2	.720	81.7	.748	83.7	.771
	994	252	959	245	952	243	953	242	957	241	963	238
	200.5	399	209.1	401	216.1	411	222.9	425	229.2	439	234.7	452
52	76.9	.665	78.0	.679	79.5	.704	80.9	.731	82.4	.758	84.3	.777
	1020	254	995	249	990	247	990	246	994	244	998	240
	196.9	402	204.6	407	211.2	418	217.6	431	223.5	444	228.4	456
54	77.4	.668	78.8	.688	80.4	.715	81.6	.743	83.2	.767	84.9	.782
	1042	255	1031	253	1029	252	1031	251	1032	248	1034	242
	193.6	404	200.2	413	206.5	425	212.4	438	217.9	450	221.9	459
56	78.1	.675	79.6	.699	81.1	.726	82.3	.752	83.8	.774	85.5	.783
	1074	258	1068	257	1068	256	1068	254	1068	250	1067	242
	190.0	408	196.0	419	202.0	431	207.6	443	212.6	454	215.3	459
58	78.9	.683	80.5	.709	81.8	.737	83.0	.762	84.4	.780	86.2	.785
	1109	262	1107	261	1109	260	1107	258	1103	252	1106	243
	186.3	413	192.0	425	197.5	438	202.8	449	207.4	458	208.3	461
60	79.6	.692	81.2	.719	82.4	.747	83.6	.770	85.0	.783	86.9	.788
	1145	265	1146	265	1148	264	1145	261	1138	254	1147	244
	182.7	418	188.1	431	193.3	444	198.2	454	201.9	459	201.4	462
62	80.4	.700	81.8	.728	83.0	.755	84.2	.776	85.5	.784	87.7	.789
	1181	269	1183	268	1185	267	1180	263	1171	254	1188	244
	179.2	423	184.4	436	189.3	449	193.8	457	196.3	460	194.7	463
64	81.2	.711	82.5	.738	83.6	.763	84.7	.780	86.1	.786	88.0	.778
	1222	273	1225	272	1224	270	1214	265	1210	255	1200	240
	175.8	430	180.6	442	185.3	454	189.5	460	190.5	461	190.2	456
66	81.9	.721	83.0	.747	84.3	.770	85.3	.784	86.8	.788		
	1263	277	1264	276	1261	273	1249	266	1251	255		
	172.5	436	177.1	448	181.5	458	184.9	462	184.7	462		
68	82.4	.729	83.6	.755	84.8	.775	85.7	.784	87.5	.789		
	1301	280	1302	279	1296	275	1281	266	1292	256		
	169.3	440	173.8	452	177.9	461	180.3	462	179.1	463		
70	83.0	.738	84.2	.762	85.3	.779	86.3	.786	88.2	.789		
	1342	284	1341	282	1330	276	1320	267	1331	256		
	166.1	446	170.4	457	174.3	463	175.4	463	173.8	463		
72	83.6	.746	84.8	.769	85.8	.783	86.9	.788	88.3	.770		
	1382	288	1380	285	1366	278	1360	267	1324	249		
	163.2	451	167.1	461	170.4	466	170.7	464	170.6	452		
74	84.1	.753	85.3	.775	86.2	.783	87.5	.789				
	1420	291	1416	287	1397	278	1401	268				
	160.4	455	164.1	464	166.7	466	165.9	465				
76	84.6	.761	85.7	.779	86.7	.785	88.1	.789				
	1460	294	1450	289	1434	279	1441	268				
	157.5	460	161.0	467	162.6	467	161.4	465				
78	85.1	.768	86.2	.782	87.2	.787	88.4	.781				
	1499	297	1484	290	1474	279	1455	265				
	154.7	464	157.9	469	158.6	468	158.3	460				

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = –0.5 %	△FUEL = +2.5 %	△FUEL = +5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF								ISA+15 CG=33.0%		**N1 (%) KG/H/ENG NM/1000KG**		**MACH IAS (KT) TAS (KT)**
WEIGHT (1000KG)	**FL100**		**FL150**		**FL200**		**FL230**		**FL250**		**FL270**	
50	60.0	.439	67.1	.528	69.8	.554	71.0	.568	72.5	.588	74.3	.616
	1067	243	1134	266	1038	254	988	245	978	243	980	245
	135.0	288	149.9	340	169.0	351	179.9	356	186.6	365	193.5	379
52	62.3	.467	68.1	.535	70.1	.555	71.8	.576	73.4	.597	75.8	.636
	1155	258	1165	270	1053	254	1021	248	1012	247	1033	253
	132.5	306	148.0	345	166.7	351	176.5	361	183.0	370	189.5	391
54	65.3	.503	68.9	.542	70.7	.559	72.7	.585	74.4	.611	77.2	.653
	1267	278	1194	273	1077	256	1055	252	1055	253	1082	260
	130.1	330	146.2	349	164.1	354	173.3	366	179.5	379	185.8	402
56	66.5	.515	69.7	.548	71.4	.566	73.6	.594	75.7	.628	78.0	.662
	1315	285	1222	277	1110	259	1091	256	1106	260	1116	264
	128.4	338	144.5	353	161.3	358	170.1	371	176.1	390	182.5	408
58	67.2	.520	70.4	.553	72.1	.573	74.4	.603	77.0	.645	78.5	.666
	1343	288	1247	279	1143	262	1127	260	1157	268	1141	266
	127.1	341	142.8	356	158.6	362	167.2	377	172.9	400	179.6	410
60	67.8	.525	70.7	.554	72.9	.580	75.5	.619	78.2	.659	79.0	.669
	1367	291	1265	280	1176	266	1179	268	1204	274	1165	267
	125.8	344	141.2	357	155.9	367	164.2	387	169.8	409	176.7	412
62	68.5	.531	71.0	.556	73.7	.588	76.8	.635	78.7	.664	79.7	.677
	1398	294	1283	281	1212	269	1231	275	1233	277	1200	270
	124.5	348	139.5	358	153.4	372	161.3	397	167.2	412	173.5	417
64	69.2	.536	71.4	.557	74.4	.595	78.0	.650	79.2	.668	80.4	.685
	1428	297	1300	281	1247	273	1282	282	1258	278	1237	274
	123.2	352	138.0	359	150.9	376	158.6	407	164.7	414	170.4	421
66	70.0	.542	71.7	.558	75.2	.604	78.9	.662	79.7	.671	81.1	.693
	1458	300	1319	282	1287	277	1325	287	1283	280	1275	277
	121.9	355	136.3	360	148.5	382	156.1	414	162.3	416	167.3	427
68	70.6	.547	72.3	.564	76.2	.617	79.4	.665	80.3	.678	81.8	.701
	1486	303	1351	285	1336	284	1352	289	1319	283	1313	281
	120.7	359	134.4	363	146.2	391	153.9	416	159.6	421	164.3	432
70	71.3	.552	72.9	.569	77.2	.631	79.8	.668	81.0	.686	82.6	.710
	1513	306	1384	288	1387	290	1375	290	1356	286	1355	285
	119.5	362	132.5	367	143.9	399	151.9	418	156.9	426	161.5	437
72	71.7	.554	73.5	.575	78.3	.645	80.2	.671	81.6	.693	83.3	.720
	1536	308	1417	290	1439	297	1400	291	1394	289	1396	289
	118.4	364	130.7	370	141.8	408	149.8	420	154.3	430	158.7	443
74	72.0	.556	74.1	.580	79.3	.657	80.8	.678	82.3	.700	83.8	.727
	1554	308	1451	293	1487	303	1437	294	1432	293	1435	292
	117.2	364	128.9	374	139.7	415	147.5	424	151.8	435	156.0	448
76	72.3	.557	74.8	.587	79.9	.664	81.4	.684	83.0	.709	84.3	.735
	1572	309	1487	297	1522	306	1474	297	1473	296	1477	296
	116.1	365	127.1	378	137.9	420	145.2	428	149.3	440	153.3	453
78	72.5	.558	75.4	.593	80.3	.667	82.0	.691	83.6	.717	84.8	.743
	1590	309	1523	300	1550	308	1512	301	1514	300	1518	299
	115.0	366	125.4	382	136.2	422	143.0	432	147.0	445	150.7	458

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = +2.5 %	△FUEL = +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	77.1	.658	77.9	.668	79.4	.691	81.0	.719	82.6	.748	84.6	.770
	1003	252	969	245	962	242	962	242	970	241	975	238
	200.4	402	208.9	405	215.8	415	222.6	428	228.7	444	234.1	457
52	77.7	.664	78.8	.678	80.3	.702	81.7	.731	83.3	.758	85.2	.777
	1030	254	1006	249	1000	247	1002	246	1007	244	1011	240
	196.8	405	204.3	411	210.9	422	217.2	435	223.0	449	227.9	461
54	78.3	.667	79.6	.688	81.3	.714	82.5	.742	84.1	.767	85.8	.782
	1054	255	1042	252	1041	251	1044	250	1046	248	1048	242
	193.4	408	200.0	417	206.2	429	212.0	442	217.4	455	221.3	464
56	78.9	.674	80.4	.697	81.9	.724	83.2	.752	84.7	.774	86.4	.783
	1086	258	1078	256	1079	255	1081	254	1082	250	1081	242
	189.7	412	195.8	422	201.6	435	207.2	448	212.1	459	214.7	464
58	79.7	.683	81.3	.708	82.6	.736	83.9	.760	85.3	.780	87.1	.785
	1122	262	1118	260	1122	260	1119	257	1118	252	1121	243
	186.0	417	191.7	429	197.1	442	202.4	453	206.9	462	207.7	466
60	80.5	.692	82.1	.719	83.3	.746	84.5	.769	85.9	.783	87.7	.783
	1159	265	1160	265	1162	263	1158	260	1152	253	1153	242
	182.3	422	187.8	435	192.8	448	197.8	458	201.4	464	201.6	465
62	81.2	.699	82.7	.728	83.9	.755	85.1	.775	86.4	.783		
	1194	268	1198	268	1200	267	1194	263	1186	254		
	178.9	427	184.0	441	188.9	453	193.4	462	195.8	465		
64	82.0	.710	83.3	.738	84.6	.763	85.6	.780	87.0	.785		
	1235	273	1240	272	1240	270	1230	265	1226	254		
	175.5	433	180.2	447	184.9	458	189.0	465	190.0	466		
66	82.7	.720	83.9	.746	85.2	.770	86.2	.783	87.7	.787		
	1276	277	1279	276	1278	273	1265	266	1267	255		
	172.2	439	176.7	452	181.0	463	184.5	467	184.3	467		
68	83.3	.728	84.5	.754	85.7	.775	86.6	.783	88.0	.778		
	1316	280	1317	279	1313	275	1297	266	1280	252		
	168.9	445	173.4	457	177.4	466	179.9	467	180.2	461		
70	83.9	.737	85.1	.762	86.2	.779	87.2	.785	88.1	.742		
	1358	284	1357	282	1347	276	1337	266	1261	239		
	165.8	450	170.0	461	173.8	468	175.0	468	174.5	440		
72	84.4	.746	85.6	.769	86.7	.783	87.8	.788				
	1399	288	1397	285	1384	278	1379	267				
	162.8	455	166.7	466	170.0	471	170.2	469				
74	84.9	.753	86.2	.774	87.1	.783	88.2	.784				
	1437	291	1433	287	1416	278	1405	266				
	160.0	460	163.6	469	166.2	471	166.2	467				
76	85.5	.760	86.6	.778	87.6	.785	88.3	.760				
	1477	294	1467	288	1454	279	1392	257				
	157.1	464	160.6	471	162.1	472	162.8	453				
78	86.0	.767	87.1	.781	88.1	.787						
	1517	296	1503	290	1495	279						
	154.3	468	157.5	473	158.1	473						

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = –0.5 %	△FUEL = +2.5 %	△FUEL = +5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA+20
CG=33.0%

N1 (%) / **MACH**
KG/H/ENG / **IAS (KT)**
NM/1000KG / **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL200		FL230		FL250		FL270	
50	60.7	.440	67.8	.528	70.4	.553	71.7	.568	73.2	.587	75.0	.614
	1083	243	1144	266	1045	253	998	245	985	243	987	244
	134.6	291	149.9	343	169.0	353	179.9	359	186.6	368	193.4	382
52	64.0	.482	68.7	.534	70.8	.554	72.6	.576	74.1	.596	76.5	.634
	1207	267	1173	269	1062	254	1031	248	1022	247	1041	252
	132.1	319	148.0	347	166.7	354	176.5	364	182.9	374	189.4	394
54	66.3	.508	69.5	.541	71.3	.558	73.4	.584	75.1	.610	78.0	.652
	1295	281	1203	273	1086	255	1065	252	1065	253	1092	260
	129.8	336	146.2	352	164.1	356	173.2	369	179.4	382	185.6	405
56	67.1	.514	70.4	.547	72.1	.565	74.3	.593	76.4	.627	78.8	.661
	1325	285	1232	276	1119	259	1101	256	1116	260	1128	264
	128.4	340	144.5	356	161.2	361	170.0	374	176.0	393	182.3	411
58	67.6	.518	71.0	.552	72.8	.572	75.1	.602	77.8	.643	79.3	.665
	1347	287	1256	278	1153	262	1138	260	1167	267	1154	266
	127.2	343	142.8	359	158.5	365	167.0	380	172.7	403	179.3	414
60	68.3	.523	71.3	.553	73.6	.579	76.2	.616	78.9	.658	79.8	.668
	1375	290	1274	279	1187	265	1187	266	1215	274	1177	267
	125.8	346	141.1	360	155.8	370	164.0	389	169.6	412	176.5	415
62	69.1	.530	71.7	.555	74.4	.587	77.4	.633	79.5	.663	80.5	.676
	1408	294	1293	280	1223	269	1240	274	1243	276	1213	270
	124.5	350	139.5	361	153.2	375	161.2	400	167.0	415	173.2	420
64	69.8	.535	72.0	.556	75.1	.594	78.7	.649	80.0	.666	81.2	.684
	1437	297	1311	281	1259	273	1292	281	1269	277	1250	273
	123.2	354	137.9	361	150.8	380	158.4	409	164.5	418	170.1	425
66	70.5	.541	72.4	.557	75.9	.603	79.6	.660	80.5	.670	81.9	.692
	1467	300	1330	281	1298	277	1336	286	1296	279	1289	277
	121.9	358	136.3	362	148.4	385	155.9	417	162.0	420	167.0	430
68	71.2	.546	73.0	.563	76.8	.616	80.1	.664	81.1	.677	82.6	.700
	1496	303	1363	284	1347	283	1365	288	1333	282	1328	281
	120.7	361	134.3	366	146.1	393	153.7	420	159.2	424	164.0	436
70	71.9	.551	73.6	.568	77.9	.631	80.5	.667	81.8	.685	83.4	.710
	1525	305	1396	287	1401	290	1390	290	1371	286	1370	285
	119.5	364	132.4	370	143.7	403	151.6	421	156.6	429	161.1	441
72	72.3	.554	74.2	.574	79.0	.643	81.0	.670	82.4	.692	84.1	.719
	1548	307	1431	290	1451	296	1416	291	1409	289	1412	289
	118.3	366	130.5	373	141.6	411	149.5	423	154.0	434	158.3	447
74	72.6	.555	74.8	.580	80.0	.656	81.6	.677	83.1	.700	84.6	.727
	1567	308	1464	293	1500	302	1453	294	1448	292	1452	292
	117.2	367	128.7	377	139.5	419	147.2	428	151.4	439	155.6	452
76	72.9	.556	75.4	.586	80.6	.663	82.2	.684	83.8	.708	85.1	.735
	1585	308	1500	296	1537	306	1491	297	1490	296	1494	295
	116.0	368	127.0	381	137.7	423	144.9	432	149.0	444	152.9	457
78	73.2	.557	76.1	.592	81.0	.666	82.8	.691	84.5	.717	85.7	.743
	1603	309	1538	300	1564	307	1529	300	1533	300	1537	299
	114.9	369	125.3	385	136.0	425	142.6	436	146.6	449	150.3	462

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = –0.5 %	△FUEL = +2.5 %	△FUEL = +5 %

R

LONG RANGE CRUISE

MAX. CRUISE THRUST LIMITS NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA+20 CG=33.0%	N1 (%) / MACH KG/H/ENG / IAS (KT) NM/1000KG / TAS (KT)

WEIGHT (1000KG)	FL290		FL310		FL330		FL350		FL370		FL390	
50	77.9	.657	78.7	.667	80.3	.691	81.9	.719	83.5	.748	85.5	.769
	1012	251	979	244	973	242	974	242	982	241	987	237
	200.2	405	208.6	408	215.5	419	222.1	433	228.1	448	233.6	461
52	78.5	.662	79.6	.677	81.1	.700	82.6	.730	84.2	.757	86.1	.776
	1039	253	1016	248	1010	246	1015	246	1021	244	1023	240
	196.6	409	204.0	415	210.6	425	216.7	440	222.4	454	227.3	465
54	79.0	.666	80.4	.686	82.1	.713	83.4	.742	85.0	.766	86.7	.781
	1064	255	1052	252	1052	251	1057	250	1059	248	1061	242
	193.1	411	199.7	420	205.8	433	211.5	447	216.8	459	220.8	468
56	79.7	.673	81.3	.696	82.8	.724	84.1	.751	85.6	.774	87.3	.781
	1096	258	1090	256	1092	255	1095	254	1096	250	1093	242
	189.4	415	195.4	426	201.2	439	206.7	453	211.5	464	214.3	468
58	80.5	.682	82.1	.707	83.5	.735	84.7	.760	86.2	.780	87.3	.756
	1133	261	1130	260	1135	259	1134	257	1133	252	1082	233
	185.7	421	191.3	432	196.6	446	201.9	458	206.3	468	209.4	453
60	81.3	.691	82.9	.717	84.2	.745	85.4	.768	86.8	.782		
	1172	265	1172	264	1176	263	1173	260	1167	253		
	182.0	426	187.4	439	192.4	453	197.3	463	200.9	469		
62	82.1	.700	83.5	.727	84.8	.754	86.0	.774	87.3	.783		
	1209	268	1213	268	1215	267	1209	262	1203	254		
	178.5	432	183.5	445	188.4	458	192.9	466	195.2	470		
64	82.9	.709	84.2	.738	85.4	.762	86.5	.780	87.7	.778		
	1250	273	1256	272	1255	270	1245	264	1224	252		
	175.1	438	179.8	451	184.4	463	188.5	470	190.5	467		
66	83.6	.719	84.8	.746	86.0	.770	87.1	.783	87.8	.750		
	1292	277	1296	276	1294	273	1281	265	1210	242		
	171.8	444	176.3	457	180.6	467	184.0	471	185.6	449		
68	84.1	.727	85.4	.754	86.6	.775	87.6	.783				
	1331	280	1334	279	1330	275	1315	266				
	168.6	449	172.9	461	176.9	470	179.4	472				
70	84.7	.736	85.9	.761	87.1	.779	88.0	.782				
	1374	284	1375	282	1364	276	1346	265				
	165.4	454	169.5	466	173.3	473	175.0	471				
72	85.3	.745	86.5	.768	87.6	.783	88.1	.761				
	1415	287	1414	284	1403	278	1335	257				
	162.4	460	166.3	470	169.5	475	171.6	458				
74	85.8	.752	87.0	.773	88.0	.783						
	1454	290	1450	287	1435	278						
	159.6	464	163.2	473	165.7	475						
76	86.3	.759	87.5	.777	88.1	.768						
	1494	293	1484	288	1430	272						
	156.7	468	160.2	475	163.0	466						
78	86.9	.766	87.9	.781	88.1	.743						
	1535	296	1522	290	1419	262						
	153.9	473	157.1	478	159.1	451						

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = –0.5 %	△FUEL = +2.5 %	△FUEL = +5 %

GENERAL

The following in cruise quick check tables allow the flight crew to determine the fuel consumption and the time required to cover a given air distance from any moment in cruise to landing.
These tables are established for :
- Cruise Mach number : M.78/LR
- Descent profile : M.78/300KT/250KT
- Approach and landing : 120 kg or 270 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) × $\triangle$ISA (°C) × Air Distance (NM)
or 0.011 (lb/°C/NM) × $\triangle$ISA (°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.
    Fuel consumption : 4053 kg
    Time needed : 2 h 07 min
- Correction due to real in cruise weight of 55000 kg

R △ fuel consumption : – 49 kg per 1000 kg below reference
R △ fuel : – 49 × (60 – 55) = – 245 kg

- Temperature correction :
  △ fuel consumption : + 0.005 kg per 1° above ISA and per 1 NM Air distance
  △ fuel : + 0.005 × 10 × 880 = 44 kg

Result :

R Fuel : 4053 – 245 + 44 = 3852 kg
Time : 2 h 07 min

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
100	385 0.22	359 0.22	335 0.22	312 0.22	290 0.22		0	0	0
125	532 0.26	498 0.26	467 0.26	439 0.26	413 0.26	391 0.26	0	0	0
150	680 0.29	637 0.29	599 0.29	565 0.29	536 0.29	513 0.29	0	0	0
175	827 0.32	776 0.32	731 0.32	692 0.32	659 0.32	636 0.32	0	1	2
200	974 0.35	915 0.35	863 0.36	818 0.36	782 0.36	758 0.36	1	1	4
225	1121 0.39	1054 0.39	994 0.39	944 0.39	904 0.39	880 0.39	1	2	5
250	1268 0.42	1193 0.42	1126 0.42	1070 0.42	1027 0.43	1002 0.43	1	3	7
275	1414 0.45	1331 0.45	1258 0.46	1195 0.46	1149 0.46	1123 0.46	2	4	8
300	1561 0.48	1470 0.49	1389 0.49	1321 0.49	1271 0.49	1244 0.49	3	5	10
325	1708 0.52	1608 0.52	1520 0.52	1446 0.52	1392 0.53	1365 0.53	3	6	12
350	1854 0.55	1746 0.55	1651 0.55	1572 0.56	1514 0.56	1486 0.56	4	7	13
375	2000 0.58	1885 0.58	1782 0.59	1697 0.59	1635 0.59	1607 0.59	5	8	15
400	2147 1.01	2023 1.02	1913 1.02	1822 1.02	1756 1.03	1727 1.03	5	9	16
425	2293 1.05	2161 1.05	2044 1.05	1947 1.06	1878 1.06	1847 1.06	6	10	18
450	2439 1.08	2299 1.08	2175 1.09	2072 1.09	1998 1.09	1967 1.09	7	11	20
475	2585 1.11	2436 1.11	2305 1.12	2197 1.12	2119 1.13	2087 1.13	7	12	21
500	2731 1.14	2574 1.15	2436 1.15	2321 1.16	2240 1.16	2206 1.16	8	13	23
525	2877 1.18	2711 1.18	2566 1.19	2446 1.19	2360 1.19	2325 1.19	8	14	24
550	3023 1.21	2849 1.21	2697 1.22	2570 1.22	2480 1.23	2444 1.23	9	15	26
575	3169 1.24	2986 1.25	2827 1.25	2694 1.26	2601 1.26	2563 1.26	10	15	32
600	3315 1.27	3124 1.28	2957 1.28	2818 1.29	2720 1.29	2682 1.29	10	16	33
625	3460 1.30	3261 1.31	3087 1.32	2942 1.32	2840 1.33	2800 1.33	11	17	35
650	3606 1.34	3398 1.34	3216 1.35	3066 1.36	2960 1.36	2918 1.36	12	18	36
675	3751 1.37	3535 1.38	3346 1.38	3190 1.39	3079 1.39	3036 1.39	12	19	38
700	3896 1.40	3672 1.41	3476 1.42	3313 1.42	3199 1.43	3154 1.43	13	20	39
725	4042 1.43	3808 1.44	3605 1.45	3437 1.46	3318 1.46	3271 1.46	13	21	41

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

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R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
725	4042 1.43	3808 1.44	3605 1.45	3437 1.46	3318 1.46	3271 1.46	13	21	41
750	4187 1.47	3945 1.47	3735 1.48	3560 1.49	3437 1.50	3388 1.50	14	22	42
775	4332 1.50	4081 1.51	3864 1.52	3683 1.52	3555 1.53	3505 1.53	15	23	43
800	4477 1.53	4218 1.54	3993 1.55	3806 1.56	3674 1.56	3622 1.56	15	23	45
825	4622 1.56	4354 1.57	4122 1.58	3929 1.59	3793 2.00	3739 2.00	16	24	46
850	4767 2.00	4490 2.01	4251 2.01	4052 2.02	3911 2.03	3855 2.03	16	25	48
875	4911 2.03	4627 2.04	4380 2.05	4175 2.06	4029 2.06	3971 2.06	17	26	49
900	5056 2.06	4763 2.07	4509 2.08	4298 2.09	4147 2.10	4087 2.10	17	27	51
925	5201 2.09	4899 2.10	4637 2.11	4420 2.12	4265 2.13	4203 2.13	18	28	52
950	5345 2.13	5034 2.14	4766 2.15	4542 2.16	4383 2.16	4319 2.16	19	29	53
975	5490 2.16	5170 2.17	4894 2.18	4665 2.19	4500 2.20	4434 2.20	19	29	55
1000	5634 2.19	5306 2.20	5023 2.21	4787 2.22	4617 2.23	4549 2.23	20	30	56
1025	5778 2.22	5441 2.23	5151 2.25	4909 2.26	4735 2.26	4664 2.26	20	31	57
1050	5922 2.26	5577 2.27	5279 2.28	5030 2.29	4852 2.30	4779 2.30	21	32	59
1075	6066 2.29	5712 2.30	5407 2.31	5152 2.32	4969 2.33	4894 2.33	21	33	60
1100	6210 2.32	5847 2.33	5535 2.35	5274 2.36	5085 2.36	5008 2.36	22	33	61
1125	6354 2.35	5983 2.37	5663 2.38	5395 2.39	5202 2.40	5122 2.40	23	34	63
1150	6498 2.39	6118 2.40	5790 2.41	5517 2.42	5319 2.43	5236 2.43	23	35	64
1175	6642 2.42	6253 2.43	5918 2.44	5638 2.46	5435 2.46	5350 2.46	24	36	65
1200	6786 2.45	6387 2.46	6045 2.48	5759 2.49	5551 2.50	5463 2.50	24	37	67
1225	6929 2.48	6522 2.50	6173 2.51	5880 2.52	5667 2.53	5577 2.53	25	37	68
1250	7073 2.52	6657 2.53	6300 2.54	6001 2.56	5783 2.57	5690 2.57	25	38	69
1275	7216 2.55	6791 2.56	6427 2.58	6122 2.59	5899 3.00	5803 3.00	26	39	70
1300	7360 2.58	6926 2.59	6554 3.01	6242 3.02	6014 3.03	5916 3.03	27	40	72
1325	7503 3.01	7061 3.03	6681 3.04	6363 3.06	6130 3.07	6029 3.07	27	41	73
1350	7647 3.05	7195 3.06	6808 3.08	6483 3.09	6245 3.10	6141 3.10	28	41	74

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

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R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
1350	7647 3.05	7195 3.06	6808 3.08	6483 3.09	6245 3.10	6141 3.10	28	41	74
1375	7790 3.08	7330 3.09	6935 3.11	6604 3.12	6360 3.13	6253 3.13	28	42	75
1400	7933 3.11	7464 3.13	7062 3.14	6724 3.16	6475 3.17	6365 3.17	29	43	77
1425	8076 3.14	7598 3.16	7189 3.17	6844 3.19	6590 3.20	6477 3.20	29	44	78
1450	8219 3.18	7733 3.19	7316 3.21	6964 3.22	6705 3.23	6589 3.23	30	44	79
1475	8362 3.21	7867 3.22	7442 3.24	7084 3.26	6819 3.27	6701 3.27	30	45	80
1500	8505 3.24	8001 3.26	7569 3.27	7204 3.29	6934 3.30	6812 3.30	31	46	81
1525	8648 3.27	8135 3.29	7695 3.31	7324 3.32	7048 3.33	6923 3.33	31	47	83
1550	8791 3.31	8269 3.32	7822 3.34	7444 3.36	7163 3.37	7034 3.37	32	47	84
1575	8933 3.34	8403 3.35	7948 3.37	7564 3.39	7277 3.40	7145 3.40	33	48	85
1600	9076 3.37	8537 3.39	8075 3.41	7683 3.42	7392 3.43	7256 3.43	33	49	86
1625	9218 3.40	8670 3.42	8201 3.44	7803 3.46	7506 3.47	7366 3.47	34	50	87
1650	9361 3.44	8804 3.45	8327 3.47	7922 3.49	7620 3.50	7477 3.50	34	50	88
1675	9503 3.47	8937 3.49	8453 3.50	8041 3.52	7734 3.53	7587 3.53	35	51	89
1700	9645 3.50	9071 3.52	8579 3.54	8160 3.56	7848 3.57	7697 3.57	35	52	91
1725	9788 3.53	9204 3.55	8704 3.57	8279 3.59	7961 4.00	7807 4.00	36	52	92
1750	9930 3.56	9337 3.58	8830 4.00	8398 4.02	8075 4.03	7916 4.04	36	53	93
1775	10072 4.00	9470 4.02	8956 4.04	8517 4.06	8188 4.07	8026 4.07	37	54	94
1800	10214 4.03	9604 4.05	9081 4.07	8636 4.09	8302 4.10	8135 4.10	37	54	95
1825	10356 4.06	9737 4.08	9207 4.10	8754 4.12	8415 4.14	8245 4.14	38	55	96
1850	10498 4.09	9869 4.11	9332 4.14	8873 4.16	8528 4.17	8354 4.17	38	56	97
1875	10639 4.13	10002 4.15	9458 4.17	8991 4.19	8641 4.20	8462 4.20	39	56	98
1900	10781 4.16	10135 4.18	9583 4.20	9110 4.22	8754 4.24	8571 4.24	39	57	99
1925	10923 4.19	10268 4.21	9708 4.23	9228 4.26	8866 4.27	8680 4.27	40	58	100
1950	11064 4.22	10400 4.25	9833 4.27	9346 4.29	8979 4.30	8788 4.30	40	58	101
1975	11206 4.26	10533 4.28	9958 4.30	9464 4.32	9091 4.34	8896 4.34	41	59	102

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

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R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
1975	11206 4.26	10533 4.28	9958 4.30	9464 4.32	9091 4.34	8896 4.34	41	59	102
2000	11347 4.29	10665 4.31	10083 4.33	9582 4.36	9203 4.37	9004 4.37	41	60	103
2025	11488 4.32	10797 4.34	10207 4.37	9700 4.39	9316 4.40	9112 4.40	42	60	104
2050	11629 4.35	10930 4.38	10332 4.40	9817 4.42	9428 4.44	9220 4.44	42	61	105
2075	11771 4.39	11062 4.41	10457 4.43	9935 4.46	9540 4.47	9327 4.47	43	62	106
2100	11912 4.42	11194 4.44	10581 4.47	10052 4.49	9652 4.50	9435 4.50	43	62	107
2125	12053 4.45	11326 4.47	10705 4.50	10170 4.52	9763 4.54	9542 4.54	44	63	108
2150	12194 4.48	11458 4.51	10830 4.53	10287 4.56	9875 4.57	9649 4.57	44	63	109
2175	12334 4.52	11590 4.54	10954 4.56	10404 4.59	9986 5.00	9756 5.00	45	64	110
2200	12475 4.55	11721 4.57	11078 5.00	10521 5.02	10098 5.04	9863 5.04	45	65	111
2225	12616 4.58	11853 5.01	11202 5.03	10638 5.06	10209 5.07	9969 5.07	46	65	112
2250	12757 5.01	11985 5.04	11326 5.06	10755 5.09	10320 5.10	10076 5.10	46	66	112
2275	12897 5.05	12116 5.07	11450 5.10	10872 5.12	10431 5.14	10182 5.14	46	67	113
2300	13038 5.08	12248 5.10	11574 5.13	10989 5.16	10542 5.17	10288 5.17	47	67	114
2325	13178 5.11	12380 5.14	11698 5.16	11105 5.19	10653 5.21	10394 5.21	47	68	115
2350	13318 5.14	12512 5.17	11821 5.20	11222 5.22	10763 5.24	10500 5.24	48	68	116
2375	13459 5.18	12643 5.20	11945 5.23	11338 5.26	10874 5.27	10606 5.27	48	69	117
2400	13599 5.21	12775 5.23	12068 5.26	11454 5.29	10984 5.31	10711 5.31	49	70	118
2425	13739 5.24	12906 5.27	12191 5.30	11571 5.32	11095 5.34	10816 5.34	49	70	119
2450	13879 5.27	13037 5.30	12315 5.33	11687 5.36	11205 5.37	10922 5.37	49	71	119
2475	14019 5.31	13169 5.33	12438 5.36	11803 5.39	11315 5.41	11027 5.41	50	71	120
2500	14159 5.34	13300 5.37	12561 5.39	11919 5.42	11425 5.44	11132 5.44	50	72	121
2525	14299 5.37	13431 5.40	12683 5.43	12034 5.46	11535 5.47	11236 5.47	51	73	122
2550	14439 5.40	13562 5.43	12806 5.46	12150 5.49	11644 5.51	11341 5.51	51	73	123
2575	14579 5.44	13693 5.46	12929 5.49	12266 5.52	11754 5.54	11445 5.54	52	74	124
2600	14718 5.47	13824 5.50	13052 5.53	12382 5.56	11863 5.57	11550 5.57	52	74	125

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

FLIP23D A320-214 CFM56-5B4/P SA3610 03301.000011 0250300 .7800 .00200 120 0300350 60 0 100 20 20 20 18590 FCOM-N0-03-05-20-006-170

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : M.78 - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
2600	14718 5.47	13824 5.50	13052 5.53	12382 5.56	11863 5.57	11550 5.57	52	74	125
2625	14858 5.50	13955 5.53	13174 5.56	12498 5.59	11973 6.01	11654 6.01	52	75	125
2650	14998 5.53	14085 5.56	13297 5.59	12613 6.02	12082 6.04	11758 6.04	53	75	126
2675	15137 5.56	14216 5.59	13419 6.03	12729 6.06	12192 6.07	11862 6.07	53	76	127
2700	15276 6.00	14347 6.03	13541 6.06	12844 6.09	12301 6.11	11965 6.11	54	77	128
2725	15416 6.03	14477 6.06	13663 6.09	12959 6.12	12411 6.14	12069 6.14	54	77	129
2750	15555 6.06	14608 6.09	13786 6.12	13075 6.16	12520 6.17	12173 6.17	55	78	130
2775	15694 6.09	14738 6.13	13908 6.16	13190 6.19	12629 6.21	12278 6.21	55	78	130
2800	15833 6.13	14869 6.16	14030 6.19	13305 6.22	12739 6.24	12382 6.24	55	79	131
2825	15972 6.16	14999 6.19	14151 6.22	13420 6.26	12848 6.27	12486 6.28	56	79	132
2850	16111 6.19	15129 6.22	14273 6.26	13534 6.29	12957 6.31	12590 6.31	56	80	133
2875	16250 6.22	15259 6.26	14395 6.29	13649 6.32	13065 6.34	12694 6.34	56	80	134
2900	16389 6.26	15390 6.29	14517 6.32	13764 6.36	13174 6.38	12798 6.38	57	81	134
2925	16528 6.29	15520 6.32	14638 6.36	13878 6.39	13283 6.41	12901 6.41	57	82	135
2950	16667 6.32	15650 6.35	14760 6.39	13993 6.42	13391 6.44	13005 6.44	58	82	136
2975	16805 6.35	15779 6.39	14881 6.42	14107 6.46	13500 6.48	13108 6.48	58	83	137
3000	16944 6.39	15909 6.42	15002 6.45	14222 6.49	13608 6.51	13211 6.51	58	83	137
3025	17082 6.42	16039 6.45	15124 6.49	14336 6.52	13716 6.54	13315 6.54	59	84	138
3050	17221 6.45	16169 6.49	15245 6.52	14450 6.56	13825 6.58	13418 6.58	59	84	139
3075	17359 6.48	16298 6.52	15366 6.55	14564 6.59	13933 7.01	13520 7.01	60	85	139
3100	17497 6.52	16428 6.55	15487 6.59	14678 7.02	14041 7.04	13623 7.04	60	85	140

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = – 0.5 %	ΔFUEL = + 3 %	ΔFUEL = + 6 %

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R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 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**
100	791 0.24	628 0.24	526 0.24	473 0.23	440 0.23	407 0.23	2	0	0
125	988 0.29	805 0.29	686 0.28	625 0.27	587 0.27	548 0.27	3	1	0
150	1186 0.33	982 0.33	846 0.32	777 0.31	733 0.31	689 0.30	4	2	1
175	1383 0.38	1158 0.37	1005 0.37	929 0.35	880 0.34	830 0.34	5	4	2
200	1580 0.42	1335 0.42	1165 0.41	1080 0.39	1027 0.38	970 0.38	6	5	3
225	1777 0.47	1511 0.46	1324 0.45	1232 0.43	1173 0.42	1111 0.42	7	6	5
250	1974 0.52	1687 0.50	1483 0.49	1383 0.47	1319 0.46	1251 0.45	8	8	6
275	2170 0.56	1863 0.54	1642 0.53	1534 0.51	1465 0.49	1391 0.49	10	9	7
300	2367 1.01	2039 0.59	1801 0.58	1684 0.55	1611 0.53	1531 0.53	11	10	8
325	2562 1.05	2214 1.03	1959 1.02	1835 0.59	1757 0.57	1671 0.57	12	12	9
350	2758 1.10	2390 1.07	2117 1.06	1985 1.03	1902 1.01	1811 1.00	13	13	10
375	2954 1.15	2565 1.12	2275 1.10	2135 1.07	2047 1.05	1950 1.04	14	14	12
400	3149 1.19	2740 1.16	2433 1.15	2285 1.12	2192 1.09	2090 1.08	16	15	13
425	3344 1.24	2915 1.20	2591 1.19	2435 1.16	2337 1.12	2229 1.12	17	17	14
450	3539 1.29	3089 1.25	2748 1.23	2585 1.20	2481 1.16	2368 1.15	18	18	15
475	3733 1.33	3263 1.29	2905 1.27	2734 1.24	2626 1.20	2507 1.19	19	19	16
500	3928 1.38	3438 1.33	3062 1.32	2883 1.28	2770 1.24	2646 1.23	20	20	17
525	4122 1.43	3612 1.38	3219 1.36	3032 1.32	2914 1.28	2785 1.27	22	22	19
550	4316 1.47	3786 1.42	3375 1.40	3181 1.36	3058 1.32	2923 1.31	23	23	20
575	4509 1.52	3959 1.46	3531 1.45	3330 1.40	3202 1.36	3062 1.34	24	24	21
600	4703 1.57	4133 1.51	3688 1.49	3478 1.44	3345 1.39	3200 1.38	25	26	22
625	4896 2.01	4306 1.55	3843 1.53	3626 1.48	3488 1.43	3338 1.42	27	27	23
650	5089 2.06	4479 2.00	3999 1.57	3774 1.52	3632 1.47	3476 1.46	28	28	25
675	5282 2.11	4652 2.04	4155 2.02	3922 1.57	3775 1.51	3614 1.49	29	29	26
700	5474 2.15	4825 2.08	4310 2.06	4070 2.01	3917 1.55	3752 1.53	30	31	27
725	5667 2.20	4997 2.13	4465 2.10	4217 2.05	4060 1.59	3890 1.57	32	32	28

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

FLIP23D A320-214 CFM56-5B4/P SA3610 03301.000011 0250300 .7801 .00200 120 0300350 60 0 100 20 20 20 18590 FCOM-N0-03-05-20-008-170

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	FUEL CONSUMED (KG) TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 100	150	200	230	250	270	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL150	FL200 FL230	FL250 FL270
725	5667 2.20	4997 2.13	4465 2.10	4217 2.05	4060 1.59	3890 1.57	32	32	28
750	5859 2.25	5170 2.17	4620 2.15	4365 2.09	4202 2.03	4027 2.01	33	33	29
775	6051 2.30	5342 2.21	4775 2.19	4512 2.13	4345 2.07	4164 2.04	34	34	30
800	6243 2.34	5514 2.26	4929 2.23	4659 2.17	4487 2.11	4302 2.08	36	35	32
825	6434 2.39	5686 2.30	5083 2.28	4806 2.21	4628 2.15	4439 2.12	37	37	33
850	6625 2.44	5857 2.35	5238 2.32	4952 2.26	4770 2.19	4576 2.16	38	38	34
875	6816 2.49	6029 2.39	5391 2.36	5099 2.30	4912 2.23	4712 2.20	40	39	35
900	7006 2.54	6200 2.43	5545 2.41	5245 2.34	5053 2.27	4849 2.23	41	40	36
925	7195 2.59	6371 2.48	5699 2.45	5391 2.38	5194 2.30	4985 2.27	42	42	38
950	7384 3.04	6542 2.52	5852 2.49	5537 2.42	5335 2.34	5122 2.31	44	43	39
975	7573 3.08	6713 2.57	6005 2.54	5683 2.47	5476 2.38	5258 2.35	45	44	40
1000	7761 3.13	6883 3.01	6158 2.58	5828 2.51	5617 2.42	5394 2.38	46	45	41
1025	7949 3.18	7053 3.05	6311 3.02	5974 2.55	5757 2.46	5530 2.42	48	47	42
1050	8137 3.23	7223 3.10	6463 3.07	6119 2.59	5898 2.50	5666 2.46	49	48	44
1075	8325 3.29	7393 3.14	6616 3.11	6264 3.03	6038 2.54	5802 2.50	50	49	45
1100	8512 3.34	7562 3.19	6768 3.16	6409 3.08	6178 2.58	5937 2.53	52	50	46
1125	8699 3.39	7732 3.23	6920 3.20	6553 3.12	6317 3.02	6073 2.57	53	51	47
1150	8886 3.44	7901 3.28	7072 3.24	6698 3.16	6457 3.06	6208 3.01	54	53	48
1175	9073 3.49	8070 3.32	7223 3.29	6842 3.20	6597 3.11	6343 3.05	56	54	49
1200	9259 3.54	8238 3.37	7375 3.33	6986 3.25	6736 3.15	6478 3.09	57	55	51
1225	9445 3.59	8407 3.42	7526 3.37	7129 3.29	6875 3.19	6613 3.12	59	56	52
1250	9631 4.04	8575 3.46	7677 3.42	7273 3.33	7014 3.23	6748 3.16	60	57	53
1275	9816 4.09	8743 3.51	7828 3.46	7416 3.37	7152 3.27	6883 3.20	62	58	54
1300	10001 4.15	8911 3.55	7979 3.51	7559 3.42	7291 3.31	7017 3.24	63	60	55
1325	10186 4.20	9079 4.00	8129 3.55	7702 3.46	7429 3.35	7151 3.28	64	61	56
1350	10371 4.25	9247 4.04	8280 3.59	7844 3.50	7567 3.39	7284 3.31	66	62	58

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

FLIP23D A320-214 CFM56-5B4/P SA3610 03301.000011 0250300 .7801 .00200 120 0300350 60 0 100 20 20 20 18590 FCOM-N0-03-05-20-009-170

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	100	**150**	**200**	**230**	**250**	**270**	**FL100 FL150**	**FL200 FL230**	**FL250 FL270**
1350	10371 4.25	9247 4.04	8280 3.59	7844 3.50	7567 3.39	7284 3.31	66	62	58
1375	10555 4.30	9414 4.09	8430 4.04	7987 3.54	7705 3.43	7418 3.35	67	63	59
1400	10740 4.35	9581 4.14	8580 4.08	8129 3.59	7842 3.47	7552 3.39	69	64	60
1425	10924 4.41	9749 4.18	8730 4.13	8271 4.03	7980 3.51	7685 3.43	70	65	61
1450	11107 4.46	9915 4.23	8879 4.17	8413 4.07	8117 3.56	7818 3.47	72	66	62
1475	11291 4.51	10082 4.27	9029 4.21	8555 4.12	8254 4.00	7951 3.51	73	67	64
1500	11474 4.57	10249 4.32	9178 4.26	8696 4.16	8391 4.04	8084 3.55	75	69	65
1525	11657 5.02	10415 4.37	9327 4.30	8838 4.20	8528 4.08	8217 3.58	76	70	66
1550	11839 5.07	10581 4.41	9476 4.35	8979 4.24	8665 4.12	8349 4.02	77	71	67
1575	12021 5.13	10747 4.46	9625 4.39	9120 4.29	8801 4.16	8482 4.06	79	72	69
1600	12202 5.19	10913 4.51	9773 4.44	9260 4.33	8938 4.21	8614 4.10	80	73	70
1625	12382 5.24	11078 4.55	9922 4.48	9401 4.37	9074 4.25	8746 4.14	82	74	71
1650	12562 5.30	11244 5.00	10070 4.52	9542 4.42	9210 4.29	8878 4.18	83	75	72
1675	12742 5.36	11409 5.05	10218 4.57	9682 4.46	9346 4.33	9010 4.22	85	76	73
1700	12922 5.42	11574 5.09	10366 5.01	9822 4.50	9481 4.37	9142 4.25	86	77	75
1725	13101 5.48	11739 5.14	10513 5.06	9962 4.55	9617 4.42	9274 4.29	88	79	76
1750	13280 5.54	11903 5.19	10661 5.10	10102 4.59	9752 4.46	9405 4.33	89	80	77
1775	13459 5.59	12068 5.23	10808 5.15	10241 5.03	9887 4.50	9536 4.37	91	81	78
1800	13637 6.05	12231 5.28	10955 5.19	10381 5.08	10022 4.54	9668 4.41	92	82	80
1825	13815 6.11	12395 5.33	11102 5.24	10520 5.12	10157 4.59	9799 4.45	94	83	81
1850	13993 6.18	12558 5.38	11249 5.28	10659 5.17	10292 5.03	9930 4.49	95	84	82
1875	14171 6.24	12721 5.43	11396 5.33	10798 5.21	10426 5.07	10060 4.53	97	85	83
1900	14348 6.30	12884 5.48	11542 5.37	10936 5.25	10561 5.11	10191 4.57	98	86	84
1925	14525 6.36	13046 5.52	11689 5.41	11075 5.30	10695 5.16	10321 5.00	100	87	86
1950	14702 6.42	13209 5.57	11835 5.46	11213 5.34	10829 5.20	10452 5.04	101	88	87
1975	14879 6.48	13371 6.02	11981 5.50	11352 5.38	10963 5.24	10582 5.08	103	89	88

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

FLIP23D A320-214 CFM56-5B4/P SA3610 03301.000011 0250300 .7801 .00200 120 0300350 60 0 100 20 20 20 18590 FCOM-N0-03-05-20-010-170

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL **100**	**150**	**200**	**230**	**250**	**270**	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) **FL100 FL150**	**FL200 FL230**	**FL250 FL270**
1975	14879 6.48	13371 6.02	11981 5.50	11352 5.38	10963 5.24	10582 5.08	103	89	88
2000	15055 6.54	13533 6.07	12127 5.55	11490 5.43	11097 5.29	10712 5.12	104	90	89
2025	15231 7.01	13695 6.12	12273 5.59	11627 5.47	11230 5.33	10842 5.16	106	91	90
2050	15407 7.07	13857 6.17	12419 6.04	11765 5.52	11363 5.37	10972 5.20	107	92	92
2075	15582 7.13	14018 6.22	12564 6.08	11903 5.56	11497 5.42	11102 5.24	109	93	93
2100	15758 7.20	14179 6.27	12710 6.13	12040 6.00	11630 5.46	11231 5.28	110	94	94
2125	15933 7.26	14341 6.32	12855 6.17	12177 6.05	11763 5.50	11360 5.32	112	95	95
2150	16107 7.33	14502 6.36	13000 6.22	12314 6.09	11895 5.55	11490 5.36	113	96	96
2175	16282 7.39	14662 6.41	13145 6.26	12451 6.14	12028 5.59	11619 5.40	115	98	98
2200	16456 7.46	14823 6.46	13290 6.30	12588 6.18	12160 6.03	11748 5.44	116	99	99
2225	16630 7.52	14983 6.51	13435 6.35	12724 6.22	12292 6.08	11877 5.47	118	100	100
2250	16804 7.59	15144 6.56	13579 6.39	12861 6.27	12424 6.12	12006 5.51	119	101	101
2275	16977 8.05	15304 7.01	13723 6.44	12997 6.31	12556 6.16	12133 5.55	120	102	102
2300	17150 8.12	15464 7.06	13868 6.48	13133 6.36	12688 6.21	12260 6.00	122	103	104
2325	17323 8.17	15623 7.11	14012 6.53	13269 6.40	12819 6.25	12388 6.04	123	104	105
2350	17495 8.23	15783 7.16	14156 6.57	13404 6.44	12950 6.29	12515 6.08	125	106	106
2375	17667 8.29	15942 7.21	14299 7.02	13540 6.49	13082 6.34	12641 6.12	126	107	107
2400	17839 8.34	16101 7.26	14443 7.06	13675 6.53	13213 6.38	12768 6.16	127	108	109
2425	18011 8.40	16260 7.31	14586 7.11	13810 6.58	13343 6.43	12895 6.20	129	109	110
2450	18182 8.46	16419 7.36	14730 7.15	13945 7.02	13474 6.47	13021 6.24	130	110	111
2475	18354 8.51	16578 7.42	14873 7.20	14080 7.07	13605 6.51	13147 6.29	131	111	112
2500	18524 8.57	16736 7.47	15016 7.24	14215 7.11	13735 6.56	13273 6.33	133	112	113
2525	18695 9.03	16895 7.52	15159 7.29	14350 7.16	13865 7.00	13399 6.37	134	114	115
2550	18866 9.09	17053 7.57	15302 7.33	14484 7.20	13995 7.05	13525 6.41	135	115	116
2575	19036 9.14	17211 8.02	15444 7.38	14619 7.24	14125 7.09	13651 6.45	137	116	117
2600	19206 9.20	17368 8.07	15587 7.42	14753 7.29	14255 7.13	13776 6.50	138	117	118

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

FLIP23D A320-214 CFM56-5B4/P SA3610 03301.000011 0250300 .7801 .00200 120 0300350 60 0 100 20 20 20 18590 FCOM-N0-03-05-20-011-170

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL **100**	**150**	**200**	**230**	**250**	**270**	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) **FL100 FL150**	**FL200 FL230**	**FL250 FL270**
2600	19206 9.20	17368 8.07	15587 7.42	14753 7.29	14255 7.13	13776 6.50	138	117	118
2625	19375 9.26	17525 8.12	15729 7.47	14887 7.33	14385 7.18	13902 6.54	139	118	120
2650	19545 9.32	17682 8.17	15871 7.51	15021 7.38	14514 7.22	14027 6.58	140	119	121
2675	19714 9.37	17839 8.22	16013 7.56	15154 7.42	14644 7.27	14152 7.02	142	120	122
2700	19883 9.43	17995 8.27	16155 8.00	15288 7.47	14773 7.31	14277 7.06	143	121	123
2725	20052 9.49	18152 8.32	16297 8.05	15421 7.51	14902 7.36	14402 7.11	144	123	125
2750	20220 9.55	18308 8.37	16438 8.09	15554 7.56	15031 7.40	14527 7.15	146	124	126
2775	20388 10.00	18464 8.42	16579 8.14	15688 8.00	15160 7.44	14651 7.19	147	125	127
2800	20557 10.06	18620 8.47	16721 8.18	15821 8.05	15288 7.49	14776 7.23	149	126	128
2825	20724 10.12	18776 8.52	16862 8.23	15953 8.09	15417 7.53	14900 7.28	150	127	130
2850	20892 10.18	18931 8.57	17003 8.27	16086 8.14	15545 7.58	15024 7.32	151	128	131
2875	21059 10.24	19086 9.02	17144 8.32	16218 8.18	15673 8.02	15148 7.36	153	129	132
2900	21226 10.30	19242 9.07	17286 8.36	16351 8.23	15802 8.07	15272 7.41	154	130	133
2925	21393 10.35	19397 9.12	17427 8.40	16483 8.27	15929 8.11	15396 7.45	155	131	135
2950	21560 10.41	19552 9.17	17569 8.45	16615 8.32	16057 8.16	15519 7.49	157	132	136
2975	21726 10.47	19706 9.22	17711 8.49	16747 8.36	16185 8.20	15643 7.53	158	134	137
3000	21892 10.53	19861 9.27	17853 8.54	16879 8.41	16312 8.25	15766 7.58	159	135	138
3025	22058 10.59	20015 9.33	17994 8.58	17010 8.45	16440 8.29	15889 8.02	160	136	139
3050	22224 11.05	20169 9.38	18135 9.02	17142 8.50	16567 8.34	16012 8.06	162	137	141
3075	22389 11.11	20323 9.43	18276 9.07	17273 8.55	16694 8.39	16135 8.11	163	138	142
3100	22553 11.17	20477 9.48	18418 9.11	17404 8.59	16821 8.43	16258 8.15	164	139	143

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

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R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
100	377 0.23	354 0.23	333 0.22	312 0.22	290 0.22		0	0	0
125	514 0.26	487 0.26	462 0.26	438 0.26	414 0.26	391 0.26	0	0	0
150	650 0.30	619 0.30	591 0.29	563 0.29	537 0.29	515 0.29	1	0	0
175	787 0.34	752 0.33	720 0.33	689 0.33	660 0.32	638 0.32	2	2	2
200	923 0.37	884 0.37	848 0.36	814 0.36	784 0.36	761 0.36	3	3	4
225	1059 0.41	1016 0.40	977 0.40	940 0.39	906 0.39	883 0.39	5	4	6
250	1195 0.45	1147 0.44	1105 0.43	1065 0.43	1029 0.42	1006 0.42	6	6	7
275	1331 0.48	1279 0.48	1233 0.47	1190 0.46	1151 0.46	1128 0.46	7	7	9
300	1466 0.52	1410 0.51	1361 0.50	1314 0.49	1274 0.49	1250 0.49	9	9	11
325	1601 0.56	1542 0.55	1489 0.54	1439 0.53	1396 0.52	1372 0.52	10	10	13
350	1737 0.59	1673 0.58	1617 0.57	1563 0.56	1517 0.56	1493 0.56	11	11	14
375	1872 1.03	1804 1.02	1744 1.01	1687 1.00	1639 0.59	1614 0.59	12	13	16
400	2006 1.07	1934 1.05	1871 1.04	1811 1.03	1760 1.02	1735 1.02	14	14	18
425	2141 1.11	2065 1.09	1998 1.08	1935 1.06	1882 1.06	1856 1.06	15	15	19
450	2275 1.14	2195 1.13	2125 1.11	2059 1.10	2003 1.09	1977 1.09	16	17	21
475	2409 1.18	2325 1.16	2252 1.15	2182 1.13	2124 1.12	2097 1.12	18	18	23
500	2543 1.22	2455 1.20	2378 1.18	2306 1.17	2244 1.16	2217 1.16	19	19	24
525	2677 1.25	2585 1.23	2504 1.22	2429 1.20	2365 1.19	2337 1.19	20	21	26
550	2811 1.29	2715 1.27	2631 1.25	2552 1.23	2485 1.23	2456 1.22	21	22	28
575	2944 1.33	2845 1.31	2757 1.29	2674 1.27	2606 1.26	2575 1.26	23	23	29
600	3078 1.37	2974 1.34	2882 1.32	2797 1.30	2726 1.29	2694 1.29	24	25	31
625	3211 1.40	3103 1.38	3008 1.36	2919 1.34	2845 1.33	2813 1.32	25	26	32
650	3344 1.44	3232 1.42	3133 1.39	3041 1.37	2965 1.36	2932 1.36	26	27	34
675	3477 1.48	3361 1.45	3259 1.43	3163 1.41	3084 1.39	3050 1.39	28	29	36
700	3609 1.51	3490 1.49	3384 1.46	3285 1.44	3204 1.43	3168 1.42	29	30	37
725	3742 1.55	3618 1.52	3509 1.50	3407 1.47	3323 1.46	3286 1.46	30	31	39

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

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R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)

TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	290	**310**	**330**	**350**	**370**	**390**	**FL290 FL310**	**FL330 FL350**	**FL370 FL390**
725	3742 1.55	3618 1.52	3509 1.50	3407 1.47	3323 1.46	3286 1.46	30	31	39
750	3874 1.59	3747 1.56	3634 1.53	3529 1.51	3442 1.49	3404 1.49	31	33	40
775	4006 2.03	3875 2.00	3758 1.57	3650 1.54	3560 1.53	3521 1.52	33	34	46
800	4138 2.06	4003 2.03	3883 2.00	3771 1.58	3679 1.56	3639 1.56	34	35	48
825	4270 2.10	4131 2.07	4007 2.04	3892 2.01	3797 1.59	3756 1.59	35	37	49
850	4401 2.14	4259 2.11	4131 2.07	4013 2.05	3916 2.03	3873 2.02	36	38	51
875	4533 2.18	4386 2.14	4255 2.11	4134 2.08	4034 2.06	3989 2.06	37	39	53
900	4664 2.21	4514 2.18	4379 2.14	4254 2.12	4152 2.09	4106 2.09	39	41	54
925	4795 2.25	4641 2.22	4502 2.18	4374 2.15	4269 2.13	4222 2.12	40	42	56
950	4926 2.29	4768 2.25	4626 2.22	4495 2.18	4387 2.16	4338 2.16	41	43	57
975	5057 2.33	4895 2.29	4749 2.25	4615 2.22	4504 2.20	4454 2.19	42	44	59
1000	5187 2.37	5022 2.33	4872 2.29	4735 2.25	4621 2.23	4569 2.22	43	46	60
1025	5318 2.40	5148 2.36	4995 2.32	4854 2.29	4738 2.26	4684 2.26	45	47	62
1050	5448 2.44	5275 2.40	5118 2.36	4974 2.32	4855 2.30	4800 2.29	46	48	63
1075	5578 2.48	5401 2.44	5241 2.39	5093 2.36	4972 2.33	4914 2.32	47	50	65
1100	5708 2.52	5527 2.47	5363 2.43	5212 2.39	5088 2.36	5029 2.36	48	51	66
1125	5838 2.55	5653 2.51	5485 2.46	5331 2.43	5205 2.40	5144 2.39	49	52	68
1150	5967 2.59	5779 2.55	5608 2.50	5450 2.46	5321 2.43	5258 2.42	51	53	69
1175	6097 3.03	5905 2.58	5730 2.54	5569 2.50	5437 2.46	5372 2.46	52	55	71
1200	6226 3.07	6031 3.02	5851 2.57	5688 2.53	5553 2.50	5486 2.49	53	56	72
1225	6355 3.11	6156 3.06	5973 3.01	5806 2.57	5668 2.53	5600 2.52	54	57	74
1250	6484 3.15	6281 3.10	6095 3.04	5924 3.00	5784 2.57	5713 2.56	55	58	75
1275	6613 3.18	6406 3.13	6216 3.08	6043 3.04	5899 3.00	5826 2.59	57	60	77
1300	6741 3.22	6531 3.17	6337 3.12	6160 3.07	6015 3.03	5940 3.02	58	61	78
1325	6870 3.26	6656 3.21	6458 3.15	6278 3.10	6130 3.07	6052 3.06	59	62	79
1350	6998 3.30	6781 3.24	6579 3.19	6396 3.14	6245 3.10	6165 3.09	60	63	81

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

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R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
1350	6998 3.30	6781 3.24	6579 3.19	6396 3.14	6245 3.10	6165 3.09	60	63	81
1375	7126 3.34	6905 3.28	6700 3.22	6513 3.17	6359 3.13	6278 3.12	61	65	82
1400	7254 3.37	7029 3.32	6821 3.26	6631 3.21	6474 3.17	6390 3.16	62	66	84
1425	7382 3.41	7153 3.36	6941 3.30	6748 3.24	6588 3.20	6502 3.19	63	67	85
1450	7510 3.45	7277 3.39	7061 3.33	6865 3.28	6702 3.24	6614 3.22	64	68	86
1475	7638 3.49	7401 3.43	7181 3.37	6982 3.31	6817 3.27	6726 3.26	66	70	88
1500	7765 3.53	7524 3.47	7301 3.40	7099 3.35	6930 3.30	6837 3.29	67	71	89
1525	7893 3.56	7648 3.51	7421 3.44	7215 3.38	7044 3.34	6949 3.32	68	72	91
1550	8020 4.00	7771 3.54	7540 3.48	7332 3.42	7158 3.37	7060 3.36	69	73	92
1575	8147 4.04	7894 3.58	7659 3.51	7448 3.45	7271 3.41	7171 3.39	70	75	93
1600	8274 4.08	8017 4.02	7779 3.55	7564 3.49	7384 3.44	7282 3.42	71	76	95
1625	8400 4.12	8140 4.05	7898 3.59	7680 3.53	7497 3.47	7393 3.46	72	77	96
1650	8527 4.16	8262 4.09	8016 4.02	7796 3.56	7610 3.51	7503 3.49	74	78	97
1675	8653 4.20	8385 4.13	8135 4.06	7912 4.00	7723 3.54	7614 3.52	75	80	99
1700	8780 4.23	8507 4.17	8254 4.10	8028 4.03	7836 3.58	7724 3.56	76	81	100
1725	8906 4.27	8629 4.21	8372 4.13	8143 4.07	7948 4.01	7834 3.59	77	82	101
1750	9032 4.31	8751 4.24	8490 4.17	8258 4.10	8061 4.04	7944 4.02	78	83	103
1775	9158 4.35	8873 4.28	8608 4.20	8374 4.14	8173 4.08	8054 4.06	79	85	104
1800	9283 4.39	8995 4.32	8726 4.24	8489 4.17	8285 4.11	8163 4.09	80	86	105
1825	9409 4.43	9116 4.36	8844 4.28	8604 4.21	8397 4.15	8273 4.12	81	87	106
1850	9534 4.46	9237 4.39	8962 4.31	8718 4.24	8509 4.18	8382 4.16	82	88	108
1875	9660 4.50	9359 4.43	9079 4.35	8833 4.28	8620 4.22	8491 4.19	83	90	109
1900	9785 4.54	9480 4.47	9197 4.39	8947 4.31	8732 4.25	8600 4.23	85	91	110
1925	9910 4.58	9601 4.51	9314 4.42	9062 4.35	8843 4.29	8708 4.26	86	92	112
1950	10035 5.02	9722 4.54	9431 4.46	9176 4.38	8954 4.32	8817 4.29	87	93	113
1975	10159 5.06	9842 4.58	9548 4.50	9290 4.42	9065 4.35	8925 4.33	88	95	114

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

FLIP23D A320-214 CFM56-5B4/P SA3610 03301.000011 0250300 .7801 .00200 120 0300350 60 0 100 20 20 20 18590 FCOM-N0-03-05-20-015-170

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 60000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 290	310	330	350	370	390	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL290 FL310	FL330 FL350	FL370 FL390
1975	10159 5.06	9842 4.58	9548 4.50	9290 4.42	9065 4.35	8925 4.33	88	95	114
2000	10284 5.10	9963 5.02	9665 4.54	9404 4.46	9176 4.39	9033 4.36	89	96	115
2025	10408 5.14	10083 5.06	9781 4.57	9518 4.49	9287 4.42	9141 4.39	90	97	117
2050	10533 5.17	10203 5.10	9898 5.01	9631 4.53	9397 4.46	9249 4.43	91	98	118
2075	10657 5.21	10323 5.13	10014 5.05	9745 4.56	9508 4.49	9357 4.46	92	100	119
2100	10781 5.25	10443 5.17	10130 5.08	9858 5.00	9618 4.53	9464 4.49	93	101	120
2125	10904 5.29	10563 5.21	10246 5.12	9971 5.03	9728 4.56	9572 4.53	94	102	121
2150	11028 5.33	10683 5.25	10362 5.16	10084 5.07	9838 5.00	9679 4.56	95	103	123
2175	11152 5.37	10802 5.29	10478 5.19	10197 5.10	9948 5.03	9786 4.59	96	105	124
2200	11275 5.41	10922 5.33	10593 5.23	10310 5.14	10058 5.06	9893 5.03	97	106	125
2225	11398 5.45	11041 5.36	10709 5.27	10423 5.18	10168 5.10	10000 5.06	98	107	126
2250	11522 5.49	11160 5.40	10824 5.31	10535 5.21	10277 5.13	10106 5.09	99	108	127
2275	11645 5.53	11279 5.44	10939 5.34	10648 5.25	10386 5.17	10212 5.13	100	109	129
2300	11767 5.56	11398 5.48	11054 5.38	10760 5.28	10496 5.20	10319 5.16	101	111	130
2325	11890 6.00	11517 5.52	11169 5.42	10872 5.32	10605 5.24	10425 5.19	103	112	131
2350	12013 6.04	11635 5.56	11284 5.45	10984 5.36	10713 5.27	10531 5.23	104	113	132
2375	12136 6.08	11754 5.59	11399 5.49	11096 5.39	10822 5.31	10636 5.26	105	114	133
2400	12259 6.12	11872 6.03	11513 5.53	11208 5.43	10931 5.34	10742 5.29	106	115	134
2425	12383 6.16	11990 6.07	11628 5.57	11319 5.46	11039 5.38	10847 5.33	107	117	136
2450	12506 6.20	12108 6.11	11742 6.00	11431 5.50	11148 5.41	10953 5.36	108	118	137
2475	12629 6.23	12225 6.15	11856 6.04	11542 5.53	11256 5.45	11058 5.39	109	119	138
2500	12751 6.27	12342 6.19	11970 6.08	11654 5.57	11364 5.48	11163 5.43	110	120	139
2525	12874 6.31	12460 6.22	12084 6.12	11765 6.01	11472 5.52	11268 5.46	111	121	140
2550	12997 6.35	12577 6.26	12197 6.15	11876 6.04	11580 5.55	11372 5.49	112	122	141
2575	13119 6.39	12693 6.30	12311 6.19	11986 6.08	11688 5.59	11477 5.53	113	123	142
2600	13241 6.43	12810 6.34	12425 6.23	12097 6.11	11795 6.02	11581 5.56	114	125	144

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

FLIP23D A320-214 CFM56-5B4/P SA3610 03301.000011 0250300 .7801 .00200 120 0300350 60 0 100 20 20 20 18590 FCOM-N0-03-05-20-016-170

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 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	13241 6.43	12810 6.34	12425 6.23	12097 6.11	11795 6.02	11581 5.56	114	125	144
2625	13364 6.46	12927 6.38	12538 6.27	12207 6.15	11903 6.06	11685 5.59	115	126	145
2650	13486 6.50	13043 6.42	12651 6.30	12317 6.19	12010 6.09	11789 6.03	116	127	146
2675	13608 6.54	13160 6.46	12764 6.34	12426 6.22	12117 6.13	11893 6.06	117	128	147
2700	13730 6.58	13276 6.50	12877 6.38	12536 6.26	12224 6.16	11997 6.09	118	129	148
2725	13851 7.02	13392 6.54	12990 6.42	12645 6.30	12330 6.20	12101 6.13	119	130	149
2750	13973 7.06	13508 6.57	13103 6.46	12755 6.33	12437 6.23	12205 6.16	120	131	150
2775	14095 7.09	13623 7.01	13216 6.49	12864 6.37	12543 6.27	12308 6.20	121	133	151
2800	14216 7.13	13739 7.05	13328 6.53	12973 6.41	12649 6.30	12412 6.23	122	134	152
2825	14337 7.17	13855 7.09	13441 6.57	13082 6.44	12755 6.34	12516 6.26	123	135	154
2850	14459 7.21	13970 7.13	13553 7.01	13190 6.48	12861 6.37	12619 6.30	124	136	155
2875	14580 7.25	14085 7.17	13665 7.04	13299 6.52	12967 6.41	12722 6.33	125	137	156
2900	14701 7.29	14200 7.21	13777 7.08	13408 6.55	13072 6.44	12825 6.36	126	138	157
2925	14822 7.32	14315 7.25	13889 7.12	13516 6.59	13178 6.48	12928 6.40	127	139	158
2950	14943 7.36	14430 7.29	14001 7.16	13624 7.03	13283 6.51	13031 6.43	128	140	159
2975	15063 7.40	14545 7.33	14112 7.20	13732 7.07	13389 6.55	13134 6.47	129	142	160
3000	15184 7.44	14659 7.36	14224 7.23	13840 7.10	13494 6.58	13237 6.50	130	143	161
3025	15304 7.48	14774 7.40	14335 7.27	13948 7.14	13599 7.02	13339 6.53	131	144	162
3050	15425 7.52	14888 7.44	14446 7.31	14056 7.18	13704 7.06	13441 6.57	132	145	164
3075	15545 7.55	15002 7.48	14557 7.35	14164 7.21	13808 7.09	13544 7.00	133	146	165
3100	15665 7.59	15117 7.52	14669 7.39	14271 7.25	13913 7.13	13646 7.04	134	147	166

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 0.5 %	△FUEL = + 3 %	△FUEL = + 6 %

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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
46	45.6 890	47.9 873	51.1 839	54.0 813	57.5 794	58.9 789	60.6 787	63.5 784
48	46.5 926	48.9 908	52.1 871	55.1 844	58.4 828	59.9 823	61.7 821	64.7 818
50	47.4 962	49.8 940	53.0 901	56.2 876	59.4 861	61.0 859	62.8 855	65.8 851
52	48.3 997	50.6 971	53.9 931	57.3 908	60.3 896	62.0 892	63.9 889	66.7 884
54	49.2 1033	51.4 1002	54.9 963	58.3 942	61.3 931	63.0 926	65.0 924	67.7 916
56	50.1 1065	52.2 1033	55.8 994	59.1 975	62.2 964	64.0 960	66.1 955	68.6 949
58	50.8 1097	52.9 1063	56.8 1026	59.9 1008	63.2 997	65.1 994	66.9 988	69.5 982
60	51.5 1128	53.7 1094	57.7 1059	60.7 1043	64.1 1031	66.1 1026	67.7 1021	70.4 1016
62	52.2 1158	54.5 1125	58.7 1092	61.6 1078	65.1 1065	66.9 1058	68.6 1054	71.2 1049
64	52.9 1189	55.3 1156	59.4 1126	62.4 1110	66.0 1097	67.7 1091	69.4 1087	72.1 1084
66	53.6 1219	56.1 1188	60.1 1159	63.2 1143	67.0 1129	68.5 1124	70.3 1120	72.9 1119
68	54.3 1250	56.9 1221	60.9 1193	64.1 1176	67.7 1162	69.3 1157	71.1 1154	73.7 1155
70	55.0 1282	57.8 1254	61.6 1228	64.9 1210	68.4 1195	70.1 1191	71.8 1188	74.6 1192
72	55.8 1314	58.6 1287	62.3 1261	65.7 1243	69.2 1228	70.8 1224	72.5 1223	75.4 1230
74	56.5 1347	59.4 1321	63.1 1294	66.6 1275	69.9 1262	71.6 1258	73.3 1258	76.1 1269
76	57.2 1380	60.2 1355	63.8 1327	67.4 1307	70.6 1296	72.3 1292	74.0 1295	76.9 1309
78	58.0 1413	60.8 1389	64.5 1360	68.2 1339	71.3 1330	73.0 1328	74.8 1332	77.6 1350

LOW AIR CONDITIONING	ENGINE ANTI ICE ON	TOTAL ANTI ICE ON	PER 1° ABOVE ISA	STRAIGHT LINE
△FF = – 0.3 %	△FF = + 5 %	△FF = + 9 %	△FF = + 0.3 %	△FF = – 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**
46	47.7 962	50.1 930	53.3 890	56.6 871	59.6 854	61.2 845	62.9 835	65.7 825
48	48.2 984	50.5 951	53.8 912	57.2 892	60.2 876	61.8 868	63.6 858	66.3 848
50	48.8 1006	51.0 972	54.4 934	57.9 915	60.8 899	62.5 891	64.3 882	66.9 873
52	49.4 1029	51.6 995	55.1 957	58.5 938	61.5 924	63.2 914	65.1 908	67.5 899
54	50.0 1054	52.1 1019	55.8 982	59.1 964	62.1 950	63.9 941	65.9 934	68.2 927
56	50.6 1079	52.7 1044	56.5 1008	59.7 990	62.8 976	64.7 969	66.5 962	68.9 955
58	51.1 1105	53.3 1070	57.2 1035	60.3 1018	63.5 1004	65.4 997	67.2 991	69.6 985
60	51.7 1131	53.9 1097	57.9 1063	60.9 1047	64.3 1034	66.3 1026	67.8 1022	70.4 1016
62	52.2 1159	54.5 1125	58.7 1093	61.6 1078	65.1 1065	67.0 1058	68.6 1053	71.2 1048
64	52.8 1187	55.2 1155	59.3 1124	62.3 1109	65.9 1097	67.6 1091	69.3 1086	71.9 1082
66	53.5 1217	56.0 1185	60.0 1156	63.1 1141	66.8 1129	68.4 1125	70.1 1121	72.7 1118
68	54.1 1248	56.7 1217	60.6 1189	63.8 1175	67.5 1164	69.1 1160	70.8 1156	73.6 1154
70	54.8 1279	57.5 1250	61.3 1223	64.6 1210	68.2 1200	69.8 1196	71.6 1193	74.4 1192
72	55.4 1312	58.2 1283	62.0 1258	65.4 1247	68.9 1238	70.6 1234	72.4 1231	75.2 1232
74	56.1 1345	59.0 1318	62.7 1293	66.3 1283	69.6 1276	71.4 1272	73.2 1271	76.0 1275
76	56.9 1381	59.8 1354	63.4 1330	67.1 1321	70.4 1315	72.2 1313	74.0 1312	76.8 1319
78	57.6 1416	60.4 1391	64.2 1369	67.9 1360	71.2 1356	73.0 1355	74.9 1354	77.5 1351
LOW AIR CONDITIONING △FF = – 0.3 %	**ENGINE ANTI ICE ON** △FF = + 5 %		**TOTAL ANTI ICE ON** △FF = + 9 %		**PER 1° ABOVE ISA** △FF = + 0.3 %		**STRAIGHT LINE** △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
46	47.1 936	49.6 914	52.6 885	54.1 874	55.8 864	57.5 858	58.9 854	60.5 850
48	48.1 972	50.4 950	53.6 921	55.2 909	57.0 901	58.5 897	59.9 891	61.6 888
50	49.1 1008	51.2 986	54.7 955	56.3 945	58.0 940	59.4 934	61.0 929	62.7 926
52	50.0 1045	52.1 1022	55.7 991	57.4 983	58.9 977	60.4 971	62.0 966	63.8 964
54	50.8 1081	52.9 1058	56.7 1028	58.4 1022	59.8 1014	61.3 1008	63.0 1004	65.0 1003
56	51.5 1118	53.8 1094	57.7 1066	59.2 1058	60.7 1052	62.3 1045	64.1 1043	66.1 1040
58	52.3 1154	54.6 1131	58.7 1104	60.0 1095	61.6 1088	63.2 1083	65.1 1081	67.0 1078
60	53.0 1190	55.5 1166	59.5 1140	60.9 1132	62.4 1125	64.2 1121	66.2 1118	67.8 1115
62	53.8 1227	56.3 1202	60.2 1177	61.7 1169	63.3 1162	65.2 1160	67.1 1156	68.7 1152
64	54.6 1264	57.2 1240	61.0 1214	62.5 1205	64.2 1200	66.2 1197	67.9 1193	69.5 1190
66	55.3 1300	58.1 1277	61.8 1250	63.4 1242	65.1 1238	67.1 1234	68.7 1231	70.4 1227
68	56.1 1336	58.9 1313	62.5 1286	64.2 1280	66.1 1275	67.9 1272	69.5 1268	71.2 1265
70	56.8 1373	59.7 1349	63.3 1322	65.0 1318	67.0 1313	68.6 1309	70.3 1306	72.0 1303
72	57.6 1410	60.4 1385	64.1 1359	65.9 1355	67.8 1351	69.3 1347	71.0 1343	72.8 1342
74	58.4 1447	61.0 1421	64.9 1397	66.7 1392	68.5 1389	70.1 1385	71.8 1382	73.6 1381
76	59.1 1482	61.7 1457	65.6 1435	67.6 1430	69.2 1427	70.8 1423	72.5 1421	74.4 1418
78	59.9 1517	62.3 1493	66.4 1472	68.3 1468	69.9 1465	71.5 1461	73.3 1460	75.1 1456

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**	**PER 1° ABOVE ISA**	**STRAIGHT LINE**
△FF = – 0.3 %	△FF = + 5 %	△FF = + 9 %	△FF = + 0.3 %	△FF = – 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
46	47.2 941	49.6 920	52.7 887	54.1 875	55.8 865	57.5 856	58.9 849	60.5 845
48	48.1 974	50.4 952	53.6 921	55.2 909	56.9 901	58.4 894	59.9 887	61.6 884
50	49.1 1009	51.2 986	54.6 955	56.3 945	58.0 940	59.4 933	60.9 928	62.7 925
52	50.1 1045	52.1 1021	55.7 992	57.5 984	58.9 980	60.4 975	62.0 969	63.9 968
54	50.9 1081	53.0 1058	56.8 1032	58.5 1025	59.9 1023	61.4 1017	63.1 1013	65.1 1012
56	51.7 1119	53.9 1096	58.0 1073	59.4 1068	60.9 1067	62.5 1061	64.3 1059	66.3 1056
58	52.6 1158	54.9 1136	59.0 1116	60.3 1113	61.9 1111	63.6 1108	65.5 1105	67.3 1102
60	53.4 1199	55.9 1177	59.9 1162	61.3 1159	62.9 1159	64.7 1156	66.7 1152	68.3 1150
62	54.4 1241	57.0 1221	60.8 1209	62.3 1206	64.0 1208	65.9 1205	67.7 1201	69.4 1199
64	55.3 1284	58.1 1267	61.8 1257	63.4 1256	65.2 1259	67.1 1254	68.7 1252	70.5 1251
66	56.3 1329	59.2 1314	62.8 1307	64.5 1310	66.4 1312	68.1 1309	69.8 1307	71.6 1308
68	57.3 1376	60.1 1364	63.8 1363	65.6 1365	67.5 1368	69.1 1366	70.9 1365	72.7 1367
70	58.4 1428	61.0 1419	64.9 1420	66.7 1421	68.5 1423	70.1 1421	72.0 1421	73.9 1422
72	59.4 1481	61.9 1473	66.0 1472	67.9 1472	69.4 1476	71.2 1475	73.1 1476	75.1 1479
74	60.4 1532	62.8 1524	67.1 1525	68.8 1527	70.5 1532	72.3 1533	74.2 1535	76.2 1542
76	61.3 1584	63.8 1577	68.3 1583	69.9 1589	71.6 1598	73.4 1600	75.5 1604	77.4 1613
78	62.2 1639	64.9 1638	69.3 1648	71.0 1655	72.8 1666	74.7 1668	76.7 1675	78.7 1685

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**	**PER 1° ABOVE ISA**	**STRAIGHT LINE**
△FF = – 0.3 %	△FF = + 5 %	△FF = + 9 %	△FF = + 0.3 %	△FF = – 5 %

GENERAL

Descent tables are established for normal descent speed M.78/300kt/250kt and emergency descent at MMO/VMO with airbrakes extended, down to 1500 feet with :
· Normal air conditioning
· CG = 33 %
· Anti ice OFF
For normal descent, cabin vertical speed is limited to 350 feet/minute.

R

DESCENT - M.78/300KT/250KT									
IDLE THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF			ISA CG=33.0%		MAXIMUM CABIN RATE OF DESCENT 350FT/MIN				
WEIGHT (1000KG)	45				65				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
390	16.1	204	101	68.8	17.4	165	106	IDLE	241
370	14.6	174	89	69.9	16.7	160	100	IDLE	252
350	12.9	134	77	72.1	16.0	156	95	IDLE	264
330	12.0	119	70	IDLE	15.4	153	91	IDLE	277
310	11.6	117	67	IDLE	14.8	149	86	IDLE	289
290	11.1	114	64	IDLE	14.2	145	82	IDLE	300
270	10.6	110	59	IDLE	13.4	141	76	IDLE	300
250	10.0	107	55	IDLE	12.7	136	71	IDLE	300
240	9.7	105	53	IDLE	12.3	133	68	IDLE	300
220	9.1	100	49	IDLE	11.5	127	62	IDLE	300
200	8.5	94	45	IDLE	10.6	119	56	IDLE	300
180	7.8	86	40	IDLE	9.8	109	51	IDLE	300
160	7.1	78	36	IDLE	8.8	97	45	IDLE	300
140	6.3	67	31	IDLE	7.9	83	39	IDLE	300
120	5.6	57	27	IDLE	6.9	70	33	IDLE	300
100	4.9	48	23	IDLE	6.0	58	28	IDLE	300
50	1.7	15	7	IDLE	2.1	18	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	–	+ 6 %	+ 6 %	–
FUEL	– 2 %	+ 28 %	+ 44 %	+ 0.2 %
DISTANCE	–	+ 3 %	+ 4 %	+ 0.3 %

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R

EMERGENCY DESCENT - M.82/350KT

IDLE THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF			ISA CG=33.0%		**AIRBRAKES EXTENDED**				
WEIGHT (1000KG)	**45**				**65**				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
390	4.8	48	34	IDLE	6.6	66	47	IDLE	255
370	4.5	46	32	IDLE	6.2	64	44	IDLE	267
350	4.3	45	30	IDLE	5.9	62	42	IDLE	279
330	4.0	43	28	IDLE	5.6	60	40	IDLE	292
310	3.8	42	27	IDLE	5.3	59	38	IDLE	306
290	3.6	41	25	IDLE	5.1	57	35	IDLE	319
270	3.4	40	24	IDLE	4.8	56	33	IDLE	333
250	3.3	38	22	IDLE	4.6	54	32	IDLE	347
240	3.2	38	21	IDLE	4.5	53	31	IDLE	350
220	2.9	36	20	IDLE	4.1	51	28	IDLE	350
200	2.7	33	18	IDLE	3.8	47	25	IDLE	350
180	2.4	30	16	IDLE	3.4	42	22	IDLE	350
160	2.2	27	14	IDLE	3.1	38	20	IDLE	350
140	1.9	23	12	IDLE	2.7	32	17	IDLE	350
120	1.6	19	10	IDLE	2.3	26	14	IDLE	350
100	1.4	15	8	IDLE	1.9	21	12	IDLE	350
50	.7	7	4	IDLE	1.0	9	6	IDLE	350
0	.0	0	0	IDLE	.0	0	0	IDLE	350

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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 pages allow 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).*

R 2. *When icing conditions are predicted during the flight and TAT is 10°C or below 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 4.5 %.*
   - *in CONF FULL, the approach speed must not be lower than VREF + 5 knots and the landing distance must be multiplied by 1.1.*
     or
     in CONF 3, the approach speed must not be lower than VLS + 10 knots and the landing distance must be multiplied by 1.15.

3. *In the following tables corrections for anti ice are only valid for OAT lower than 10°C.*

APPROACH CLIMB LIMITING WEIGHT (1000 KG) ONE ENGINE OUT ONE ENGINE AT GO AROUND THRUST	Gradient : 2.1% High Air Conditioning Anti ice OFF V = 1.23 Vs	CONF 2

R

OAT (°C)	PRESSURE ALTITUDE (FT) −2000	0	200	400	600	800	1000	1500	2000	5000	10000	14100
≤ 10	84.6	83.7	83.4	83.2	83.0	82.7	82.5	81.9	81.4	81.7	71.2	61.0
20	84.2	83.3	83.1	82.9	82.6	82.4	82.2	81.7	81.1	81.4	67.5	55.0
22	84.2	83.3	83.1	82.8	82.6	82.4	82.1	81.6	81.1	81.4	66.3	54.2
24	84.1	83.2	83.0	82.8	82.5	82.3	82.1	81.5	81.0	80.9	65.0	
26	84.1	83.2	82.9	82.7	82.5	82.3	82.0	81.5	81.0	80.0	64.0	
28	84.0	83.1	82.9	82.7	82.4	82.2	82.0	81.5	80.9	79.0	63.0	
30	83.9	83.1	82.8	82.6	82.4	82.1	81.9	81.4	80.9	78.1	62.0	
32	83.9	83.0	82.8	82.6	82.3	82.1	81.9	81.4	80.8	77.1	61.0	
34	83.8	83.0	82.8	82.5	82.3	82.1	81.9	81.3	80.8	76.2	60.0	
36	83.8	83.0	82.7	82.5	82.3	82.1	81.8	81.3	80.8	74.9		
38	83.7	82.9	82.7	82.5	82.3	82.0	81.8	81.3	80.8	73.4		
40	83.7	82.9	82.7	82.5	82.3	82.0	81.8	81.3	80.7	71.7		
42	83.7	82.9	82.7	82.5	82.2	82.0	81.7	80.3	78.8	70.0		
44	83.6	82.8	82.2	81.6	81.1	80.5	79.9	78.5	77.0	68.3		
46	83.6	81.0	80.4	79.8	79.3	78.7	78.1	76.7	75.6			
48	83.5	79.1	78.6	78.0	77.4	76.9	76.4	75.3	74.1			
50	81.5	77.3	76.8	76.3	75.9	75.4	75.0	73.8	72.5			
52	79.6	75.8	75.3	74.8	74.4	73.9	73.5	72.2				
54	77.7	74.2	73.8	73.3								
55	76.8	73.5										

AIR CONDITIONING OFF ADD	ENGINE ANTI ICE ON SUBTRACT	TOTAL ANTI ICE ON SUBTRACT	SPEED INCREASE PER 0.01 Vs ADD
1400 kg	900 kg up to 10000 ft 3600 kg above 10000 ft	1100 kg up to 5000 ft 7000 kg above 5000 ft	200 kg

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 3

R

OAT (°C)	PRESSURE ALTLTITUDE (FT) –2000	0	200	400	600	800	1000	1500	2000	5000	10000	14100
≤10	84.4	83.5	83.2	83.0	82.7	82.5	82.3	81.7	81.2	81.4	70.3	60.3
20	84.0	83.1	82.9	82.7	82.4	82.2	82.0	81.4	80.9	81.2	66.7	54.3
22	84.0	83.1	82.8	82.6	82.4	82.2	81.9	81.4	80.8	81.1	65.5	53.4
24	83.9	83.0	82.8	82.6	82.3	82.1	81.9	81.3	80.8	80.7	64.2	
26	83.9	83.0	82.7	82.5	82.3	82.0	81.8	81.3	80.7	79.7	63.3	
28	83.8	82.9	82.7	82.5	82.2	82.0	81.8	81.2	80.7	78.8	62.3	
30	83.7	82.9	82.6	82.4	82.2	81.9	81.7	81.2	80.7	77.8	61.3	
32	83.7	82.8	82.6	82.4	82.1	81.9	81.7	81.2	80.6	76.9	60.3	
34	83.6	82.8	82.6	82.3	82.1	81.9	81.7	81.1	80.6	76.0	59.3	
36	83.6	82.8	82.5	82.3	82.1	81.8	81.6	81.1	80.6	74.5		
38	83.5	82.7	82.5	82.3	82.1	81.8	81.6	81.1	80.6	72.7		
40	83.5	82.7	82.5	82.3	82.0	81.8	81.6	81.1	80.5	70.9		
42	83.5	82.7	82.5	82.2	82.0	81.8	81.5	80.1	78.6	69.2		
44	83.4	82.6	82.0	81.4	80.9	80.3	79.7	78.3	76.9	67.6		
46	83.4	80.8	80.2	79.6	79.1	78.5	77.9	76.6	75.2			
48	83.3	78.9	78.4	77.8	77.3	76.7	76.2	74.9	73.6			
50	81.3	77.1	76.6	76.1	75.6	75.1	74.6	73.2	71.8			
52	79.4	75.5	75.0	74.4	73.9	73.4	72.8	71.4				
54	77.5	73.8	73.2	72.7								
55	76.6	72.8										

AIR CONDITIONING OFF ADD 1400 kg	ENGINE ANTI ICE ON SUBTRACT 900 kg up to 10000 ft 3600 kg above 10000 ft	TOTAL ANTI ICE ON SUBTRACT 1100 kg up to 5000 ft 6900 kg above 5000 ft	SPEED INCREASE PER 0.01 Vs ADD 170 kg

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

R

PRESSURE ALTITUDE (FT)												
OAT (°C)	–2000	0	200	400	600	800	1000	1500	2000	5000	10000	14100
≤ 10	83.0	82.1	81.9	81.6	81.4	81.2	80.9	80.4	79.8	80.1	69.3	59.5
20	82.7	81.8	81.6	81.3	81.1	80.9	80.7	80.1	79.6	79.8	65.8	53.6
22	82.6	81.7	81.5	81.3	81.0	80.8	80.6	80.1	79.5	79.8	64.6	52.8
24	82.6	81.7	81.4	81.2	81.0	80.8	80.5	80.0	79.4	79.3	63.4	
26	82.5	81.6	81.4	81.2	80.9	80.7	80.5	80.0	79.4	78.4	62.4	
28	82.4	81.6	81.3	81.1	80.9	80.7	80.4	79.9	79.4	77.5	61.4	
30	82.4	81.5	81.3	81.1	80.8	80.6	80.4	79.9	79.3	76.7	60.5	
32	82.3	81.5	81.3	81.0	80.8	80.6	80.4	79.9	79.3	75.9	59.5	
34	82.3	81.4	81.2	81.0	80.8	80.5	80.3	79.8	79.3	74.9	58.5	
36	82.2	81.4	81.2	81.0	80.7	80.5	80.3	79.8	79.3	73.3		
38	82.2	81.4	81.2	81.0	80.7	80.5	80.3	79.8	79.3	71.6		
40	82.2	81.4	81.1	80.9	80.7	80.5	80.3	79.8	79.2	69.8		
42	82.1	81.3	81.1	80.9	80.7	80.4	80.2	78.8	77.4	68.2		
44	82.1	81.2	80.7	80.1	79.6	79.0	78.5	77.0	75.8	66.6		
46	82.0	79.5	78.9	78.4	77.8	77.3	76.8	75.5	74.1			
48	81.9	77.7	77.2	76.7	76.2	75.7	75.2	73.8	72.4			
50	80.0	76.1	75.6	75.1	74.5	74.0	73.4	72.1	70.7			
52	78.2	74.4	73.8	73.3	72.8	72.2	71.7	70.4				
54	76.4	72.6	72.1	71.6								
55	75.6	71.7										

AIR CONDITIONING OFF ADD 1400 kg	ENGINE ANTI ICE ON SUBTRACT 900 kg up to 10000 ft 3500 kg above 10000 ft	TOTAL ANTI ICE ON SUBTRACT 1000 kg up to 5000 ft 6700 kg above 5000 ft

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APPROACH CLIMB LIMITING WEIGHT (1000 KG) ONE ENGINE OUT ONE ENGINE AT GO AROUND THRUST	Gradient : 2.5% High Air Conditioning Anti ice OFF	CAT II CONF 3

R

OAT (°C)	PRESSURE ALTITUDE (FT) –2000	0	200	400	600	800	1000	1500	2000	5000	10000	14100
≤ 10	81.1	80.2	80.0	79.7	79.5	79.3	79.0	78.5	78.0	78.2	67.5	58.0
20	80.8	79.9	79.7	79.4	79.2	79.0	78.8	78.2	77.7	78.0	64.1	52.3
22	80.7	79.8	79.6	79.4	79.1	78.9	78.7	78.2	77.7	77.9	63.0	51.5
24	80.6	79.8	79.5	79.3	79.1	78.9	78.6	78.1	77.6	77.5	61.8	
26	80.6	79.7	79.5	79.3	79.0	78.8	78.6	78.1	77.6	76.6	60.9	
28	80.5	79.7	79.4	79.2	79.0	78.8	78.5	78.0	77.5	75.8	60.0	
30	80.4	79.6	79.4	79.2	79.0	78.7	78.5	78.0	77.5	74.9	59.0	
32	80.4	79.6	79.4	79.1	78.9	78.7	78.5	78.0	77.4	74.0	58.1	
34	80.4	79.5	79.3	79.1	78.9	78.7	78.4	77.9	77.4	73.0	57.1	
36	80.3	79.5	79.3	79.1	78.9	78.6	78.4	77.9	77.4	71.5		
38	80.3	79.5	79.3	79.1	78.8	78.6	78.4	77.9	77.4	69.9		
40	80.2	79.5	79.3	79.0	78.8	78.6	78.4	77.9	77.3	68.2		
42	80.2	79.5	79.2	79.0	78.8	78.5	78.3	77.0	75.7	66.6		
44	80.2	79.4	78.8	78.3	77.7	77.2	76.7	75.4	74.0	65.1		
46	80.1	77.6	77.1	76.6	76.1	75.6	75.1	73.7	72.3			
48	80.0	76.0	75.5	75.0	74.4	73.9	73.4	72.0	70.7			
50	78.2	74.3	73.8	73.3	72.8	72.2	71.7	70.4	69.1			
52	76.4	72.6	72.1	71.6	71.1	70.6	70.0	68.7				
54	74.7	70.9	70.4	69.9								
55	73.8	70.1										

AIR CONDITIONING OFF ADD	ENGINE ANTI ICE ON SUBTRACT	TOTAL ANTI ICE ON SUBTRACT
1300 kg	900 kg up to 10000 ft 3400 Kg above 10000 ft	1000 kg up to 5000 ft 6600 kg above 5000 ft

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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 : 100 kg or 220 lb
- Climb profile : 250KT/300KT/M.78
- Long range cruise
- Descent profile : M.78/300KT/250KT
- Approach and landing at alternate airport : 80 kg or 180 lb (4 min)
- ISA
- CG : 33 %
- Normal air conditioning
- Anti ice off

Note : 1. *In the tables, a "*" means that a step climb of 4000 feet has been made to reach the corresponding flight level.*
2. *The flight level shown on the top of each column is the final flight level.*
3. *For each degree Celcius above ISA temperature apply a fuel correction of 0.015 (kg/°C/NM) × $\triangle$ISA (°C) × Air Distance (NM) or 0.033 (lb/°C/NM) × $\triangle$ISA (°C) × Air Distance (NM)*

CORRECTION FOR DEVIATION FROM REFERENCE WEIGHT

The alternate planning tables are based on a reference landing weight at destination.
The fuel consumption must be corrected when the landing weight is different from the reference landing weight.
If it is lower (or greater) than the reference weight, subtract (or add) the value given in the correction part of the table per 1000 kg or 1000 lb below (or above) the reference weight.

R

ALTERNATE PLANNING FROM DESTINATION TO ALTERNATE AIRPORT
GO-AROUND 100 KG - CLIMB 250KT/300KT/M.78 - CRUISE LONG RANGE
DESCENT M.78/300KT/250KT - VMC PROCEDURE 80 KG (4MIN)

REF. LDG WT AT DEST. = 55000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 100	120	140	160	180	200	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL120	FL140 FL160	FL180 FL200
50	599 0.14	585 0.14					3		
100	986 0.23	955 0.23	943 0.23	937 0.23	934 0.23	937 0.22	6	5	6
150	1373 0.33	1325 0.33	1298 0.32	1276 0.31	1258 0.31	1247 0.31	8	8	8
200	1762 0.42	1697 0.42	1653 0.41	1616 0.40	1582 0.40	1559 0.40	11	10	11
250	2152 0.51	2070 0.51	2009 0.50	1957 0.49	1907 0.49	1871 0.48	14	12	13
300	2544 1.00	2443 1.00	2367 0.59	2299 0.57	2233 0.57	2184 0.57	16	15	15
350	2936 1.10	2818 1.09	2725 1.07	2641 1.06	2559 1.06	2498 1.05	19	17	18
400	3329 1.19	3193 1.18	3084 1.16	2984 1.15	2886 1.15	2813 1.14	21	19	20
450	3722 1.28	3569 1.27	3443 1.25	3328 1.23	3214 1.23	3128 1.23	24	21	23
500	4117 1.37	3946 1.36	3803 1.34	3672 1.32	3543 1.32	3445 1.31	26	24	25
550	4512 1.46	4324 1.45	4165 1.42	4017 1.41	3873 1.41	3762 1.40	29	26	28
600	4909 1.55	4703 1.54	4527 1.51	4362 1.49	4203 1.49	4080 1.48	31	28	30
650	5306 2.05	5082 2.03	4889 1.59	4708 1.58	4534 1.58	4399 1.57	34	30	33
700	5705 2.14	5463 2.11	5253 2.08	5055 2.06	4866 2.07	4719 2.05	36	32	35
750	6104 2.23	5844 2.20	5618 2.17	5403 2.15	5198 2.15	5040 2.13	38	35	38
800	6504 2.31	6227 2.29	5983 2.25	5751 2.24	5532 2.24	5362 2.22	41	37	41
850	6906 2.40	6610 2.38	6349 2.34	6099 2.32	5866 2.32	5685 2.30	43	39	43
900	7308 2.49	6994 2.46	6716 2.42	6449 2.41	6201 2.41	6008 2.39	45	41	46
950	7711 2.58	7379 2.55	7084 2.51	6799 2.50	6537 2.50	6332 2.47	47	43	49
1000	8116 3.07	7766 3.03	7453 2.59	7150 2.58	6873 2.58	6658 2.55	50	45	52
1050	8520 3.16	8153 3.12	7823 3.08	7501 3.07	7211 3.07	6984 3.04	52	47	54
1100	8925 3.25	8540 3.20	8193 3.16	7854 3.15	7549 3.15	7311 3.12	54	50	57
1150	9331 3.33	8928 3.29	8564 3.24	8206 3.24	7888 3.24	7639 3.20	57	52	60
1200	9738 3.42	9316 3.38	8935 3.33	8560 3.33	8227 3.32	7968 3.29	59	54	63

LOW AIR CONDITIONING	**ENGINE ANTI ICE ON**	**TOTAL ANTI ICE ON**
△FUEL = – 1 %	△FUEL = + 3 %	△FUEL = + 5.5 %

R

ALTERNATE PLANNING FROM DESTINATION TO ALTERNATE AIRPORT
GO-AROUND 100 KG - CLIMB 250KT/300KT/M.78 - CRUISE LONG RANGE
DESCENT M.78/300KT/250KT - VMC PROCEDURE 80 KG (4MIN)

REF.LDG WT AT DEST. = 55000 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)		
	230	**270**	**310**	**350**	**390**	**FL230 FL270**	**FL310 FL350**	**FL390**
150	1242 0.30	1248 0.29				9		
200	1538 0.38	1523 0.37	1524 0.36	1531 0.35		12	13	
250	1834 0.47	1799 0.44	1781 0.43	1773 0.42		14	16	12
300	2131 0.55	2076 0.52	2038 0.51	2016 0.49	2009 0.49	17	18	20
350	2429 1.03	2353 0.59	2297 0.58	2260 0.56	2243 0.55	19	21	23
400	2728 1.12	2630 1.07	2555 1.05	2504 1.03	2479 1.02	22	24	27
450	3027 1.20	2909 1.14	2815 1.12	2749 1.10	2715 1.09	24	27	31
500	3327 1.28	3188 1.22	3075 1.20	2994 1.17	2952 1.16	27	29	35
550	3628 1.36	3467 1.30	3336 1.27	3240 1.24	3190 1.22	29	32	39
600	3930 1.44	3747 1.37	3598 1.34	3487 1.31	3428 1.29	32	35	43
650	4232 1.52	4028 1.45	3860 1.42	3735 1.37	3668 1.36	35	38	47
700	4536 2.00	4309 1.52	4122 1.49	3983 1.44	3908 1.42	37	41	51
750	4840 2.08	4591 2.00	4386 1.56	4232 1.51	4150 1.49	40	44	55
800	5145 2.16	4873 2.07	4650 2.03	4482 1.58	4392 1.56	42	46	59
850	5450 2.24	5156 2.15	4915 2.10	4732 2.05	4636 2.02	45	49	63
900	5757 2.32	5440 2.22	5180 2.17	4983 2.12	4880 2.09	48	52	67
950	6064 2.40	5724 2.30	5446 2.25	5235 2.18	5126 2.16	50	55	71
1000	6372 2.48	6008 2.37	5713 2.32	5488 2.25	5372 2.22	53	58	75
1050	6681 2.56	6294 2.45	5981 2.39	5741 2.32	5619 2.29	55	61	79
1100	6991 3.04	6580 2.52	6249 2.46	5996 2.39	5868 2.36	58	64	83
1150	7302 3.12	6866 3.00	6518 2.53	6250 2.45	6117 2.42	61	67	87
1200	7614 3.19	7153 3.07	6788 3.00	6506 2.52	6367 2.49	63	70	91
LOW AIR CONDITIONING △FUEL = – 1 %			**ENGINE ANTI ICE ON** △FUEL = + 3 %			**TOTAL ANTI ICE ON** △FUEL = + 5.5 %		

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

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LONG RANGE SPEED UP TO FL270

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**	12	14	17
20	14	16	18	**20**	23	27	33
30	21	24	26	**30**	35	41	50
40	29	32	35	**40**	46	55	67
50	36	39	44	**50**	58	68	83
100	71	79	88	**100**	115	136	167
200	143	158	176	**200**	231	273	333
300	214	237	265	**300**	346	409	500
400	286	316	353	**400**	462	545	667
500	357	395	441	**500**	577	682	833
1000	714	789	882	**1000**	1154	1364	1667
1500	1071	1184	1324	**1500**	1731	2046	2500
2000	1429	1579	1765	**2000**	2308	2727	3334
2500	1786	1974	2206	**2500**	2885	3409	4167
3000	2143	2368	2647	**3000**	3462	4091	5000
3500	2500	2763	3088	**3500**	4039	4773	5834
4000	2857	3158	3529	**4000**	4615	5455	6667
4500	3214	3553	3971	**4500**	5192	6137	7500
5000	3571	3947	4412	**5000**	5769	6818	8334

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	8	8	9	**10**	11	13	15
20	15	16	18	**20**	22	26	30
30	23	25	27	**30**	34	38	45
40	30	33	36	**40**	45	51	60
50	38	41	45	**50**	56	64	75
100	75	82	90	**100**	112	128	149
200	150	164	180	**200**	225	256	299
300	226	246	270	**300**	337	385	448
400	301	328	360	**400**	449	513	597
500	376	410	450	**500**	562	641	746
1000	752	820	901	**1000**	1124	1282	1493
1500	1128	1230	1351	**1500**	1685	1923	2239
2000	1504	1639	1802	**2000**	2247	2564	2985
2500	1880	2049	2252	**2500**	2809	3205	3731
3000	2256	2459	2703	**3000**	3371	3846	4478
3500	2632	2869	3153	**3500**	3933	4487	5224
4000	3008	3279	3604	**4000**	4494	5128	5970
4500	3383	3689	4054	**4500**	5056	5769	6716
5000	3759	4098	4505	**5000**	5618	6410	7463

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06.00 CONTENTS

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06.30 STANDARD STRATEGY

06.40 OBSTACLE STRATEGY

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06.70 GROUND DISTANCE / AIR DISTANCE CONVERSION

INTRODUCTION

This chapter provides the single engine performance data to be used for the conduct and monitoring of the flight following an engine failure.
The diversion strategy (descent and cruise speed schedules) shall be selected, and specified in the operator's routes specifications, as a function of the prevailing operational factors (e.g. obstacles clearance requirements and/or ETOPS operation).

FLIGHT PREPARATION

In readiness for a possible engine failure occurring during the flight, any flight shall be planned so as to comply with any of the following requirements, as applicable :
· obstacle clearance,
· oxygen,
· maximum diversion distance (ETOPS operation).
The following FCOM sections provide flight preparation and fuel planning information :
· 2.05.10 thru 2.05.60, for Standard Fuel Planning,
· 2.04.40, for Extended Range Operation (ETOPS) and associated fuel requirements.

STRATEGY

Depending on the prevailing operational constraints, the most appropriate diversion strategy shall be selected, out of the following options :

	STANDARD STRATEGY	OBSTACLE STRATEGY	FIXED SPEED STRATEGIES	
			320 KT	VMO
DESCENT TO CEILING	. M.78/300KT . MCT	. Green Dot Speed . MCT	. M.78/320KT . MCT	. M.80/350KT . MCT
CRUISE	LR ceiling LR speed	— Obstacle not cleared: Maintain Green Dot Speed at MCT — Obstacle cleared : Revert to standard strategy	FL per 2.04.40 MCT/320KT	FL per 2.04.40 MCT/350KT
DESCENT TO LANDING	IDLE/M.78/300KT/250KT			
Approx increase in fuel consumption compared with both engines operative	+ 33 %			

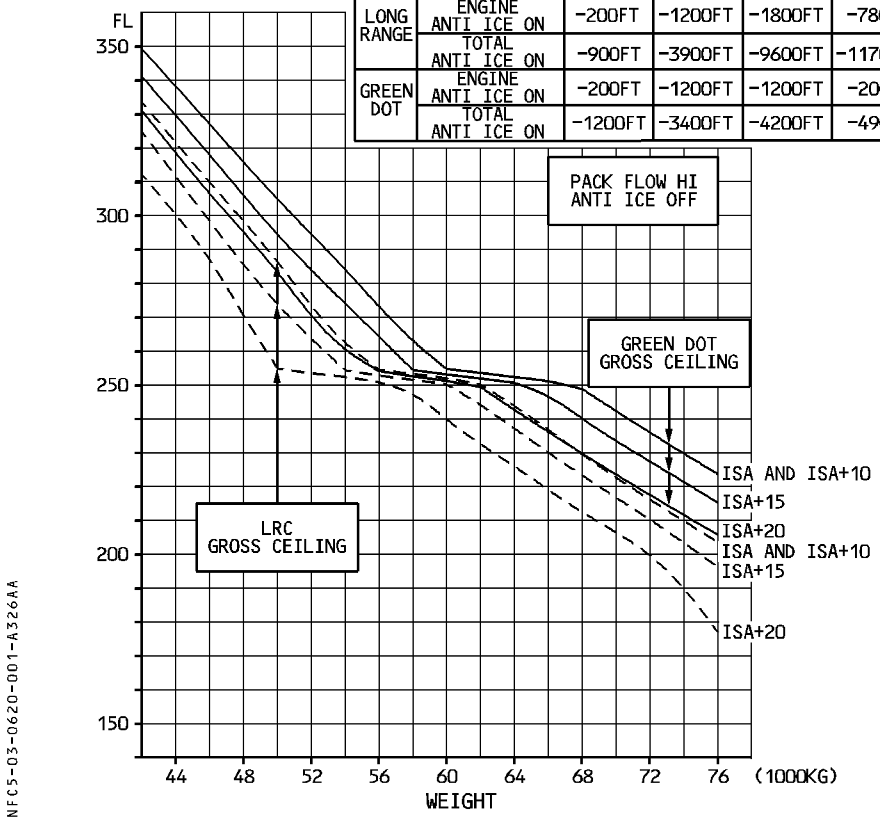
For ETOPS operations, any of the above diversion strategies can be used provided that the selected strategy and speed schedule is used in :

- establishing the area of operation (maximum diversion distance), as described in Section 2.04.40,
- calculating the diversion fuel requirements for the single engine ETOPS critical scenario, as provided in section 2.04.40,
- demonstrating the applicable obstacle clearance requirements (net flight path and net ceiling).

During the diversion, the flight crew is expected to use the planned speed schedule. However, based on the evaluation of the actual situation, the pilot in command has the authority to deviate from this planned one engine inoperative speed.

GROSS CEILINGS AT LONG RANGE AND GREEN DOT SPEEDS

		ISA	ISA+10	ISA+15	ISA+20
LONG RANGE	ENGINE ANTI ICE ON	-200FT	-1200FT	-1800FT	-7800FT
	TOTAL ANTI ICE ON	-900FT	-3900FT	-9600FT	-11700FT
GREEN DOT	ENGINE ANTI ICE ON	-200FT	-1200FT	-1200FT	-2000FT
	TOTAL ANTI ICE ON	-1200FT	-3400FT	-4200FT	-4900FT



Note : If severe icing conditions are encountered, ice formation may build up on non heated structure and therefore the ceiling will be reduced by 2000 feet.

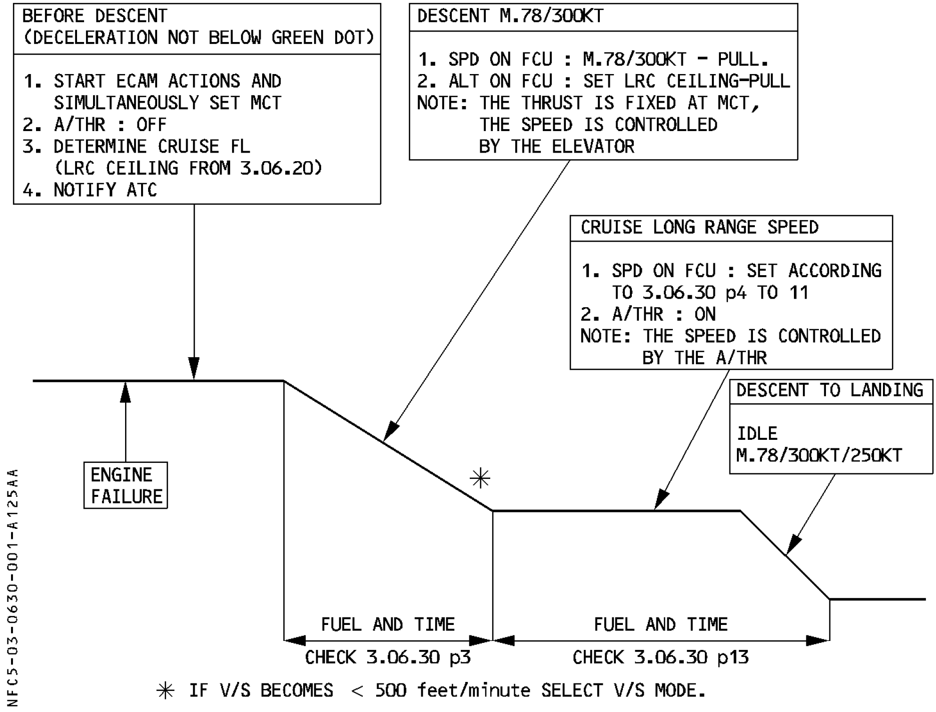
NET CEILING AT GREEN DOT SPEED

To obtain the net ceiling at green dot speed, apply the following corrections to the gross ceiling at green dot speed :

	WEIGHT (1000 KG)							
	48	52	56	60	64	68	72	76
≤ISA+10	– 5800 FT	– 4200 FT	– 2700 FT	– 2400 FT	– 3600 FT	– 4700 FT	– 5100 FT	– 6100 FT
ISA+20	– 4200 FT	– 2800 FT	– 2600 FT	– 3800 FT	– 4500 FT	– 6300 FT	– 10100 FT	– 11800 FT

PROCEDURE

Unless a specific procedure has been established before dispatch (ETOPS, mountainous areas) the recommended procedure is as follows :



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 :

LRC ceiling : (see 3.06.20 p1) FL220
Descent to cruise level : (FL220) Distance = 231 – 151 = 80 NM
(see 3.06.30 p3) Fuel = 1274 – 896 = 378 kg
Time = 35 – 24 = 11 min

Cruise at long range speed (FL220) to landing
(Weight = 70 000 – 378 = 69 622 kg : Distance = 540 – 80 = 460 NM)
Determine on (3.06.30 p13) time and fuel consumption at ISA conditions and for a reference weight of 55 000 kg. Interpolate the remaining air distance of 460 NM at FL220.

R Fuel : 2482 kg
R Time : 1 h 29 min

Correction due to actual in-cruise weight

R $\triangle$Fuel = + 25 kg per 1000 kg above reference weight
R $\triangle$Fuel = + 25 kg × (69.7 – 55) ~ 368 kg

Result :

R Total Fuel = 378 + 2482 + 368 = 3228 kg
R Time = 1 h 29 min + 11 min = 1 h 40 min

R

DESCENT - M.78/300KT - 1 ENGINE OUT										
MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF			ISA CG=33.0%		**MINIMUM RATE OF DESCENT 500FT/MIN**					
WEIGHT (1000KG)	**50**				**70**					
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	IAS (KT)
390	41.6	1408	280	MCT					241
370	39.8	1372	267	MCT	39.4	1386	264	MCT	252
350	38.1	1330	255	MCT	38.0	1353	253	MCT	264
330	36.5	1288	243	MCT	36.5	1315	243	MCT	277
310	35.1	1246	231	MCT	35.0	1274	231	MCT	289
290	33.6	1201	220	MCT	33.5	1226	219	MCT	300
270	31.5	1134	205	MCT	31.3	1156	203	MCT	300
250	29.1	1052	187	MCT	28.8	1072	185	MCT	300
230	26.0	942	165	MCT	25.9	967	164	MCT	300
220	24.0	867	151	V/S	24.0	896	151	V/S	300
210	22.0	793	137	V/S	22.0	818	137	V/S	300
200	20.0	719	124	V/S	20.0	741	124	V/S	300
190	18.0	645	111	V/S	18.0	665	111	V/S	300
180	16.0	572	98	V/S	16.0	589	98	V/S	300
170	14.0	499	85	V/S	14.0	514	85	V/S	300
160	12.0	427	72	V/S	12.0	439	72	V/S	300
150	10.0	355	60	V/S	10.0	365	60	V/S	300
140	8.0	283	47	V/S	8.0	291	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	– 0.3 %	– 1.5 %	–
FUEL	+ 2 %	+ 4 %	+ 0.3 %
DISTANCE	– 0.5 %	– 1.5 %	+ 0.2 %

11.0-08F0A320-214 CFM56-5B4/P SA23200010C6KG330 0 018590 0 0 3 .0 .0 500.00 0 02 .780300.000 .000 0 FCOM-N0-03-06-30-003-200

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF	ISA CG=33.0%	N1 (%) / MACH KG/H / IAS (KT) NM/1000KG / TAS (KT)

WEIGHT (1000KG)	FL100		FL120		FL140		FL160		FL180		FL200	
50	75.5	.453	77.4	.472	78.9	.487	80.3	.500	81.8	.516	82.7	.525
	1891	251	1888	251	1867	250	1842	247	1824	245	1783	240
	153.0	289	158.3	299	163.9	306	169.6	312	175.1	319	180.8	322
52	76.7	.463	78.5	.480	79.7	.492	81.3	.508	82.5	.520	83.6	.532
	1967	256	1959	256	1924	253	1908	251	1876	247	1852	243
	150.1	295	155.3	304	160.9	309	166.1	317	171.5	322	176.6	327
54	77.8	.471	79.3	.486	80.7	.499	82.2	.515	83.1	.524	84.5	.540
	2041	261	2021	259	1991	256	1973	254	1929	249	1924	247
	147.4	301	152.5	308	157.8	314	162.8	321	168.1	324	172.5	332
56	78.9	.479	80.1	.492	81.6	.507	82.9	.519	83.9	.530	85.4	.547
	2112	265	2078	262	2059	260	2029	257	1998	252	1995	250
	144.9	306	149.9	311	154.7	319	159.7	324	164.4	328	168.6	336
58	79.7	.485	80.9	.498	82.5	.513	83.5	.523	84.7	.537	86.0	.552
	2175	268	2141	265	2126	264	2081	258	2068	256	2057	253
	142.4	310	147.3	315	151.9	323	156.7	326	160.9	333	164.9	339
60	80.4	.490	81.8	.504	83.3	.519	84.2	.528	85.6	.545	86.7	.556
	2233	271	2209	269	2187	266	2145	261	2141	259	2119	255
	140.1	313	144.6	320	149.1	326	153.7	330	157.5	337	161.3	342
62	81.1	.495	82.7	.511	83.8	.522	84.9	.534	86.3	.550	87.3	.561
	2292	274	2277	272	2239	268	2214	264	2209	262	2183	256
	137.9	316	142.1	324	146.5	328	150.6	333	154.3	341	157.7	344
64	82.0	.502	83.5	.517	84.4	.525	85.7	.541	86.9	.555	88.1	.567
	2363	278	2343	276	2293	270	2289	268	2272	264	2259	259
	135.5	320	139.7	327	144.0	330	147.6	338	151.1	343	154.1	348
66	82.8	.508	84.1	.520	85.1	.531	86.5	.548	87.5	.558	88.7	.570
	2431	281	2399	278	2362	273	2362	271	2334	266	2325	261
	133.3	324	137.4	330	141.3	334	144.7	342	148.1	346	150.6	350
68	83.6	.514	84.6	.523	85.8	.537	87.1	.552	88.1	.562	89.2	.571
	2499	284	2453	279	2433	276	2426	273	2401	268	2383	261
	131.2	328	135.2	332	138.7	338	142.0	344	145.0	348	147.2	351
70	84.3	.519	85.1	.527	86.5	.543	87.6	.556	88.8	.569	90.2	.581
	2563	287	2510	281	2506	279	2488	275	2481	271	2492	266
	129.1	331	133.0	334	136.2	341	139.4	347	141.9	352	143.1	357
72	84.8	.522	85.8	.532	87.2	.549	88.2	.559	89.4	.571	91.1	.588
	2619	289	2582	284	2580	282	2553	277	2544	272	2595	270
	127.1	333	130.7	337	133.7	345	136.7	349	139.0	353	139.3	361
74	85.3	.524	86.5	.538	87.7	.553	88.8	.563	89.9	.572	92.0	.595
	2672	291	2655	287	2645	284	2618	279	2602	273	2697	273
	125.3	335	128.4	341	131.4	348	134.2	351	136.1	354	135.6	366
76	85.8	.528	87.1	.544	88.2	.556	89.4	.568	90.8	.580	93.1	.606
	2731	293	2729	291	2707	286	2697	282	2710	277	2821	278
	123.4	337	126.3	345	129.2	350	131.5	355	132.6	359	132.0	372
78	86.4	.533	87.8	.549	88.8	.559	90.0	.572	91.6	.588	93.7	.607
	2802	295	2802	293	2772	288	2767	283	2817	281	2883	279
	121.4	340	124.2	348	126.9	352	128.9	357	129.3	364	129.3	373

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
$\triangle$FUEL = + 3.5 %	$\triangle$FUEL = + 7 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

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

ISA
CG=33.0%

N1 (%) / MACH
KG/H / IAS (KT)
NM/1000KG / TAS (KT)

WEIGHT (1000KG)	FL210		FL220		FL230		FL240		FL250		FL260	
50	83.3	.533	84.1	.541	84.7	.549	85.2	.554	85.8	.560	86.5	.567
	1778	238	1777	237	1771	236	1759	233	1750	231	1752	229
	183.3	326	185.6	330	188.0	333	190.4	335	192.5	337	194.1	340
52	84.3	.541	85.0	.548	85.5	.554	86.0	.559	86.7	.567	87.2	.568
	1851	242	1846	241	1833	238	1821	235	1825	234	1807	230
	178.8	331	181.1	334	183.4	336	185.4	338	187.0	341	188.5	341
54	85.2	.548	85.7	.553	86.2	.558	86.9	.566	87.4	.568	88.4	.580
	1920	246	1907	243	1896	240	1898	239	1880	235	1912	235
	174.6	335	176.8	337	178.8	339	180.4	342	181.8	342	181.8	348
56	85.9	.553	86.4	.558	87.0	.565	87.6	.569	88.4	.577	88.6	.568
	1983	248	1970	245	1969	243	1958	240	1975	238	1917	229
	170.7	338	172.6	340	174.2	343	175.5	344	175.9	347	177.5	340
58	86.5	.557	87.1	.564	87.7	.569	88.5	.574	89.5	.586	88.5	.539
	2045	250	2041	248	2035	245	2039	242	2075	242	1899	217
	166.8	341	168.3	344	169.7	345	170.3	347	170.1	353	170.2	323
60	87.2	.562	87.9	.569	88.4	.571	89.5	.585	90.6	.595		
	2112	252	2112	250	2100	246	2144	247	2178	246		
	162.9	344	164.2	347	165.2	347	164.9	353	164.5	358		
62	88.0	.569	88.5	.570	89.6	.583	90.6	.593	92.1	.610		
	2190	255	2169	251	2211	251	2243	250	2302	253		
	159.0	348	160.2	347	160.0	354	159.7	358	159.3	367		
64	88.6	.570	89.5	.579	90.5	.590	91.8	.605	92.4	.601		
	2247	256	2270	255	2306	254	2362	256	2323	249		
	155.2	349	155.5	353	155.2	358	154.8	366	155.7	362		
66	89.4	.575	90.4	.587	91.5	.599	92.6	.605	92.6	.582		
	2327	258	2371	259	2413	258	2422	256	2315	241		
	151.2	352	150.9	358	150.6	363	151.0	366	151.3	350		
68	90.3	.584	91.4	.595	92.7	.609	92.9	.594				
	2434	263	2473	262	2523	263	2434	251				
	146.9	358	146.6	363	146.5	370	147.5	359				
70	91.2	.591	92.6	.606	93.1	.601	93.0	.569				
	2529	266	2595	267	2547	260	2418	240				
	142.9	362	142.4	370	143.3	365	142.3	344				
72	92.2	.599	93.2	.605	93.3	.585						
	2638	269	2648	267	2543	252						
	138.9	366	139.3	369	139.7	355						
74	93.3	.609	93.5	.597	93.5	.554						
	2752	274	2666	263	2524	238						
	135.4	373	136.4	364	133.1	336						
76	93.6	.603	93.6	.577								
	2778	271	2656	254								
	132.7	369	132.3	351								
78	93.9	.591										
	2784	265										
	129.8	361										

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
△FUEL = + 3.5 %	△FUEL = + 7 %

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**	
50	76.8	.451	78.8	.470	80.4	.485	81.8	.499	83.4	.514	84.3	.523
	1921	249	1921	250	1904	249	1879	246	1862	244	1821	239
	152.7	293	157.9	303	163.3	311	169.0	317	174.4	325	180.0	328
52	78.0	.461	79.9	.478	81.2	.490	82.8	.507	84.0	.519	85.2	.531
	2000	255	1994	255	1960	252	1949	250	1917	246	1893	243
	149.8	300	154.9	309	160.3	314	165.4	322	170.8	327	175.8	333
54	79.2	.470	80.8	.485	82.2	.498	83.8	.514	84.7	.523	86.1	.539
	2076	260	2059	258	2030	256	2016	254	1973	248	1967	246
	147.0	305	152.0	313	157.1	319	162.1	327	167.3	330	171.6	338
56	80.3	.478	81.6	.490	83.1	.505	84.5	.518	85.6	.530	87.0	.546
	2152	264	2117	261	2101	259	2073	256	2044	252	2041	250
	144.4	311	149.3	316	154.1	324	159.0	330	163.6	335	167.7	342
58	81.1	.484	82.4	.496	84.1	.512	85.1	.521	86.4	.537	87.7	.551
	2217	268	2185	265	2170	263	2126	258	2117	255	2107	252
	141.9	315	146.6	320	151.2	328	156.0	332	160.1	339	164.0	345
60	81.9	.489	83.4	.503	84.8	.517	85.8	.527	87.3	.544	88.4	.555
	2279	271	2257	269	2233	266	2193	261	2193	259	2170	254
	139.5	318	144.0	325	148.4	331	152.9	335	156.6	343	160.4	348
62	82.6	.494	84.2	.510	85.4	.521	86.5	.533	88.0	.549	89.0	.560
	2339	273	2327	272	2289	268	2265	264	2261	261	2237	256
	137.2	321	141.4	329	145.8	334	149.8	339	153.4	347	156.8	351
64	83.5	.501	85.1	.516	85.9	.524	87.3	.540	88.6	.553	89.8	.566
	2412	277	2394	275	2344	269	2339	267	2325	263	2317	259
	134.9	325	139.0	333	143.3	336	146.8	343	150.3	349	153.1	355
66	84.3	.506	85.6	.519	86.7	.530	88.1	.547	89.2	.557	90.4	.569
	2481	280	2452	277	2418	273	2416	271	2390	265	2382	260
	132.7	329	136.7	335	140.6	340	143.9	348	147.2	352	149.6	356
68	85.1	.512	86.2	.522	87.4	.536	88.7	.551	89.8	.561	91.0	.570
	2551	284	2507	279	2490	276	2483	273	2459	267	2445	261
	130.5	333	134.5	337	137.9	344	141.2	350	144.1	354	146.2	357
70	85.8	.517	86.7	.526	88.1	.542	89.3	.555	90.5	.567	92.0	.580
	2618	287	2568	281	2566	279	2547	275	2540	270	2559	266
	128.5	336	132.2	340	135.4	347	138.5	353	141.0	358	142.1	363
72	86.3	.520	87.4	.532	88.9	.548	89.9	.558	91.1	.570	92.9	.587
	2675	288	2640	284	2641	282	2613	277	2604	271	2662	269
	126.5	338	129.9	343	132.9	351	135.9	355	138.1	360	138.2	368
74	86.8	.523	88.1	.537	89.4	.552	90.5	.562	91.6	.571	93.8	.594
	2731	290	2715	287	2708	284	2684	279	2665	272	2768	273
	124.6	340	127.7	347	130.6	354	133.3	358	135.2	360	134.5	372
76	87.4	.527	88.7	.543	89.9	.555	91.1	.568	92.5	.580	94.8	.604
	2794	292	2791	290	2772	286	2765	281	2781	276	2888	277
	122.6	343	125.5	350	128.4	356	130.6	361	131.6	366	131.0	378
78	88.0	.532	89.4	.548	90.4	.558	91.7	.570	93.4	.587	95.5	.605
	2867	295	2866	293	2838	287	2833	283	2888	280	2958	278
	120.7	346	123.4	354	126.1	358	128.1	363	128.3	371	128.2	379

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
△FUEL = + 3.5 %	△FUEL = + 7 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF	ISA+10 CG=33.0%	N1 (%) / MACH KG/H / IAS (KT) NM/1000KG / TAS (KT)

WEIGHT (1000KG)	FL210		FL220		FL230		FL240		FL250		FL260	
50	85.0	.532	85.8	.540	86.4	.548	87.0	.554	87.5	.559	88.2	.566
	1818	238	1818	237	1814	236	1804	233	1795	231	1794	229
	182.4	332	184.8	336	187.1	339	189.4	342	191.4	344	193.0	346
52	86.0	.540	86.6	.547	87.2	.553	87.7	.558	88.5	.566	89.0	.567
	1892	242	1888	240	1877	238	1868	235	1870	234	1852	229
	178.0	337	180.2	340	182.5	342	184.4	344	186.0	348	187.4	347
54	86.8	.547	87.4	.552	87.9	.557	88.6	.566	89.1	.567	90.2	.579
	1964	245	1952	242	1940	240	1946	239	1928	234	1963	234
	173.8	341	176.0	343	177.9	345	179.4	349	180.8	348	180.6	355
56	87.6	.552	88.1	.557	88.8	.564	89.3	.567	90.3	.577	90.3	.565
	2030	247	2016	245	2017	243	2005	239	2030	239	1962	228
	169.8	345	171.7	346	173.2	349	174.6	350	174.7	355	176.3	346
58	88.2	.556	88.9	.563	89.5	.567	90.2	.574	91.3	.586	90.3	.536
	2092	249	2089	247	2082	244	2091	242	2130	242	1944	216
	165.9	347	167.4	350	168.7	351	169.3	354	168.9	360	168.8	328
60	88.9	.561	89.6	.567	90.2	.571	91.3	.583	92.4	.595		
	2163	252	2162	249	2153	246	2196	246	2237	246		
	162.0	350	163.2	353	164.1	353	163.8	360	163.4	365		
62	89.7	.568	90.2	.568	91.3	.581	92.3	.591	93.9	.608		
	2241	255	2219	250	2263	250	2300	250	2362	252		
	158.0	354	159.2	353	159.0	360	158.6	365	158.2	374		
64	90.3	.569	91.2	.578	92.3	.589	93.6	.603	94.2	.599		
	2301	255	2328	254	2365	254	2420	255	2382	248		
	154.3	355	154.4	359	154.1	365	153.6	372	154.6	368		
66	91.1	.574	92.2	.586	93.3	.597	94.4	.604	94.3	.579		
	2388	258	2432	258	2476	258	2484	255	2369	239		
	150.1	358	149.9	364	149.5	370	149.9	372	150.0	356		
68	92.1	.584	93.2	.594	94.5	.607	94.6	.591				
	2498	262	2538	262	2586	262	2490	250				
	145.8	364	145.5	369	145.4	376	146.4	364				
70	93.0	.591	94.4	.606	94.9	.599	94.8	.565				
	2599	265	2666	267	2610	259	2474	238				
	141.8	369	141.3	377	142.2	371	141.0	349				
72	94.0	.599	95.0	.604	95.0	.581						
	2710	269	2715	266	2600	250						
	137.8	374	138.3	376	138.4	360						
74	95.1	.608	95.2	.593	95.3	.543						
	2822	273	2727	261	2579	233						
	134.4	379	135.3	369	130.3	336						
76	95.4	.601	95.4	.572								
	2850	270	2717	252								
	131.6	375	131.0	356								
78	95.6	.587										
	2850	264										
	128.7	367										

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = + 3.5 %	△FUEL = + 7 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

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

ISA+15
CG=33.0%

N1 (%) **MACH**
KG/H **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	FL100		FL120		FL140		FL160		FL180		FL200	
50	77.5	.451	79.5	.469	81.1	.485	82.5	.498	84.1	.514	85.1	.523
	1939	249	1938	250	1923	249	1897	246	1881	244	1842	239
	152.5	296	157.6	306	163.0	313	168.6	320	174.0	327	179.6	331
52	78.7	.460	80.6	.478	81.9	.490	83.6	.506	84.8	.518	86.0	.531
	2018	254	2013	254	1980	251	1969	250	1938	246	1914	242
	149.5	302	154.6	311	160.0	317	165.1	325	170.4	330	175.3	336
54	79.9	.469	81.5	.484	82.9	.498	84.6	.513	85.5	.522	86.9	.538
	2094	259	2078	258	2052	255	2038	254	1993	248	1988	246
	146.8	307	151.7	315	156.8	322	161.7	330	166.9	333	171.2	340
56	81.0	.477	82.3	.489	83.9	.505	85.3	.518	86.4	.529	87.8	.546
	2171	264	2137	261	2124	259	2096	256	2067	252	2063	249
	144.1	313	149.0	318	153.7	326	158.5	332	163.2	337	167.3	345
58	81.8	.483	83.2	.496	84.8	.511	85.9	.521	87.2	.536	88.5	.551
	2238	267	2207	264	2192	263	2151	258	2141	255	2131	252
	141.6	317	146.3	323	150.8	331	155.5	335	159.6	342	163.5	348
60	82.6	.488	84.1	.503	85.6	.516	86.6	.527	88.1	.543	89.2	.555
	2301	270	2280	268	2255	265	2219	260	2217	259	2196	254
	139.2	320	143.6	328	148.1	334	152.4	338	156.2	346	159.9	351
62	83.4	.493	85.0	.509	86.2	.520	87.4	.533	88.8	.549	89.9	.559
	2363	273	2351	272	2312	267	2292	264	2288	261	2263	256
	136.9	324	141.1	332	145.4	336	149.4	342	152.9	350	156.3	354
64	84.3	.500	85.9	.515	86.7	.524	88.2	.540	89.4	.553	90.6	.566
	2437	277	2421	275	2370	269	2367	267	2354	263	2344	259
	134.6	328	138.6	336	142.9	339	146.4	346	149.8	353	152.6	358
66	85.1	.506	86.4	.519	87.5	.530	88.9	.546	90.0	.557	91.3	.568
	2509	280	2479	277	2444	272	2442	270	2419	265	2410	260
	132.3	332	136.3	338	140.2	343	143.5	350	146.7	355	149.1	359
68	85.9	.512	86.9	.522	88.2	.536	89.6	.551	90.7	.561	91.9	.570
	2579	283	2535	279	2519	275	2511	273	2490	267	2475	261
	130.2	336	134.1	340	137.5	346	140.7	353	143.7	358	145.7	360
70	86.6	.517	87.5	.526	88.9	.542	90.1	.554	91.4	.567	92.9	.580
	2646	286	2598	281	2596	279	2577	274	2571	270	2594	266
	128.1	339	131.8	342	135.0	350	138.1	356	140.6	361	141.5	367
72	87.1	.520	88.2	.531	89.7	.548	90.7	.558	91.9	.569	93.8	.587
	2703	288	2672	284	2672	282	2644	276	2635	271	2698	269
	126.1	341	129.5	346	132.5	354	135.4	358	137.6	363	137.7	371
74	87.6	.522	88.9	.537	90.2	.552	91.3	.562	92.5	.570	94.7	.594
	2759	290	2746	287	2740	284	2716	278	2698	272	2806	273
	124.2	343	127.3	350	130.2	357	132.8	361	134.7	363	134.0	376
76	88.1	.526	89.5	.542	90.7	.555	92.0	.567	93.4	.579	95.2	.593
	2823	292	2822	290	2805	286	2798	281	2816	276	2862	272
	122.3	345	125.1	353	127.9	359	130.2	364	131.1	369	131.1	375
78	88.8	.532	90.2	.548	91.3	.558	92.5	.570	94.2	.587	95.3	.580
	2899	295	2899	293	2873	287	2867	282	2924	280	2855	266
	120.3	349	123.0	357	125.6	361	127.6	366	127.8	374	128.5	367

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = + 3.5 %	△FUEL = + 7 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

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

ISA+15
CG=33.0%

N1 (%) / **MACH**
KG/H / **IAS (KT)**
NM/1000KG / **TAS (KT)**

WEIGHT (1000KG)	FL210		FL220		FL230		FL240		FL250		FL260	
50	85.8	.531	86.6	.540	87.3	.548	87.8	.553	88.4	.559	89.1	.565
	1840	238	1840	237	1836	235	1824	233	1817	230	1814	228
	182.0	335	184.3	339	186.6	343	188.8	344	190.9	347	192.5	349
52	86.8	.539	87.5	.547	88.0	.553	88.6	.558	89.3	.565	89.8	.566
	1914	241	1910	240	1901	238	1891	235	1892	233	1875	229
	177.5	340	179.7	343	181.9	346	183.9	348	185.4	351	186.8	350
54	87.7	.546	88.2	.552	88.8	.557	89.5	.566	90.0	.566	89.9	.552
	1986	245	1976	242	1965	240	1970	238	1950	234	1874	223
	173.3	344	175.4	347	177.3	349	178.8	352	180.2	351	182.0	341
56	88.4	.552	88.9	.556	89.6	.564	90.2	.567	91.1	.577	89.9	.518
	2053	247	2040	244	2043	243	2029	239	2056	238	1853	208
	169.3	348	171.2	349	172.7	353	174.0	353	174.1	358	172.7	320
58	89.1	.556	89.7	.562	90.3	.567	91.1	.574	92.2	.585		
	2118	249	2115	247	2108	244	2120	242	2158	242		
	165.4	350	166.9	353	168.2	354	168.6	357	168.3	363		
60	89.8	.561	90.4	.567	91.1	.570	92.2	.583	93.3	.594		
	2189	251	2187	249	2181	246	2226	246	2266	246		
	161.4	353	162.7	356	163.5	357	163.2	363	162.8	369		
62	90.6	.567	91.0	.568	92.2	.581	93.3	.591	93.5	.581		
	2268	254	2245	249	2292	250	2332	250	2265	240		
	157.5	357	158.7	356	158.4	363	158.0	368	159.2	360		
64	91.1	.568	92.1	.578	93.1	.588	93.8	.589	93.5	.556		
	2326	255	2359	254	2394	254	2380	249	2249	230		
	153.8	358	153.8	363	153.6	368	154.1	367	153.5	345		
66	92.0	.574	93.1	.586	94.1	.595	93.9	.570				
	2418	258	2463	258	2497	257	2369	241				
	149.6	362	149.3	368	149.1	372	150.0	355				
68	93.0	.583	94.1	.594	94.2	.581	94.0	.535				
	2530	262	2571	261	2488	250	2349	225				
	145.3	368	144.9	373	146.0	363	141.9	333				
70	93.9	.590	94.5	.590	94.3	.559						
	2633	265	2611	260	2476	241						
	141.3	372	141.7	370	141.3	350						
72	94.8	.597	94.6	.573								
	2737	268	2602	252								
	137.4	376	138.4	360								
74	94.9	.585	94.7	.548								
	2730	263	2589	241								
	134.9	368	133.0	344								
76	95.0	.566										
	2721	254										
	131.2	357										
78	95.2	.529										
	2705	237										
	123.3	334										

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = + 3.5 %	△FUEL = + 7 %

R

LONG RANGE CRUISE - 1 ENGINE OUT

MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF	ISA+20 CG=33.0%	N1 (%) / MACH KG/H / IAS (KT) NM/1000KG / TAS (KT)

WEIGHT (1000KG)	FL100		FL120		FL140		FL160		FL180		FL200	
50	78.2	.450	80.2	.468	81.8	.484	83.3	.498	84.9	.513	85.9	.523
	1957	249	1957	249	1940	248	1916	246	1901	244	1864	239
	152.2	298	157.3	308	162.7	316	168.2	322	173.6	330	179.1	334
52	79.4	.459	81.3	.477	82.6	.489	84.3	.506	85.6	.517	86.8	.530
	2036	254	2032	254	1999	251	1989	250	1958	246	1937	242
	149.3	304	154.3	313	159.6	319	164.7	328	169.9	333	174.8	339
54	80.5	.468	82.2	.483	83.7	.497	85.4	.513	86.3	.521	87.8	.538
	2113	259	2098	258	2075	255	2060	253	2015	248	2012	246
	146.5	309	151.4	318	156.4	324	161.3	332	166.4	335	170.7	343
56	81.7	.476	83.0	.488	84.7	.504	86.0	.517	87.1	.529	88.6	.545
	2190	263	2158	260	2147	259	2118	255	2090	251	2087	249
	143.8	315	148.7	321	153.3	329	158.1	335	162.7	340	166.8	348
58	82.6	.482	83.9	.495	85.6	.511	86.6	.521	88.0	.536	89.4	.550
	2260	267	2229	264	2217	262	2175	257	2165	255	2155	252
	141.3	319	145.9	325	150.4	333	155.1	337	159.2	345	163.0	351
60	83.3	.487	84.9	.502	86.3	.516	87.4	.526	88.9	.543	90.0	.554
	2322	270	2303	268	2280	265	2244	260	2243	258	2222	254
	138.9	323	143.3	330	147.6	337	152.0	341	155.7	349	159.4	354
62	84.1	.493	85.8	.509	86.9	.519	88.2	.533	89.6	.548	90.7	.559
	2388	273	2375	271	2337	267	2318	264	2314	261	2290	256
	136.6	326	140.7	334	145.0	339	148.9	345	152.4	353	155.8	357
64	85.0	.500	86.6	.515	87.5	.523	89.0	.539	90.2	.553	91.5	.565
	2464	277	2446	275	2396	269	2396	267	2381	263	2372	259
	134.2	331	138.2	338	142.4	341	145.9	350	149.3	356	152.1	361
66	85.8	.506	87.2	.518	88.3	.529	89.8	.546	90.8	.557	92.1	.567
	2537	280	2505	276	2471	272	2472	270	2449	265	2437	260
	131.9	335	135.9	340	139.7	345	143.0	354	146.2	358	148.6	362
68	86.6	.511	87.7	.521	89.0	.535	90.4	.550	91.5	.561	92.7	.569
	2607	283	2563	278	2546	275	2541	272	2520	267	2506	261
	129.8	338	133.7	343	137.1	349	140.3	356	143.2	361	145.1	364
70	87.4	.516	88.3	.525	89.7	.541	90.9	.554	92.2	.567	93.7	.580
	2674	286	2627	280	2624	278	2607	274	2604	270	2626	266
	127.7	342	131.4	345	134.5	353	137.6	359	140.1	365	141.0	370
72	87.9	.519	89.0	.531	90.4	.547	91.5	.557	92.8	.569	94.5	.584
	2732	288	2703	284	2701	281	2675	276	2668	271	2715	268
	125.7	343	129.1	349	132.1	357	135.0	361	137.1	366	137.4	373
74	88.3	.522	89.7	.536	91.0	.551	92.1	.562	93.3	.570	94.6	.573
	2789	289	2779	287	2772	284	2750	278	2735	272	2711	262
	123.8	345	126.9	353	129.7	360	132.3	364	134.1	367	134.8	366
76	88.9	.526	90.4	.542	91.5	.555	92.8	.567	93.9	.572	94.6	.556
	2856	291	2857	290	2839	285	2832	281	2803	272	2706	254
	121.9	348	124.7	356	127.5	362	129.7	367	131.2	368	131.1	355
78	89.5	.531	91.0	.547	92.1	.558	93.3	.569	94.0	.561	94.8	.528
	2930	294	2934	292	2909	287	2900	282	2801	267	2700	241
	119.9	351	122.6	360	125.2	364	127.2	369	128.8	361	124.8	337

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = + 3.5 %	△FUEL = + 7 %

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	
50	86.6	.531	87.4	.540	88.1	.547	88.6	.552	89.2	.558	89.5	.556
	1863	238	1862	237	1857	235	1846	233	1838	230	1799	225
	181.5	338	183.7	342	186.0	345	188.3	348	190.3	350	193.1	347
52	87.6	.539	88.3	.547	88.9	.552	89.4	.558	90.1	.564	89.5	.539
	1937	241	1934	240	1923	238	1914	235	1913	233	1787	217
	177.0	343	179.2	347	181.3	349	183.3	351	184.9	354	188.3	336
54	88.5	.546	89.0	.552	89.6	.557	90.4	.565	90.8	.565	89.5	.500
	2010	245	2000	242	1990	240	1993	238	1972	233	1764	201
	172.8	347	174.9	350	176.8	352	178.2	355	179.7	354	177.0	312
56	89.2	.551	89.8	.556	90.5	.564	91.0	.566	92.0	.576		
	2076	247	2066	244	2069	243	2052	239	2083	238		
	168.8	351	170.6	353	172.1	356	173.4	356	173.5	361		
58	89.9	.555	90.6	.562	91.2	.566	92.0	.574	92.6	.574		
	2142	249	2142	247	2133	244	2149	242	2131	237		
	164.9	353	166.4	356	167.6	358	168.0	361	168.7	360		
60	90.6	.560	91.3	.566	92.0	.571	93.0	.580	92.6	.554		
	2215	251	2212	249	2212	246	2242	245	2121	229		
	160.9	356	162.2	359	162.9	360	162.8	365	163.8	347		
62	91.4	.566	91.9	.567	93.1	.580	93.0	.565	92.7	.489		
	2294	254	2273	249	2323	250	2234	238	2095	201		
	157.0	360	158.1	359	157.8	366	159.2	356	146.4	307		
64	92.0	.567	93.0	.578	93.4	.574	93.1	.540				
	2354	254	2388	254	2350	247	2223	227				
	153.3	361	153.3	366	154.2	362	152.9	340				
66	92.9	.574	93.7	.581	93.4	.555						
	2449	258	2469	256	2341	239						
	149.0	365	149.1	368	149.8	351						
68	93.9	.582	93.8	.567	93.6	.517						
	2560	262	2463	249	2327	222						
	144.8	371	146.0	360	140.3	327						
70	94.2	.576	93.9	.546								
	2587	259	2455	240								
	141.7	367	141.1	346								
72	94.2	.561										
	2582	252										
	138.3	357										
74	94.3	.537										
	2574	241										
	132.8	342										
76												
78												

ENGINE ANTI ICE ON △FUEL = + 3.5 %	TOTAL ANTI ICE ON △FUEL = + 7 %

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 : 120 kg or 270 lb – 6 minute IMC
- ISA
- CG = 33 %
- Pack Flow HI
- Anti ice OFF

Note : 1. *In the tables, the asterisk (*) means that a step climb of 4000 feet must be flown to reach the corresponding flight level.*
2. *The flight level shown on top of each column is the final flight level.*
3. *For each degree Celsius above ISA temperature apply a fuel correction of 0.015 (kg/°C/NM) × △ ISA (°C) × air distance (NM) or 0.033 (lb/°C/NM) × △ ISA (°C) × air distance (NM).*

CORRECTION FOR DEVIATION FROM REFERENCE WEIGHT

The in cruise quick check tables are based on a reference initial weight.
A correction on the fuel consumption has to be made, when the actual initial weight is different from the reference initial weight.
If it is lower (or greater) than the reference weight, subtract (or add) the value given in the correction part of the table per 1000 kg or 1000 lb below (or above) the reference initial weight (see example 3.06.30 p2).

R

IN CRUISE QUICK CHECK FROM ANY MOMENT IN CRUISE TO LANDING - ONE ENGINE FAILURE
CRUISE : LONG RANGE - DESCENT : M.78/300KT/250KT
IMC PROCEDURE : 120 KG (6MIN)

REF. INITIAL WEIGHT = 55000 KG PACK FLOW HI ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL						CORRECTION ON FUEL CONSUMPTION (KG/1000KG)		
	100	**150**	**200**	**220**	**240**	**250**	**FL100 FL150**	**FL200 FL220**	**FL240 FL250**
200	1379 0.45	1188 0.44	1061 0.42	1017 0.42	978 0.41	960 0.41	9	7	8
250	1718 0.56	1500 0.54	1352 0.52	1301 0.51	1256 0.50	1236 0.50	12	11	12
300	2055 1.06	1811 1.03	1641 1.01	1583 1.00	1534 0.59	1511 0.59	15	14	16
350	2391 1.16	2121 1.13	1930 1.10	1865 1.09	1810 1.08	1785 1.08	18	17	20
400	2727 1.26	2430 1.22	2217 1.19	2146 1.18	2085 1.17	2058 1.17	21	21	24
450	3061 1.36	2738 1.32	2504 1.28	2426 1.27	2359 1.25	2330 1.25	24	24	28
500	3394 1.46	3046 1.41	2790 1.37	2705 1.35	2632 1.34	2602 1.34	27	27	32
550	3727 1.56	3352 1.51	3075 1.46	2983 1.44	2904 1.43	2872 1.43	30	30	36
600	4058 2.06	3658 2.00	3358 1.55	3260 1.53	3174 1.52	3141 1.52	33	34	39
650	4388 2.17	3962 2.10	3641 2.05	3537 2.02	3444 2.01	3409 2.00	36	37	43
700	4718 2.27	4266 2.20	3924 2.14	3812 2.11	3713 2.10	3676 2.09	39	40	47
750	5046 2.37	4568 2.29	4205 2.23	4087 2.20	3981 2.19	3942 2.18	41	43	50
800	5373 2.48	4870 2.39	4485 2.32	4360 2.29	4248 2.28	4207 2.27	44	46	54
850	5700 2.58	5171 2.49	4764 2.42	4633 2.38	4514 2.37	4471 2.36	47	49	57
900	6025 3.08	5471 2.59	5042 2.51	4905 2.47	4779 2.46	4734 2.44	50	53	60
950	6350 3.19	5769 3.08	5320 3.00	5175 2.57	5044 2.55	4996 2.53	53	56	64
1000	6673 3.29	6068 3.18	5596 3.10	5445 3.06	5307 3.04	5257 3.02	56	59	67
1050	6995 3.40	6365 3.28	5872 3.19	5715 3.15	5569 3.13	5518 3.11	59	62	70
1100	7316 3.51	6661 3.38	6147 3.28	5983 3.24	5830 3.22	5777 3.20	62	65	74
1150	7636 4.01	6956 3.48	6421 3.38	6250 3.33	6091 3.31	6035 3.29	65	68	77
1200	7955 4.12	7251 3.58	6694 3.47	6517 3.42	6350 3.40	6293 3.37	68	71	80
1250	8273 4.22	7544 4.07	6966 3.56	6782 3.51	6609 3.49	6549 3.46	71	74	83
1300	8590 4.33	7837 4.17	7237 4.06	7047 4.00	6868 3.58	6804 3.55	74	77	86
1350	8906 4.44	8129 4.27	7507 4.15	7311 4.10	7125 4.07	7058 4.04	76	80	89
1400	9222 4.55	8420 4.37	7777 4.25	7574 4.19	7382 4.16	7312 4.13	79	83	92

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
△FUEL = + 2.5 %	△FUEL = + 5 %

FLIP23D A320-214 CFM56-5B4/P SA3610 03301.001011 0250300 .7801 .00100 120 0300350 55 0 100100 40100 18590 FCOM-N0-03-06-30-013-200

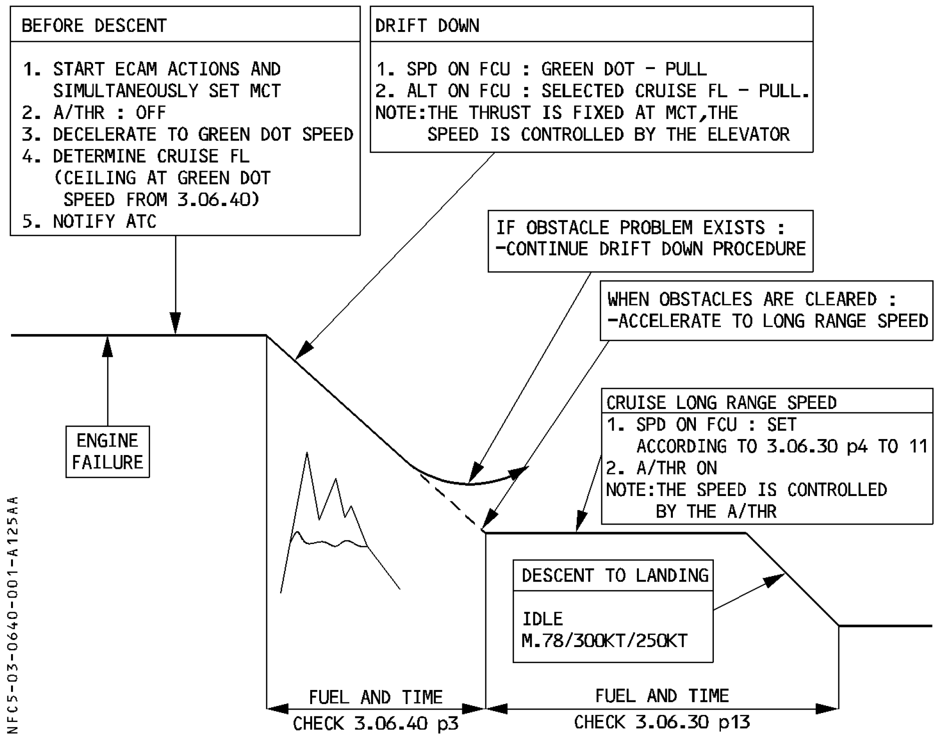
PROCEDURE

In order to maintain the highest possible level, the drift down procedure must be adopted. This requires maximum continuous thrust on the remaining engine at green dot speed.

- If, having reached drift down ceiling altitude, an obstacle problem remains, the drift down procedure must be maintained so as to fly an ascending cruise profile.
- If, after drift down, no obstacle problem remains, the speed should be allowed to increase to long range speed and maintained. The subsequent cruise should be made using either the long range speed by adjusting it as a function of aircraft weight or by maintaining the initial cruise speed.

Note : Due to the fact that the long range speed is higher than the green dot speed, the cruise will be made at an altitude lower than the drift down ceiling.

R



EXAMPLE

Given :

GW at engine failure = 62000 kg
FL at engine failure = 350
Temperature = ISA
Distance to destination airport = 1500 NM
No wind

Find :

Level off (drift down ceiling) : 25400 ft
(see 3.06.40 p3)
R Distance : 267 NM
R Fuel : 1400 kg
R Time : 48 min
LRC ceiling : (see 3.06.20 p1) FL250
Cruise at long range speed (FL250) to landing
R (weight = 62000 – 1400 = 60600 kg : Distance = 1500 – 267 = 1233 NM)
Determine on (3.06.30 p13) time and fuel consumption at ISA conditions for a reference
R weight of 55000 kg. Interpolate the remaining air distance of 1233 NM at FL250.
R Fuel : 6462 kg
R Time : 3 h 42 min
Correction due to actual in-cruise weight
R △Fuel = + 82 kg per 1000 kg above reference weight
R △Fuel = + 82 kg × (60.6 – 55) = 459 kg

Result :

R Total Fuel = 6462 + 459 + 1400 = 8321 kg
R Time = 3 h 42 min + 48 min = 4 h 30 min

R

GROSS FLIGHT PATH DESCENT AT GREEN DOT SPEED

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA CG=33.0%	**DISTANCE (NM) TIME (MIN)** **INITIAL SPEED(KT) FUEL(1000KG)** **LEVEL OFF (FT)**

INIT. GW (1000KG)	INITIAL FLIGHT LEVEL 230	250	270	290	310	330	350	370	390
50					83 16 196 .4 30700	205 38 198 1.0 31000	253 47 200 1.2 31200	284 52 202 1.3 31200	308 56 204 1.4 31300
52					170 32 200 .9 29900	237 44 202 1.2 30000	273 51 204 1.3 30100	301 55 206 1.5 30200	322 58 208 1.5 30200
54				102 20 202 .6 28700	207 39 204 1.1 29000	255 48 206 1.3 29100	287 53 208 1.5 29200	311 57 210 1.5 29200	331 60 212 1.6 29200
56				174 33 206 1.0 27800	238 45 208 1.3 28000	276 51 210 1.5 28100	304 56 212 1.6 28200	324 59 214 1.6 28200	345 62 216 1.7 28200
58			111 21 208 .6 26600	215 41 210 1.2 26900	262 49 212 1.5 27000	294 55 214 1.6 27100	320 59 216 1.7 27200	339 62 218 1.8 27200	358 65 220 1.8 27200
60			179 34 212 1.1 25800	244 46 214 1.4 26000	283 53 216 1.6 26100	311 58 218 1.7 26100	334 61 220 1.8 26200	353 64 222 1.9 26200	369 67 224 1.9 26300
62			101 19 216 .6 25300	176 33 218 1.0 25400	220 41 220 1.2 25400	240 44 222 1.3 25400	267 48 224 1.4 25400	302 54 226 1.6 25400	321 57 228 1.7 25400
64			72 13 220 .4 25200	117 21 222 .7 25200	149 27 224 .8 25200	175 31 226 .9 25300	197 35 228 1.0 25300	216 37 230 1.1 25300	233 40 232 1.2 25300
66			61 11 224 .4 25100	98 18 226 .6 25100	126 22 228 .7 25100	149 26 230 .8 25100	169 29 232 .9 25100	187 32 234 .9 25100	203 34 236 1.0 25100
68		26 5 226 .2 24900	62 11 228 .4 25000	94 17 230 .5 25000	120 21 232 .7 25000	141 24 234 .8 25000	153 26 236 .8 25000	170 28 238 .8 25000	185 30 240 .9 25000
70		119 21 230 .8 24500	158 28 232 1.1 24600	182 32 234 1.2 24600	205 36 236 1.3 24600	222 39 238 1.3 24700	238 41 240 1.4 24700	253 43 242 1.4 24700	
72		153 27 234 1.1 23900	190 34 236 1.3 24000	214 38 238 1.4 24000	234 41 240 1.5 24100	252 44 242 1.6 24100	268 46 244 1.6 24100	284 48 246 1.7 24100	
74		178 32 238 1.3 23400	210 37 240 1.5 23400	232 41 242 1.6 23500	253 44 244 1.7 23500	270 47 246 1.7 23500	286 49 248 1.8 23500	300 51 250 1.8 23500	
76	106 19 240 .8 22600	196 35 242 1.4 22800	223 39 244 1.6 22900	246 43 246 1.7 22900	264 46 248 1.8 22900	280 48 250 1.8 22900	295 50 252 1.9 23000	311 52 254 1.9 23000	
78	145 26 244 1.1 22100	209 37 246 1.6 22300	236 41 248 1.7 22300	256 44 250 1.8 22300	274 47 252 1.9 22300	291 50 254 1.9 22400	306 52 256 2.0 22400		

CORRECTIONS	**DISTANCE**	**TIME**	**FUEL**	**LEVEL OFF**
ENGINE ANTI ICE ON	+ 3 %	+ 3 %	+ 7 %	– 100 FT
TOTAL ANTI ICE ON	+ 8 %	+ 8 %	+ 10 %	– 700 FT

R

GROSS FLIGHT PATH DESCENT AT GREEN DOT SPEED

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA+10 CG=33.0%	**DISTANCE (NM) TIME (MIN)** **INITIAL SPEED(KT) FUEL(1000KG)** **LEVEL OFF (FT)**

INIT. GW (1000KG)	INITIAL FLIGHT LEVEL 230	250	270	290	310	330	350	370	390
50					103 19 196 .5 30700	213 39 198 1.1 31000	260 47 200 1.3 31100	292 52 202 1.4 31200	317 56 204 1.5 31200
52					177 33 200 .9 29800	245 45 202 1.2 30000	283 51 204 1.4 30100	309 55 206 1.5 30100	333 59 208 1.6 30200
54				110 21 202 .6 28600	215 40 204 1.1 28900	263 48 206 1.4 29000	295 53 208 1.5 29100	320 57 210 1.6 29200	342 61 212 1.7 29200
56				180 34 206 1.0 27800	245 45 208 1.3 28000	284 52 210 1.5 28100	311 56 212 1.6 28100	334 60 214 1.7 28200	355 63 216 1.8 28200
58			118 22 208 .7 26600	221 41 210 1.3 26900	270 50 212 1.5 27000	302 55 214 1.7 27100	329 59 216 1.8 27200	348 62 218 1.8 27200	368 65 220 1.9 27200
60			185 35 212 1.1 25800	251 47 214 1.5 26000	291 53 216 1.7 26100	320 58 218 1.8 26100	343 62 220 1.9 26200	363 65 222 2.0 26200	381 67 224 2.0 26200
62			103 19 216 .6 25300	183 33 218 1.1 25400	225 41 220 1.3 25400	257 46 222 1.4 25400	274 48 224 1.5 25400	299 52 226 1.6 25400	331 58 228 1.7 25400
64			74 13 220 .4 25200	120 21 222 .7 25200	154 27 224 .9 25200	180 31 226 1.0 25200	203 35 228 1.1 25300	223 38 230 1.1 25300	241 40 232 1.2 25300
66			63 11 224 .4 25100	101 18 226 .6 25100	130 23 228 .7 25100	154 26 230 .8 25100	175 30 232 .9 25100	194 32 234 1.0 25100	211 35 236 1.0 25100
68		40 7 226 .3 24900	93 16 228 .6 25000	98 17 230 .6 25000	124 21 232 .7 25000	146 25 234 .8 25000	166 28 236 .9 25000	184 30 238 .9 25000	200 32 240 1.0 25000
70		125 22 230 .9 24500	166 29 232 1.1 24500	192 33 234 1.2 24600	213 37 236 1.3 24600	232 40 238 1.4 24600	249 42 240 1.5 24600	264 44 242 1.5 24700	
72		162 28 234 1.2 23900	197 34 236 1.4 24000	222 39 238 1.5 24000	244 42 240 1.6 24000	262 45 242 1.6 24100	279 47 244 1.7 24100	295 49 246 1.8 24100	
74	11 2 236 .1 22900	185 32 238 1.3 23300	215 37 240 1.5 23400	239 41 242 1.6 23400	261 44 244 1.7 23500	279 47 246 1.8 23500	296 50 248 1.9 23500	309 51 250 1.9 23500	
76	93 16 240 .7 22500	202 35 242 1.5 22800	230 40 244 1.6 22800	254 43 246 1.8 22800	274 46 248 1.8 22900	291 49 250 1.9 22900	307 51 252 2.0 22900	321 53 254 2.0 22900	
78	111 19 244 .8 22000	217 37 246 1.6 22200	244 42 248 1.8 22200	265 45 250 1.9 22300	283 48 252 1.9 22300	300 50 254 2.0 22300	316 52 256 2.1 22300		

CORRECTIONS	**DISTANCE**	**TIME**	**FUEL**	**LEVEL OFF**
ENGINE ANTI ICE ON	+ 3 %	+ 3 %	+ 7 %	– 100 FT
TOTAL ANTI ICE ON	+ 8 %	+ 8 %	+ 10 %	– 700 FT

R

GROSS FLIGHT PATH DESCENT AT GREEN DOT SPEED

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA+15 CG=33.0%	**DISTANCE (NM) TIME (MIN)** **INITIAL SPEED(KT) FUEL(1000KG)** **LEVEL OFF (FT)**

INIT. GW (1000KG)	INITIAL FLIGHT LEVEL 230	250	270	290	310	330	350	370	390
50					179 33 196 .9 29900	249 46 198 1.2 30100	288 53 200 1.4 30200	317 57 202 1.5 30200	339 61 204 1.6 30300
52				115 22 198 .6 28600	220 41 200 1.1 28900	270 50 202 1.4 29000	304 55 204 1.5 29100	329 59 206 1.6 29200	350 63 208 1.6 29200
54				188 35 202 1.0 27700	252 47 204 1.3 27900	293 54 206 1.5 28000	321 59 208 1.6 28100	345 62 210 1.7 28100	364 65 212 1.8 28100
56			132 25 204 .8 26500	230 43 206 1.3 26800	279 52 208 1.5 26900	312 57 210 1.7 27000	338 62 212 1.8 27000	358 65 214 1.8 27100	379 68 216 1.9 27100
58			196 37 208 1.1 25600	259 49 210 1.5 25800	299 55 212 1.7 25900	327 60 214 1.8 26000	352 64 216 1.9 26000	372 67 218 1.9 26000	390 70 220 2.0 26100
60			97 18 212 .6 25300	175 32 214 1.0 25300	198 36 216 1.1 25300	231 41 218 1.2 25300	275 49 220 1.4 25400	296 52 222 1.5 25400	317 56 224 1.6 25400
62			73 13 216 .4 25200	118 21 218 .7 25200	174 31 220 1.0 25200	202 36 222 1.1 25200	222 39 224 1.2 25200	220 38 226 1.1 25200	238 40 228 1.1 25200
64			62 11 220 .4 25000	99 18 222 .5 25100	128 22 224 .7 25100	152 26 226 .8 25100	173 29 228 .9 25100	191 32 230 .9 25100	208 34 232 1.0 25100
66		72 13 222 .5 24800	126 23 224 .8 24900	149 26 226 .9 24900	167 29 228 1.0 24900	182 31 230 1.0 24900	194 33 232 1.0 24900	209 35 234 1.1 25000	225 37 236 1.1 25000
68		140 25 226 1.0 24300	179 32 228 1.2 24300	205 36 230 1.3 24400	227 40 232 1.4 24400	246 42 234 1.5 24400	263 45 236 1.5 24400	278 47 238 1.6 24500	
70		170 30 230 1.2 23700	204 36 232 1.4 23700	229 40 234 1.5 23800	249 43 236 1.6 23800	269 46 238 1.6 23800	286 49 240 1.7 23900	302 51 242 1.8 23900	
72	63 11 232 .5 22800	192 34 234 1.3 23100	221 39 236 1.5 23200	246 43 238 1.6 23200	266 46 240 1.7 23200	284 48 242 1.8 23200	300 51 244 1.8 23300	316 53 246 1.9 23300	
74	132 23 236 1.0 22400	208 36 238 1.5 22500	234 41 240 1.6 22600	256 44 242 1.7 22600	277 47 244 1.8 22600	295 50 246 1.9 22700	311 52 248 1.9 22700	326 54 250 2.0 22700	
76	162 28 240 1.2 21800	221 39 242 1.6 22000	246 43 244 1.7 22000	268 46 246 1.8 22000	284 48 248 1.9 22000	303 51 250 2.0 22100	319 53 252 2.0 22100		
78	186 32 244 1.4 21300	233 40 246 1.7 21400	256 44 248 1.8 21400	276 47 250 1.9 21500	293 50 252 2.0 21500	309 52 254 2.0 21500	326 54 256 2.1 21500		

CORRECTIONS	**DISTANCE**	**TIME**	**FUEL**	**LEVEL OFF**
ENGINE ANTI ICE ON	+ 3 %	+ 3 %	+ 7 %	– 100 FT
TOTAL ANTI ICE ON	+ 8 %	+ 8 %	+ 10 %	– 700 FT

R

GROSS FLIGHT PATH DESCENT AT GREEN DOT SPEED

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA+20 CG=33.0%	**DISTANCE (NM) TIME (MIN)** **INITIAL SPEED(KT) FUEL(1000KG)** **LEVEL OFF (FT)**

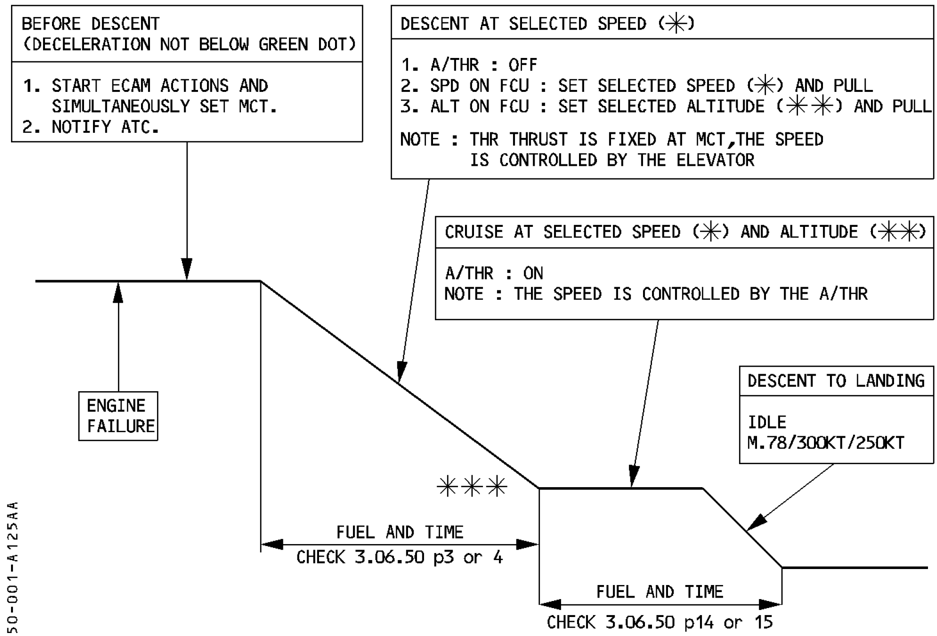
INIT. GW (1000KG)	INITIAL FLIGHT LEVEL 230	250	270	290	310	330	350	370	390
50				119 23 194 .6 28600	224 42 196 1.1 28900	273 51 198 1.3 29000	307 57 200 1.5 29100	333 61 202 1.5 29100	354 64 204 1.6 29200
52				191 36 198 1.0 27700	255 48 200 1.3 27900	295 55 202 1.5 27900	324 60 204 1.6 28000	348 63 206 1.7 28100	368 66 208 1.7 28100
54			138 27 200 .8 26400	231 44 202 1.2 26700	280 53 204 1.5 26800	314 58 206 1.6 26900	339 62 208 1.7 26900	362 66 210 1.8 27000	381 69 212 1.8 27000
56			200 38 204 1.1 25500	262 50 206 1.4 25700	301 56 208 1.6 25800	330 61 210 1.7 25800	353 65 212 1.8 25900	374 68 214 1.9 25900	392 71 216 1.9 26000
58			96 18 208 .5 25200	152 28 210 .8 25300	212 39 212 1.1 25300	243 44 214 1.3 25300	268 48 216 1.4 25300	291 52 218 1.4 25300	309 54 220 1.5 25300
60			74 14 212 .4 25100	118 21 214 .6 25100	150 27 216 .8 25100	176 31 218 .9 25100	198 35 220 1.0 25100	218 38 222 1.0 25100	236 40 224 1.1 25100
62		26 5 214 .2 24900	64 12 216 .4 25000	100 18 218 .5 25000	128 23 220 .7 25000	152 26 222 .8 25000	173 30 224 .8 25000	191 32 226 .9 25000	208 35 228 .9 25000
64		121 22 218 .8 24500	165 30 220 1.0 24500	194 35 222 1.2 24600	214 38 224 1.2 24600	234 41 226 1.3 24600	253 44 228 1.4 24700	268 46 230 1.4 24700	
66		159 29 222 1.1 23900	197 35 224 1.2 24000	223 40 226 1.4 24000	245 43 228 1.5 24000	265 46 230 1.5 24100	281 49 232 1.6 24100	299 51 234 1.6 24100	
68	11 2 224 .1 22900	183 33 226 1.2 23300	216 39 228 1.4 23400	240 43 230 1.5 23400	260 46 232 1.6 23400	281 49 234 1.7 23500	296 51 236 1.7 23500	313 53 238 1.8 23500	
70	92 17 228 .7 22500	201 36 230 1.4 22700	230 41 232 1.5 22800	253 45 234 1.6 22800	273 48 236 1.7 22800	291 50 238 1.8 22900	308 53 240 1.8 22900	323 55 242 1.9 22900	
72	153 27 232 1.1 22000	215 38 234 1.5 22100	242 43 236 1.6 22200	263 46 238 1.7 22200	282 49 240 1.8 22200	298 51 242 1.9 22300	316 54 244 1.9 22300		
74	177 31 236 1.3 21500	227 40 238 1.6 21600	251 44 240 1.7 21600	272 47 242 1.8 21600	289 50 244 1.9 21700	307 52 246 1.9 21700	324 55 248 2.0 21700		
76	195 34 240 1.4 20900	237 41 242 1.7 21000	260 45 244 1.8 21100	279 48 246 1.9 21100	297 51 248 2.0 21100	314 53 250 2.0 21100	328 55 252 2.1 21100		
78	210 37 244 1.6 20400	245 43 246 1.8 20500	267 46 248 1.9 20500	287 49 250 2.0 20500	303 51 252 2.0 20500	320 54 254 2.1 20600	335 56 256 2.1 20600		

CORRECTIONS	**DISTANCE**	**TIME**	**FUEL**	**LEVEL OFF**
ENGINE ANTI ICE ON	+ 3 %	+ 3 %	+ 7 %	– 100 FT
TOTAL ANTI ICE ON	+ 8 %	+ 8 %	+ 10 %	– 700 FT

– For LONG RANGE CRUISE table (Refer to 3.06.30 p4 to 11)
– For IN CRUISE QUICK CHECK (Refer to 3.06.30 p12)

PROCEDURE

This section provides single engine performance data for two fixed speed diversion strategies (fixed descent and cruise speed schedules) recommended for ETOPS operation, provided that the requirements set forth in section 3.06.10, GENERAL, are complied with.



✳ USE M.80/350KT OR M.78/320KT AS ESTABLISHED BEFORE DISPATCH.

✳✳ SET 15000 feet OR VALUE ESTABLISHED BEFORE DISPATCH.

✳✳✳ IF V/S BECOMES < 500 feet/minute SELECT V/S MODE.

EXAMPLE

Given :

GW at engine failure	=	70000 kg
FL at engine failure	=	350
Temperature	=	ISA
Distance to diversion airport	=	500 NM
Speed selected before dispatch	=	350 KT
Cruise level for diversion		
Selected before dispatch	=	FL180

Find :

R Descent to cruise level : Distance = 178 – 92 = 86 NM
R (See 3.06.50 p3) Fuel = 1030 – 651 = 379 kg
R Time = 24.1 – 13.1 = 11 min

Cruise
R Weight = 70000 – 379 = 69621 kg
R Distance = 500 – 86 = 414 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 414 NM at FL180
R Fuel = 2804 kg
R Time = 1 h 11 min

Correction due to actual in-cruise weight : no correction here
R $\triangle$Fuel = + 3 kg per 1000 kg above reference weight
R $\triangle$Fuel = + 3 kg × (69.6 – 55) ~ 44 kg

Result :

R Total Fuel = 2804 + 44 + 379 = 3227 kg
R Time = 1h11 min + 11 min = 1 h 22 min

R

DESCENT - M.80/350KT - 1 ENGINE OUT									
MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF		ISA CG=33.0%		MINIMUM RATE OF DESCENT 500FT/MIN					
WEIGHT (1000KG)	50				70				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	IAS (KT)
390	24.8	1011	183	MCT					248
370	23.3	980	172	MCT	25.3	1060	188	MCT	260
350	21.9	946	162	MCT	24.1	1030	178	MCT	272
330	20.6	911	151	MCT	22.8	998	169	MCT	284
310	19.4	876	142	MCT	21.6	962	159	MCT	297
290	18.3	842	133	MCT	20.4	924	149	MCT	311
270	17.3	809	126	MCT	19.2	886	140	MCT	324
250	16.4	778	119	MCT	18.1	849	131	MCT	338
230	15.6	749	112	MCT	17.1	811	123	MCT	350
220	15.1	728	108	MCT	16.4	785	118	MCT	350
210	14.5	705	103	MCT	15.6	756	112	MCT	350
200	13.8	679	98	MCT	14.8	724	105	MCT	350
190	13.2	651	93	MCT	14.0	689	99	MCT	350
180	12.4	620	87	MCT	13.1	651	92	MCT	350
170	11.5	582	81	MCT	12.1	607	84	MCT	350
160	10.5	534	73	MCT	10.9	551	76	MCT	350
150	9.2	473	64	MCT	9.4	483	65	MCT	350
140	7.8	399	53	MCT	7.8	402	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	– 1.5 %	– 4.5 %	–
FUEL	+ 0.5 %	–	+ 0.3 %
DISTANCE	– 1.5 %	– 5 %	+ 0.3 %

11.0-08F0A320-214 CFM56-5B4/P SA23200010C6KG330 0 018590 0 0 3 .0 .0 500.00 0 02 .800350.000 .000 0 FCOM-N0-03-06-50-003-200

R

DESCENT - M.78/320KT - 1 ENGINE OUT									
MAX. CONTINUOUS THRUST LIMITS PACK FLOW HI ANTI-ICING OFF			ISA CG=33.0%		MINIMUM RATE OF DESCENT 500FT/MIN				
WEIGHT (1000KG)	50				70				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	TIME (MIN)	FUEL (KG)	DIST. (NM)	MODE	IAS (KT)
390	35.7	1327	250	MCT					241
370	34.0	1290	237	MCT	34.4	1315	240	MCT	252
350	32.3	1249	224	MCT	33.0	1282	230	MCT	264
330	30.7	1207	212	MCT	31.6	1244	219	MCT	277
310	29.2	1164	201	MCT	30.1	1202	208	MCT	289
290	27.8	1123	191	MCT	28.6	1158	197	MCT	302
270	26.6	1082	181	MCT	27.2	1113	186	MCT	315
250	25.2	1032	170	MCT	25.6	1056	173	MCT	320
230	23.3	966	156	MCT	23.5	981	157	MCT	320
220	22.3	927	148	MCT	22.3	938	149	MCT	320
210	21.1	882	140	MCT	21.1	890	140	MCT	320
200	19.7	828	130	MCT	19.7	834	130	MCT	320
190	18.0	755	118	V/S	18.0	763	118	MCT	320
180	16.0	669	104	V/S	16.0	678	104	V/S	320
170	14.0	584	90	V/S	14.0	591	90	V/S	320
160	12.0	499	77	V/S	12.0	505	77	V/S	320
150	10.0	415	64	V/S	10.0	420	64	V/S	320
140	8.0	332	50	V/S	8.0	335	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	– 0.6 %	– 3 %	–
FUEL	+ 1.5 %	+ 5 %	+ 0.3 %
DISTANCE	– 0.8 %	– 2.5 %	+ 0.3 %

11.0-08F0A320-214 CFM56-5B4/P SA23200010C6KG330 0 018590 0 0 3 .0 .0 500.00 0 02 .780320.000 .000 0 FCOM-N0-03-06-50-004-200

R

CRUISE - MCT/VMO - 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**	
50	89.6	.609	91.3	.641	91.4	.645	91.1	.644	91.3	.649	91.1	.647
	3249	338	3072	325	3010	321	2798	308	2663	299	2480	286
	119.6	389	130.7	402	133.7	403	142.5	399	149.7	399	158.9	394
52	89.6	.608	91.3	.640	91.5	.644	91.2	.643	91.4	.647	91.2	.645
	3251	338	3076	325	3015	321	2804	308	2673	298	2490	285
	119.3	388	130.3	401	133.3	402	141.9	398	148.7	398	157.8	393
54	89.6	.607	91.3	.639	91.5	.642	91.2	.641	91.5	.645	91.3	.642
	3252	337	3080	324	3019	320	2811	307	2683	297	2500	284
	119.1	387	129.9	400	132.8	401	141.2	397	147.8	397	156.5	391
56	89.6	.605	91.4	.637	91.6	.641	91.3	.639	91.6	.644	91.5	.640
	3254	337	3084	323	3024	319	2820	306	2694	296	2512	283
	118.8	386	129.4	399	132.2	400	140.4	396	146.8	395	155.2	390
58	89.6	.604	91.4	.636	91.6	.639	91.4	.638	91.8	.642	91.6	.637
	3255	336	3088	322	3029	318	2828	305	2705	295	2525	281
	118.4	386	128.9	398	131.7	399	139.6	395	145.7	394	153.8	388
60	89.6	.603	91.5	.634	91.7	.637	91.5	.636	91.9	.639	91.8	.634
	3257	335	3093	321	3035	317	2836	304	2717	294	2539	280
	118.1	385	128.4	397	131.1	398	138.8	394	144.6	393	152.2	386
62	89.7	.601	91.5	.632	91.7	.636	91.6	.634	92.0	.637	91.9	.630
	3259	334	3098	320	3041	316	2845	303	2731	293	2554	278
	117.7	384	127.8	396	130.4	397	137.9	392	143.3	391	150.4	384
64	89.7	.600	91.6	.630	91.8	.634	91.7	.631	92.2	.634	92.1	.627
	3260	333	3104	319	3047	315	2856	302	2745	292	2571	277
	117.4	383	127.2	395	129.8	395	136.9	391	142.0	390	148.6	382
66	89.7	.598	91.6	.628	91.9	.631	91.8	.629	92.3	.632	92.3	.622
	3258	332	3109	318	3054	314	2868	301	2761	291	2587	275
	117.1	381	126.5	393	129.1	394	135.8	389	140.5	388	146.6	379
68	89.7	.595	91.7	.626	91.9	.629	91.9	.626	92.5	.629	92.6	.617
	3257	331	3116	317	3061	313	2881	300	2779	289	2605	272
	116.7	380	125.9	392	128.3	393	134.6	388	139.0	386	144.4	376
70	89.7	.593	91.7	.624	92.0	.627	92.0	.623	92.7	.625	92.9	.612
	3255	330	3122	316	3068	312	2896	298	2797	287	2625	270
	116.3	379	125.1	391	127.5	391	133.3	386	137.3	384	142.1	373
72	89.7	.591	91.8	.621	92.1	.624	92.2	.620	92.9	.621	93.2	.605
	3253	328	3129	315	3077	310	2911	297	2817	286	2648	267
	115.9	377	124.4	389	126.6	390	131.9	384	135.5	382	139.3	369
74	89.7	.588	91.9	.619	92.2	.621	92.4	.617	93.1	.617	93.5	.597
	3251	327	3137	313	3086	309	2928	295	2836	283	2666	263
	115.5	376	123.5	387	125.6	388	130.4	382	133.6	379	136.4	364
76	89.7	.586	92.0	.616	92.3	.618	92.5	.613	93.4	.612	93.6	.577
	3249	325	3145	312	3097	307	2946	293	2857	281	2656	254
	115.1	374	122.6	386	124.6	386	128.8	380	131.6	376	132.3	351
78	89.7	.583	92.0	.612	92.4	.615	92.7	.609	93.7	.607		
	3246	324	3154	310	3109	305	2967	291	2883	279		
	114.6	372	121.6	384	123.3	383	127.1	377	129.3	373		

ENGINE ANTI ICE ON △FUEL = + 1.5 %	**TOTAL ANTI ICE ON** △FUEL = + 4 %

R

CRUISE - MCT/VMO - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
PACK FLOW HI
ANTI-ICING OFF

ISA+10
CG=33.0%

N1 (%) **MACH**
KG/H **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL160		FL180		FL200		FL220	
50	91.2	.607	93.0	.640	93.2	.644	92.8	.643	93.1	.648	92.9	.646
	3317	338	3146	325	3085	321	2868	308	2731	298	2543	286
	119.0	395	129.9	409	132.9	410	141.6	406	148.7	406	157.9	401
52	91.2	.606	93.0	.639	93.2	.643	92.9	.642	93.2	.646	93.0	.643
	3319	337	3150	324	3089	320	2874	307	2741	298	2553	285
	118.7	394	129.5	408	132.4	409	141.0	405	147.7	405	156.7	400
54	91.2	.605	93.0	.638	93.2	.642	93.0	.640	93.3	.645	93.1	.641
	3320	336	3154	323	3094	319	2882	306	2751	297	2564	283
	118.5	393	129.1	407	131.9	408	140.2	404	146.8	404	155.5	399
56	91.2	.604	93.1	.636	93.3	.640	93.1	.638	93.4	.643	93.2	.639
	3322	336	3158	323	3099	319	2890	306	2762	296	2575	282
	118.2	393	128.6	406	131.4	407	139.5	403	145.8	403	154.2	397
58	91.2	.602	93.1	.635	93.3	.638	93.1	.637	93.5	.641	93.4	.636
	3323	335	3163	322	3104	318	2898	305	2774	295	2589	281
	117.9	392	128.1	405	130.8	406	138.7	402	144.7	401	152.7	395
60	91.2	.601	93.2	.633	93.4	.637	93.2	.635	93.6	.638	93.5	.633
	3325	334	3168	321	3110	317	2907	304	2787	294	2603	280
	117.5	391	127.5	404	130.2	405	137.8	401	143.6	400	151.1	393
62	91.2	.600	93.2	.631	93.5	.635	93.3	.633	93.8	.636	93.7	.629
	3326	333	3173	320	3116	316	2917	303	2800	293	2619	278
	117.2	390	127.0	403	129.6	404	136.9	399	142.3	399	149.4	391
64	91.2	.598	93.3	.629	93.5	.633	93.4	.630	93.9	.633	93.9	.625
	3325	332	3179	319	3122	315	2928	302	2815	291	2636	276
	116.9	389	126.4	402	128.9	402	135.9	398	141.0	397	147.5	389
66	91.2	.596	93.3	.627	93.6	.631	93.5	.628	94.1	.631	94.1	.621
	3323	331	3185	318	3129	314	2941	300	2832	290	2652	274
	116.6	387	125.7	400	128.2	401	134.8	396	139.5	395	145.6	386
68	91.2	.594	93.4	.625	93.7	.628	93.7	.625	94.3	.627	94.4	.616
	3322	330	3191	317	3136	313	2954	299	2850	289	2671	272
	116.2	386	125.0	399	127.4	400	133.6	395	138.0	393	143.4	383
70	91.2	.591	93.4	.623	93.7	.626	93.8	.622	94.5	.624	94.7	.610
	3320	329	3198	316	3144	311	2969	298	2869	287	2691	269
	115.8	385	124.3	398	126.6	398	132.4	393	136.3	391	141.0	380
72	91.2	.589	93.5	.620	93.8	.623	93.9	.619	94.7	.620	95.0	.604
	3318	327	3205	314	3153	310	2985	296	2888	285	2715	266
	115.4	383	123.6	396	125.7	396	131.0	391	134.5	389	138.3	376
74	91.2	.587	93.6	.618	93.9	.620	94.1	.616	94.9	.616	95.2	.593
	3316	326	3213	313	3163	308	3002	294	2909	283	2727	261
	115.0	381	122.7	394	124.7	395	129.5	389	132.6	386	135.3	369
76	91.2	.584	93.7	.615	94.0	.617	94.3	.612	95.2	.611	95.4	.572
	3314	324	3222	311	3174	307	3021	292	2932	281	2717	252
	114.5	380	121.8	392	123.6	392	127.9	386	130.6	383	131.0	356
78	91.2	.581	93.8	.611	94.1	.613	94.5	.608	95.5	.605		
	3312	323	3232	310	3187	305	3042	290	2958	278		
	114.0	378	120.8	390	122.4	390	126.1	384	128.2	379		

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
△FUEL = + 1.5 %	△FUEL = + 4 %

R

CRUISE - MCT/VMO - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
PACK FLOW HI
ANTI-ICING OFF

ISA+15
CG=33.0%

N1 (%) / **MACH**
KG/H / **IAS (KT)**
NM/1000KG / **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL160		FL180		FL200		FL220	
50	90.7	.592	92.7	.626	93.0	.631	92.8	.632	93.2	.637	92.9	.634
	3170	329	3028	318	2976	314	2792	302	2665	293	2474	280
	122.5	388	133.3	404	136.1	405	144.3	403	151.3	403	161.0	398
52	90.7	.591	92.8	.625	93.0	.630	92.9	.630	93.2	.636	93.0	.632
	3169	328	3032	317	2980	313	2799	302	2674	292	2484	279
	122.3	388	132.8	403	135.6	404	143.5	402	150.4	402	159.7	397
54	90.7	.590	92.8	.624	93.0	.628	93.0	.629	93.3	.634	93.1	.629
	3168	327	3037	316	2985	312	2808	301	2684	292	2495	278
	122.1	387	132.3	402	135.1	403	142.7	401	149.4	401	158.3	395
56	90.7	.588	92.8	.622	93.1	.626	93.1	.627	93.5	.632	93.2	.626
	3167	327	3041	315	2990	311	2816	300	2694	291	2508	276
	121.8	386	131.8	401	134.4	402	141.9	400	148.3	400	156.8	393
58	90.7	.586	92.9	.620	93.1	.624	93.2	.625	93.6	.629	93.4	.623
	3165	326	3046	314	2996	310	2825	299	2706	289	2521	275
	121.5	385	131.2	400	133.8	401	141.0	398	147.1	398	155.1	391
60	90.7	.585	92.9	.618	93.2	.622	93.3	.623	93.7	.627	93.6	.619
	3164	325	3051	313	3002	309	2835	298	2720	288	2536	273
	121.2	383	130.6	398	133.1	400	140.0	397	145.8	397	153.3	389
62	90.7	.583	93.0	.616	93.3	.620	93.4	.621	93.8	.624	93.8	.615
	3162	324	3057	312	3009	308	2846	297	2735	287	2553	271
	120.9	382	129.9	397	132.4	398	139.0	396	144.4	395	151.3	386
64	90.7	.581	93.0	.614	93.3	.618	93.5	.618	94.0	.621	94.0	.611
	3160	322	3063	311	3016	307	2857	296	2751	286	2572	269
	120.5	381	129.2	396	131.6	397	137.9	394	142.9	393	149.1	384
66	90.7	.578	93.1	.612	93.4	.616	93.6	.616	94.2	.618	94.2	.606
	3158	321	3070	310	3023	306	2870	294	2768	284	2592	267
	120.1	379	128.5	394	130.7	395	136.7	392	141.2	391	146.7	380
68	90.7	.576	93.2	.610	93.5	.613	93.7	.613	94.4	.614	94.4	.601
	3156	320	3077	309	3032	305	2883	293	2787	282	2615	265
	119.7	378	127.7	393	129.9	394	135.5	390	139.4	389	144.2	377
70	90.7	.573	93.2	.607	93.6	.610	93.9	.610	94.6	.611	94.5	.590
	3154	318	3084	307	3041	303	2898	291	2808	280	2611	260
	119.2	376	126.8	391	128.9	392	134.1	388	137.5	386	141.7	370
72	90.7	.571	93.3	.604	93.7	.607	94.0	.606	94.8	.606	94.6	.573
	3152	317	3093	306	3050	302	2916	289	2831	278	2602	252
	118.7	374	125.8	389	127.8	390	132.4	386	135.5	384	138.4	360
74	90.7	.568	93.4	.601	93.8	.604	94.2	.602	95.0	.602	94.7	.548
	3150	315	3102	304	3061	300	2935	287	2856	276	2589	241
	118.2	372	124.8	387	126.6	388	130.7	384	133.2	381	133.0	344
76	90.7	.564	93.4	.597	93.9	.600	94.3	.597	95.2	.593		
	3147	313	3103	302	3073	298	2946	285	2862	272		
	117.6	370	123.9	385	125.4	385	129.1	380	131.1	375		
78	90.7	.561	93.5	.592	93.9	.595	94.4	.590	95.3	.580		
	3144	311	3102	300	3072	295	2948	281	2855	266		
	117.0	368	123.0	382	124.3	382	127.5	376	128.5	367		

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
ΔFUEL = + 1.5 %	ΔFUEL = + 4 %

R

CRUISE - MCT/VMO - 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**	
50	90.1	.577	92.5	.612	92.7	.617	92.8	.620	93.1	.626	92.8	.621
	3029	321	2912	310	2864	307	2712	297	2595	288	2402	274
	126.1	382	136.6	398	139.5	400	147.2	399	154.0	400	163.9	394
52	90.1	.576	92.5	.610	92.8	.615	92.9	.619	93.2	.624	92.9	.619
	3028	320	2916	309	2869	306	2720	296	2604	287	2411	273
	125.8	381	136.1	397	138.9	399	146.3	398	153.0	398	162.6	392
54	90.1	.574	92.5	.609	92.8	.613	93.0	.617	93.3	.622	93.0	.616
	3027	319	2921	308	2874	305	2729	295	2615	286	2422	272
	125.5	380	135.5	396	138.3	397	145.4	397	151.8	397	161.1	390
56	90.1	.573	92.6	.607	92.9	.612	93.0	.615	93.5	.620	93.2	.612
	3026	318	2926	307	2880	304	2738	294	2626	285	2434	270
	125.2	379	134.9	395	137.6	396	144.4	395	150.7	396	159.4	388
58	90.1	.571	92.6	.605	92.9	.610	93.1	.613	93.6	.617	93.3	.608
	3025	317	2932	306	2886	303	2749	293	2637	284	2447	268
	124.9	378	134.2	393	136.8	395	143.4	394	149.4	394	157.6	386
60	90.1	.569	92.7	.603	93.0	.607	93.2	.610	93.7	.614	93.5	.604
	3023	316	2938	305	2892	302	2759	292	2650	282	2463	266
	124.5	376	133.4	392	136.1	394	142.3	393	148.0	392	155.5	383
62	90.1	.567	92.7	.601	93.0	.605	93.4	.608	93.9	.611	93.7	.599
	3022	314	2944	304	2899	300	2771	290	2665	281	2478	264
	124.1	375	132.7	391	135.2	392	141.1	391	146.5	390	153.3	380
64	90.1	.564	92.8	.598	93.1	.603	93.5	.605	94.0	.608	93.7	.591
	3020	313	2945	303	2906	299	2784	289	2680	279	2474	260
	123.6	373	132.0	389	134.4	390	139.8	389	144.9	388	151.5	375
66	90.1	.562	92.8	.595	93.2	.600	93.6	.602	94.2	.604	93.7	.581
	3018	312	2943	301	2913	298	2798	288	2699	277	2469	256
	123.1	372	131.4	387	133.4	389	138.4	387	143.0	386	149.1	368
68	90.1	.559	92.8	.591	93.2	.596	93.7	.598	94.4	.600	93.8	.567
	3017	310	2941	299	2911	296	2808	286	2720	275	2463	249
	122.6	370	130.7	385	132.7	386	137.1	385	140.9	383	146.0	360
70	90.1	.556	92.8	.588	93.2	.592	93.8	.593	94.5	.593	93.9	.546
	3014	308	2939	297	2909	294	2807	283	2718	272	2455	240
	122.0	368	130.0	382	131.8	383	135.9	382	139.3	379	141.1	346
72	90.1	.553	92.8	.583	93.2	.587	93.8	.587	94.5	.584		
	3012	307	2937	295	2907	291	2805	280	2715	268		
	121.4	366	129.1	379	130.8	380	134.6	378	137.4	373		
74	90.1	.549	92.8	.579	93.3	.582	93.8	.580	94.6	.573		
	3010	305	2935	292	2905	289	2804	277	2711	262		
	120.7	363	128.2	376	129.8	377	133.1	373	134.8	366		
76	90.1	.545	92.9	.573	93.3	.576	93.9	.572	94.6	.556		
	3007	302	2932	290	2903	286	2803	272	2706	254		
	119.9	361	127.1	373	128.5	373	131.2	368	131.1	355		
78	90.1	.540	92.9	.567	93.3	.569	94.0	.561	94.8	.528		
	3005	300	2929	287	2901	282	2801	267	2700	241		
	119.0	358	126.0	369	127.1	369	128.8	361	124.8	337		
ENGINE ANTI ICE ON △FUEL = + 1.5 %							**TOTAL ANTI ICE ON** △FUEL = + 4 %					

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**	
50	86.7	.576	90.5	.631	91.2	.643	91.1	.644	91.3	.649	91.1	.647
	2868	320	2958	320	2984	320	2798	308	2663	299	2480	286
	128.3	368	133.6	395	134.4	401	142.5	399	149.7	399	158.9	394
52	86.8	.576	90.6	.631	91.4	.643	91.2	.643	91.4	.647	91.2	.645
	2883	320	2976	320	3004	320	2804	308	2673	298	2490	285
	127.6	368	132.8	395	133.5	401	141.9	398	148.7	398	157.8	393
54	87.0	.576	90.7	.631	91.5	.642	91.2	.641	91.5	.645	91.3	.642
	2899	320	2996	320	3019	320	2811	307	2683	297	2500	284
	126.9	368	132.0	395	132.8	401	141.2	397	147.8	397	156.5	391
56	87.1	.576	90.9	.631	91.6	.641	91.3	.639	91.6	.644	91.5	.640
	2917	320	3017	320	3024	319	2820	306	2694	296	2512	283
	126.1	368	131.0	395	132.2	400	140.4	396	146.8	395	155.2	390
58	87.3	.576	91.1	.631	91.6	.639	91.4	.638	91.8	.642	91.6	.637
	2934	320	3039	320	3029	318	2828	305	2705	295	2525	281
	125.4	368	130.1	395	131.7	399	139.6	395	145.7	394	153.8	388
60	87.4	.576	91.3	.631	91.7	.637	91.5	.636	91.9	.639	91.8	.634
	2954	320	3064	320	3035	317	2836	304	2717	294	2539	280
	124.5	368	129.0	395	131.1	398	138.8	394	144.6	393	152.2	386
62	87.6	.576	91.4	.631	91.7	.636	91.6	.634	92.0	.637	91.9	.630
	2975	320	3089	320	3041	316	2845	303	2731	293	2554	278
	123.7	368	128.0	395	130.4	397	137.9	392	143.3	391	150.4	384
64	87.8	.576	91.6	.630	91.8	.634	91.7	.631	92.2	.634	92.1	.627
	2997	320	3104	319	3047	315	2856	302	2745	292	2571	277
	122.8	368	127.2	395	129.8	395	136.9	391	142.0	390	148.6	382
66	88.0	.576	91.6	.628	91.9	.631	91.8	.629	92.3	.632	92.3	.622
	3019	320	3109	318	3054	314	2868	301	2761	291	2587	275
	121.8	368	126.5	393	129.1	394	135.8	389	140.5	388	146.6	379
68	88.2	.576	91.7	.626	91.9	.629	91.9	.626	92.5	.629	92.6	.617
	3043	320	3116	317	3061	313	2881	300	2779	289	2605	272
	120.9	368	125.9	392	128.3	393	134.6	388	139.0	386	144.4	376
70	88.4	.576	91.7	.624	92.0	.627	92.0	.623	92.7	.625	92.9	.612
	3067	320	3122	316	3068	312	2896	298	2797	287	2625	270
	120.0	368	125.1	391	127.5	391	133.3	386	137.3	384	142.1	373
72	88.6	.576	91.8	.621	92.1	.624	92.2	.620	92.9	.621	93.2	.605
	3092	320	3129	315	3077	310	2911	297	2817	286	2648	267
	119.0	368	124.4	389	126.6	390	131.9	384	135.5	382	139.3	369
74	88.8	.576	91.9	.619	92.2	.621	92.4	.617	93.1	.617	93.5	.597
	3119	320	3137	313	3086	309	2928	295	2836	283	2666	263
	118.0	368	123.5	387	125.6	388	130.4	382	133.6	379	136.4	364
76	89.0	.576	92.0	.616	92.3	.618	92.5	.613	93.4	.612	93.6	.577
	3148	320	3145	312	3097	307	2946	293	2857	281	2656	254
	116.9	368	122.6	386	124.6	386	128.8	380	131.6	376	132.3	351
78	89.2	.576	92.0	.612	92.4	.615	92.7	.609	93.7	.607		
	3178	320	3154	310	3109	305	2967	291	2883	279		
	115.8	368	121.6	384	123.3	383	127.1	377	129.3	373		

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
△FUEL = + 2 %	△FUEL = + 5 %

R

CRUISE - MCT/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA+10 CG=33.0%	**N1 (%)** / **MACH** **KG/H** / **IAS (KT)** **NM/1000KG** / **TAS (KT)**

WEIGHT (1000KG)	**FL100**		**FL150**		**FL160**		**FL180**		**FL200**		**FL220**	
50	88.4	.576	92.2	.631	93.0	.643	92.8	.643	93.1	.648	92.9	.646
	2942	320	3039	320	3067	320	2868	308	2731	298	2543	286
	127.4	375	132.6	403	133.3	409	141.6	406	148.7	406	157.9	401
52	88.5	.576	92.3	.631	93.2	.643	92.9	.642	93.2	.646	93.0	.643
	2958	320	3058	320	3087	320	2874	307	2741	298	2553	285
	126.7	375	131.8	403	132.4	409	141.0	405	147.7	405	156.7	400
54	88.6	.576	92.5	.631	93.2	.642	93.0	.640	93.3	.645	93.1	.641
	2974	320	3079	320	3094	319	2882	306	2751	297	2564	283
	126.0	375	130.9	403	131.9	408	140.2	404	146.8	404	155.5	399
56	88.8	.576	92.7	.631	93.3	.640	93.1	.638	93.4	.643	93.2	.639
	2992	320	3100	320	3099	319	2890	306	2762	296	2575	282
	125.2	375	130.0	403	131.4	407	139.5	403	145.8	403	154.2	397
58	88.9	.576	92.8	.631	93.3	.638	93.1	.637	93.5	.641	93.4	.636
	3010	320	3123	320	3104	318	2898	305	2774	295	2589	281
	124.5	375	129.0	403	130.8	406	138.7	402	144.7	401	152.7	395
60	89.1	.576	93.0	.631	93.4	.637	93.2	.635	93.6	.638	93.5	.633
	3031	320	3148	320	3110	317	2907	304	2787	294	2603	280
	123.6	375	128.0	403	130.2	405	137.8	401	143.6	400	151.1	393
62	89.3	.576	93.2	.631	93.5	.635	93.3	.633	93.8	.636	93.7	.629
	3052	320	3173	320	3116	316	2917	303	2800	293	2619	278
	122.8	375	127.0	403	129.6	404	136.9	399	142.3	399	149.4	391
64	89.5	.576	93.3	.629	93.5	.633	93.4	.630	93.9	.633	93.9	.625
	3074	320	3179	319	3122	315	2928	302	2815	291	2636	276
	121.9	375	126.4	402	128.9	402	135.9	398	141.0	397	147.5	389
66	89.7	.576	93.3	.627	93.6	.631	93.5	.628	94.1	.631	94.1	.621
	3098	320	3185	318	3129	314	2941	300	2832	290	2652	274
	121.0	375	125.7	400	128.2	401	134.8	396	139.5	395	145.6	386
68	89.9	.576	93.4	.625	93.7	.628	93.7	.625	94.3	.627	94.4	.616
	3122	320	3191	317	3136	313	2954	299	2850	289	2671	272
	120.0	375	125.0	399	127.4	400	133.6	395	138.0	393	143.4	383
70	90.1	.576	93.4	.623	93.7	.626	93.8	.622	94.5	.624	94.7	.610
	3147	320	3198	316	3144	311	2969	298	2869	287	2691	269
	119.1	375	124.3	398	126.6	398	132.4	393	136.3	391	141.0	380
72	90.3	.576	93.5	.620	93.8	.623	93.9	.619	94.7	.620	95.0	.604
	3173	320	3205	314	3153	310	2985	296	2888	285	2715	266
	118.1	375	123.6	396	125.7	396	131.0	391	134.5	389	138.3	376
74	90.5	.576	93.6	.618	93.9	.620	94.1	.616	94.9	.616	95.2	.593
	3201	320	3213	313	3163	308	3002	294	2909	283	2727	261
	117.0	375	122.7	394	124.7	395	129.5	389	132.6	386	135.3	369
76	90.7	.576	93.7	.615	94.0	.617	94.3	.612	95.2	.611	95.4	.572
	3231	320	3222	311	3174	307	3021	292	2932	281	2717	252
	116.0	375	121.8	392	123.6	392	127.9	386	130.6	383	131.0	356
78	90.9	.576	93.8	.611	94.1	.613	94.5	.608	95.5	.605		
	3262	320	3232	310	3187	305	3042	290	2958	278		
	114.9	375	120.8	390	122.4	390	126.1	384	128.2	379		

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
△FUEL = + 2 %	△FUEL = + 5 %

R

CRUISE - MCT/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST PACK FLOW HI ANTI-ICING OFF	ISA+15 CG=33.0%	**N1 (%)** **KG/H** **NM/1000KG**	**MACH** **IAS (KT)** **TAS (KT)**

WEIGHT (1000KG)	**FL100**		**FL150**		**FL160**		**FL180**		**FL200**		**FL220**	
50	89.2	.576	92.7	.626	93.0	.631	92.8	.632	93.2	.637	92.9	.634
	2979	320	3028	318	2976	314	2792	302	2665	293	2474	280
	126.9	378	133.3	404	136.1	405	144.3	403	151.3	403	161.0	398
52	89.3	.576	92.8	.625	93.0	.630	92.9	.630	93.2	.636	93.0	.632
	2995	320	3032	317	2980	313	2799	302	2674	292	2484	279
	126.2	378	132.8	403	135.6	404	143.5	402	150.4	402	159.7	397
54	89.5	.576	92.8	.624	93.0	.628	93.0	.629	93.3	.634	93.1	.629
	3012	320	3037	316	2985	312	2808	301	2684	292	2495	278
	125.5	378	132.3	402	135.1	403	142.7	401	149.4	401	158.3	395
56	89.6	.576	92.8	.622	93.1	.626	93.1	.627	93.5	.632	93.2	.626
	3030	320	3041	315	2990	311	2816	300	2694	291	2508	276
	124.8	378	131.8	401	134.4	402	141.9	400	148.3	400	156.8	393
58	89.8	.576	92.9	.620	93.1	.624	93.2	.625	93.6	.629	93.4	.623
	3049	320	3046	314	2996	310	2825	299	2706	289	2521	275
	124.0	378	131.2	400	133.8	401	141.0	398	147.1	398	155.1	391
60	89.9	.576	92.9	.618	93.2	.622	93.3	.623	93.7	.627	93.6	.619
	3069	320	3051	313	3002	309	2835	298	2720	288	2536	273
	123.2	378	130.6	398	133.1	400	140.0	397	145.8	397	153.3	389
62	90.1	.576	93.0	.616	93.3	.620	93.4	.621	93.8	.624	93.8	.615
	3091	320	3057	312	3009	308	2846	297	2735	287	2553	271
	122.3	378	129.9	397	132.4	398	139.0	396	144.4	395	151.3	386
64	90.3	.576	93.0	.614	93.3	.618	93.5	.618	94.0	.621	94.0	.611
	3114	320	3063	311	3016	307	2857	296	2751	286	2572	269
	121.4	378	129.2	396	131.6	397	137.9	394	142.9	393	149.1	384
66	90.5	.576	93.1	.612	93.4	.616	93.6	.616	94.2	.618	94.2	.606
	3137	320	3070	310	3023	306	2870	294	2768	284	2592	267
	120.5	378	128.5	394	130.7	395	136.7	392	141.2	391	146.7	380
68	90.7	.576	93.2	.610	93.5	.613	93.7	.613	94.4	.614	94.4	.601
	3156	320	3077	309	3032	305	2883	293	2787	282	2615	265
	119.7	378	127.7	393	129.9	394	135.5	390	139.4	389	144.2	377
70	90.7	.573	93.2	.607	93.6	.610	93.9	.610	94.6	.611	94.5	.590
	3154	318	3084	307	3041	303	2898	291	2808	280	2611	260
	119.2	376	126.8	391	128.9	392	134.1	388	137.5	386	141.7	370
72	90.7	.571	93.3	.604	93.7	.607	94.0	.606	94.8	.606	94.6	.573
	3152	317	3093	306	3050	302	2916	289	2831	278	2602	252
	118.7	374	125.8	389	127.8	390	132.4	386	135.5	384	138.4	360
74	90.7	.568	93.4	.601	93.8	.604	94.2	.602	95.0	.602	94.7	.548
	3150	315	3102	304	3061	300	2935	287	2856	276	2589	241
	118.2	372	124.8	387	126.6	388	130.7	384	133.2	381	133.0	344
76	90.7	.564	93.4	.597	93.9	.600	94.3	.597	95.2	.593		
	3147	313	3103	302	3073	298	2946	285	2862	272		
	117.6	370	123.9	385	125.4	385	129.1	380	131.1	375		
78	90.7	.561	93.5	.592	93.9	.595	94.4	.590	95.3	.580		
	3144	311	3102	300	3072	295	2948	281	2855	266		
	117.0	368	123.0	382	124.3	382	127.5	376	128.5	367		

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
△FUEL = + 2 %	△FUEL = + 5 %

R

CRUISE - MCT/320KT - 1 ENGINE OUT

MAX. CONTINUOUS THRUST
PACK FLOW HI
ANTI-ICING OFF

ISA+20
CG=33.0%

N1 (%) **MACH**
KG/H **IAS (KT)**
NM/1000KG **TAS (KT)**

WEIGHT (1000KG)	FL100		FL150		FL160		FL180		FL200		FL220	
50	90.0	.576	92.5	.612	92.7	.617	92.8	.620	93.1	.626	92.8	.621
	3017	320	2912	310	2864	307	2712	297	2595	288	2402	274
	126.4	381	136.6	398	139.5	400	147.2	399	154.0	400	163.9	394
52	90.1	.576	92.5	.610	92.8	.615	92.9	.619	93.2	.624	92.9	.619
	3028	320	2916	309	2869	306	2720	296	2604	287	2411	273
	125.8	381	136.1	397	138.9	399	146.3	398	153.0	398	162.6	392
54	90.1	.574	92.5	.609	92.8	.613	93.0	.617	93.3	.622	93.0	.616
	3027	319	2921	308	2874	305	2729	295	2615	286	2422	272
	125.5	380	135.5	396	138.3	397	145.4	397	151.8	397	161.1	390
56	90.1	.573	92.6	.607	92.9	.612	93.0	.615	93.5	.620	93.2	.612
	3026	318	2926	307	2880	304	2738	294	2626	285	2434	270
	125.2	379	134.9	395	137.6	396	144.4	395	150.7	396	159.4	388
58	90.1	.571	92.6	.605	92.9	.610	93.1	.613	93.6	.617	93.3	.608
	3025	317	2932	306	2886	303	2749	293	2637	284	2447	268
	124.9	378	134.2	393	136.8	395	143.4	394	149.4	394	157.6	386
60	90.1	.569	92.7	.603	93.0	.607	93.2	.610	93.7	.614	93.5	.604
	3023	316	2938	305	2892	302	2759	292	2650	282	2463	266
	124.5	376	133.4	392	136.1	394	142.3	393	148.0	392	155.5	383
62	90.1	.567	92.7	.601	93.0	.605	93.4	.608	93.9	.611	93.7	.599
	3022	314	2944	304	2899	300	2771	290	2665	281	2478	264
	124.1	375	132.7	391	135.2	392	141.1	391	146.5	390	153.3	380
64	90.1	.564	92.8	.598	93.1	.603	93.5	.605	94.0	.608	93.7	.591
	3020	313	2945	303	2906	299	2784	289	2680	279	2474	260
	123.6	373	132.0	389	134.4	390	139.8	389	144.9	388	151.5	375
66	90.1	.562	92.8	.595	93.2	.600	93.6	.602	94.2	.604	93.7	.581
	3018	312	2943	301	2913	298	2798	288	2699	277	2469	256
	123.1	372	131.4	387	133.4	389	138.4	387	143.0	386	149.1	368
68	90.1	.559	92.8	.591	93.2	.596	93.7	.598	94.4	.600	93.8	.567
	3017	310	2941	299	2911	296	2808	286	2720	275	2463	249
	122.6	370	130.7	385	132.7	386	137.1	385	140.9	383	146.0	360
70	90.1	.556	92.8	.588	93.2	.592	93.8	.593	94.5	.593	93.9	.546
	3014	308	2939	297	2909	294	2807	283	2718	272	2455	240
	122.0	368	130.0	382	131.8	383	135.9	382	139.3	379	141.1	346
72	90.1	.553	92.8	.583	93.2	.587	93.8	.587	94.5	.584		
	3012	307	2937	295	2907	291	2805	280	2715	268		
	121.4	366	129.1	379	130.8	380	134.6	378	137.4	373		
74	90.1	.549	92.8	.579	93.3	.582	93.8	.580	94.6	.573		
	3010	305	2935	292	2905	289	2804	277	2711	262		
	120.7	363	128.2	376	129.8	377	133.1	373	134.8	366		
76	90.1	.545	92.9	.573	93.3	.576	93.9	.572	94.6	.556		
	3007	302	2932	290	2903	286	2803	272	2706	254		
	119.9	361	127.1	373	128.5	373	131.2	368	131.1	355		
78	90.1	.540	92.9	.567	93.3	.569	94.0	.561	94.8	.528		
	3005	300	2929	287	2901	282	2801	267	2700	241		
	119.0	358	126.0	369	127.1	369	128.8	361	124.8	337		

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON
△FUEL = + 2 %	△FUEL = + 5 %

GENERAL

The following in cruise quick check tables allow the flight crew to determine the fuel consumption and the time required to cover a given air distance from any moment in cruise to landing with one engine inoperative.
These tables are established for :
- Cruise speed : MCT/VMO, MCT/320 KT.
- Descent profile : M.78/300KT/250KT
- Approach and landing : 120 kg or 270 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) × △ISA (°C) × Air Distance (NM)
or 0.033 (lb/°C/NM) × △ISA (°C) × Air Distance (NM)

CORRECTION FOR DEVIATION FROM REFERENCE WEIGHT

The in cruise quick check tables are based on a reference initial weight.
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 : 120 KG (6MIN)

REF. INITIAL WEIGHT = 55000 KG
NORMAL AIR CONDITIONING
ANTI-ICING OFF

ISA
CG = 33.0 %

FUEL CONSUMED (KG)
TIME (H.MIN)

AIR DIST. (NM)	FLIGHT LEVEL 100	150	160	180	200	220	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL150	FL160 FL180	FL200 FL220
200	1648 0.38	1399 0.38	1357 0.38	1257 0.38	1180 0.38	1098 0.38	0	0	0
250	2069 0.45	1785 0.45	1735 0.45	1612 0.46	1520 0.46	1418 0.46	0	0	1
300	2489 0.53	2171 0.53	2112 0.53	1967 0.53	1859 0.53	1738 0.54	1	1	2
350	2909 1.01	2556 1.00	2489 1.00	2322 1.01	2198 1.01	2058 1.01	1	2	4
400	3329 1.08	2941 1.08	2866 1.08	2676 1.08	2536 1.08	2378 1.09	2	2	5
450	3749 1.16	3326 1.15	3242 1.15	3030 1.16	2874 1.16	2697 1.17	2	3	6
500	4169 1.24	3711 1.23	3619 1.23	3383 1.23	3211 1.23	3015 1.24	3	4	7
550	4589 1.32	4095 1.30	3995 1.30	3737 1.31	3549 1.31	3333 1.32	3	5	8
600	5008 1.39	4479 1.38	4371 1.38	4090 1.38	3885 1.38	3651 1.39	4	5	9
650	5427 1.47	4863 1.45	4746 1.45	4442 1.46	4222 1.46	3968 1.47	4	6	10
700	5846 1.55	5247 1.53	5122 1.52	4795 1.53	4558 1.54	4286 1.55	5	7	11
750	6265 2.03	5631 2.00	5497 2.00	5147 2.01	4894 2.01	4602 2.02	5	7	12
800	6683 2.10	6014 2.08	5872 2.07	5499 2.08	5230 2.09	4919 2.10	6	8	13
850	7102 2.18	6397 2.15	6246 2.15	5851 2.16	5565 2.16	5235 2.18	6	9	14
900	7520 2.26	6780 2.22	6621 2.22	6202 2.23	5899 2.24	5550 2.25	7	9	15
950	7938 2.33	7162 2.30	6995 2.30	6553 2.31	6234 2.31	5865 2.33	7	10	16
1000	8356 2.41	7545 2.37	7369 2.37	6904 2.38	6568 2.39	6180 2.40	7	11	17
1050	8773 2.49	7927 2.45	7743 2.44	7254 2.46	6902 2.46	6495 2.48	8	11	18
1100	9191 2.56	8309 2.52	8116 2.52	7605 2.53	7235 2.54	6809 2.56	8	12	19
1150	9608 3.04	8690 3.00	8489 2.59	7955 3.01	7568 3.01	7123 3.03	9	13	20
1200	10025 3.12	9072 3.07	8862 3.07	8305 3.08	7901 3.09	7436 3.11	9	13	21
1250	10442 3.19	9454 3.14	9235 3.14	8654 3.16	8233 3.16	7750 3.18	10	14	22
1300	10859 3.27	9835 3.22	9608 3.22	9004 3.23	8565 3.24	8063 3.26	10	14	23
1350	11275 3.35	10216 3.29	9980 3.29	9353 3.31	8897 3.31	8375 3.33	12	15	24
1400	11692 3.43	10597 3.37	10352 3.36	9701 3.38	9228 3.39	8687 3.41	12	16	25

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
△FUEL = + 2.5 %	△FUEL = + 5 %

FLIP23D A320-214 CFM56-5B4/P SA3611 03301.001011 0250300 .7800 .00100 120 0300350 55 0 100100 40100 18590 FCOM-N0-03-06-50-014-170

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 : 120 KG (6MIN)

REF. INITIAL WEIGHT = 55000 KG NORMAL AIR CONDITIONING ANTI-ICING OFF	ISA CG = 33.0 %	**FUEL CONSUMED (KG)** **TIME (H.MIN)**

AIR DIST. (NM)	FLIGHT LEVEL 100	150	160	180	200	220	CORRECTION ON FUEL CONSUMPTION (KG/1000KG) FL100 FL150	FL160 FL180	FL200 FL220
200	1556 0.39	1381 0.38	1358 0.38	1257 0.38	1180 0.38	1098 0.38	2	0	0
250	1950 0.47	1760 0.46	1737 0.45	1612 0.46	1520 0.46	1418 0.46	3	1	1
300	2344 0.55	2139 0.53	2115 0.53	1967 0.53	1859 0.53	1738 0.54	4	1	2
350	2737 1.03	2518 1.01	2493 1.00	2322 1.01	2198 1.01	2058 1.01	5	2	4
400	3130 1.12	2896 1.08	2870 1.08	2676 1.08	2536 1.08	2378 1.09	6	3	5
450	3523 1.20	3274 1.16	3248 1.15	3030 1.16	2874 1.16	2697 1.17	7	4	6
500	3915 1.28	3651 1.24	3618 1.23	3383 1.23	3211 1.23	3015 1.24	8	5	7
550	4306 1.36	4028 1.31	3993 1.30	3737 1.31	3549 1.31	3333 1.32	9	6	8
600	4698 1.44	4404 1.39	4368 1.38	4090 1.38	3885 1.38	3651 1.39	10	7	9
650	5089 1.52	4780 1.46	4742 1.45	4442 1.46	4222 1.46	3968 1.47	11	8	10
700	5479 2.01	5156 1.54	5116 1.53	4795 1.53	4558 1.54	4286 1.55	12	9	11
750	5869 2.09	5531 2.02	5489 2.00	5147 2.01	4894 2.01	4602 2.02	13	10	12
800	6258 2.17	5906 2.09	5862 2.07	5499 2.08	5230 2.09	4919 2.10	14	11	13
850	6648 2.25	6280 2.17	6234 2.15	5851 2.16	5565 2.16	5235 2.18	15	11	14
900	7036 2.33	6654 2.24	6606 2.22	6202 2.23	5899 2.24	5550 2.25	16	12	15
950	7425 2.41	7027 2.32	6977 2.30	6553 2.31	6234 2.31	5865 2.33	17	13	16
1000	7813 2.49	7400 2.39	7348 2.37	6904 2.38	6568 2.39	6180 2.40	18	14	17
1050	8201 2.58	7773 2.47	7719 2.45	7254 2.46	6902 2.46	6495 2.48	19	15	18
1100	8588 3.06	8145 2.55	8089 2.52	7605 2.53	7235 2.54	6809 2.56	20	16	19
1150	8975 3.14	8517 3.02	8459 3.00	7955 3.01	7568 3.01	7123 3.03	21	17	20
1200	9361 3.22	8889 3.10	8828 3.07	8305 3.08	7901 3.09	7436 3.11	22	18	21
1250	9748 3.30	9260 3.17	9197 3.15	8654 3.16	8233 3.16	7750 3.18	23	19	22
1300	10134 3.38	9631 3.25	9565 3.22	9004 3.23	8565 3.24	8063 3.26	25	20	23
1350	10519 3.46	10001 3.32	9933 3.30	9353 3.31	8897 3.31	8375 3.33	26	21	24
1400	10905 3.55	10371 3.40	10301 3.37	9701 3.38	9228 3.39	8687 3.41	28	22	25

ENGINE ANTI ICE ON	**TOTAL ANTI ICE ON**
△FUEL = + 2.5 %	△FUEL = + 6 %

FLIP23D A320-214 CFM56-5B4/P SA3611 03301.001011 0250300 .7800 .00100 120 0300350 55 0 100100 40100 18590 FCOM-N0-03-06-50-015-170

HOLDING

R

RACE TRACK HOLDING PATTERN - GREEN DOT SPEED - 1 ENGINE OUT

MAX. CRUISE 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	61.2 1573	63.7 1562	68.1 1553	69.7 1549	71.4 1545	73.2 1544	75.1 1544	77.1 1549
50	62.2 1637	64.8 1626	69.2 1617	70.8 1613	72.5 1610	74.4 1610	76.4 1611	78.2 1618
52	63.1 1701	65.9 1691	70.2 1681	71.9 1677	73.7 1676	75.6 1677	77.5 1682	79.4 1687
54	64.1 1766	67.0 1758	71.2 1745	73.0 1742	74.8 1742	76.8 1744	78.6 1751	80.6 1757
56	65.1 1831	68.1 1823	72.3 1810	74.0 1808	75.9 1809	77.8 1815	79.7 1820	81.5 1830
58	66.1 1896	69.2 1885	73.3 1875	75.1 1875	77.1 1877	78.9 1884	80.8 1890	82.4 1906
60	67.1 1963	70.2 1949	74.3 1941	76.1 1943	78.1 1947	79.9 1953	81.7 1963	83.4 1982
62	68.1 2027	71.0 2014	75.3 2009	77.2 2011	79.0 2017	80.9 2024	82.6 2038	84.3 2066
64	69.1 2090	71.9 2079	76.3 2077	78.2 2081	80.0 2087	81.9 2095	83.4 2114	85.2 2153
66	70.1 2153	72.8 2145	77.2 2146	79.1 2150	80.9 2158	82.7 2170	84.3 2193	
68	70.9 2217	73.7 2211	78.2 2215	80.0 2220	81.8 2229	83.5 2246	85.2 2278	
70	71.7 2284	74.6 2278	79.1 2283	80.8 2291	82.7 2302	84.3 2322		
72	72.5 2350	75.4 2346	79.9 2354	81.7 2363	83.4 2377	85.1 2402		
74	73.3 2417	76.3 2416	80.7 2426	82.6 2436	84.2 2454			
76	74.1 2486	77.1 2486	81.6 2499	83.4 2510	85.0 2531			

ENGINE ANTI ICE ON	TOTAL ANTI ICE ON	PER 1° ABOVE ISA
△FF = + 3 %	△FF = + 6 %	△FF = + 0.3 %

11.0-08F0A320-214 CFM56-5B4/P SA14300010C6KG330 0 018590 0 0 1 1.0 180.0 30.00 0 01 1.000 .000 .000 0 FCOM-N0-03-06-55-001-200

DESCENT TO LANDING

R

DESCENT - M.78/300KT/250KT - 1 ENGINE OUT									
IDLE THRUST NORMAL AIR CONDITIONING ANTI-ICING OFF			ISA CG=33.0%						
WEIGHT (1000KG)	50				70				
FL	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	TIME (MIN)	FUEL (KG)	DIST. (NM)	N1	IAS (KT)
390	14.1	66	85	IDLE					241
370	13.5	64	80	IDLE	16.5	79	99	IDLE	252
350	12.9	62	76	IDLE	15.8	77	94	IDLE	264
330	12.4	61	72	IDLE	15.2	75	90	IDLE	277
310	11.9	59	69	IDLE	14.6	73	85	IDLE	289
290	11.4	58	65	IDLE	14.1	71	81	IDLE	300
270	10.9	56	61	IDLE	13.3	69	75	IDLE	300
250	10.3	54	56	IDLE	12.5	66	69	IDLE	300
240	9.9	53	54	IDLE	12.1	65	67	IDLE	300
220	9.3	51	50	IDLE	11.3	62	61	IDLE	300
200	8.7	48	45	IDLE	10.5	58	55	IDLE	300
180	8.0	44	41	IDLE	9.6	53	50	IDLE	300
160	7.3	39	37	IDLE	8.8	48	44	IDLE	300
140	6.6	34	32	IDLE	7.9	41	39	IDLE	300
120	5.9	29	28	IDLE	7.0	35	33	IDLE	300
100	5.2	25	24	IDLE	6.0	29	28	IDLE	300
50	1.9	8	8	IDLE	2.2	9	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	+ 2.5 %	+ 3 %	+ 0.2 %
FUEL	+ 22 %	+ 38 %	+ 0.5 %
DISTANCE	+ 2.5 %	+ 3 %	+ 0.5 %

11.0-08F0A320-214 CFM56-5B4/P SA23100010C5KG330 0 018590 0 0–1 .0 .0 .00 0 03 .780300.000250.000 0 FCOM-N0-03-06-60-001-200

GENERAL

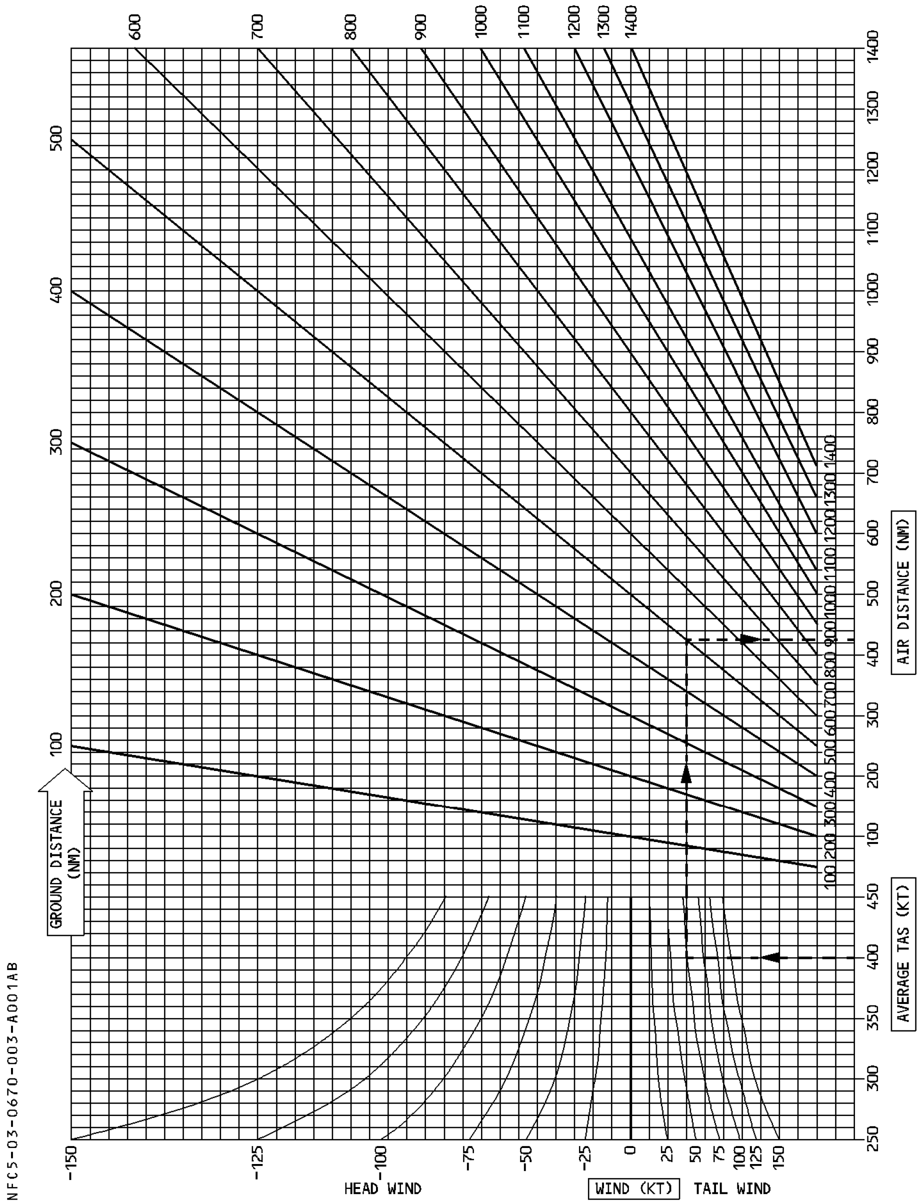
The ground distance/air distance conversion tables are used to calculate the air distance for a given ground distance due to the influence of the wind.
Tables are given for :
– LONG RANGE SPEED
– FIXED SPEEDS

LONG RANGE SPEED

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	31
30	22	24	27	**30**	34	39	46
40	30	32	36	**40**	45	52	61
50	37	41	45	**50**	57	65	77
60	44	49	54	**60**	68	78	92
70	52	57	63	**70**	79	91	108
80	59	65	72	**80**	91	104	123
90	67	73	81	**90**	102	117	138
100	74	81	90	**100**	113	130	154
200	148	162	179	**200**	226	261	307
300	222	243	269	**300**	340	391	461
400	296	324	358	**400**	453	521	615
500	371	406	448	**500**	566	652	768
600	445	487	537	**600**	679	782	922
700	519	568	627	**700**	792	913	1076
800	593	649	717	**800**	905	1043	1230
900	667	730	806	**900**	1019	1173	1383
1000	741	811	896	**1000**	1132	1304	1537
1100	815	892	985	**1100**	1245	1434	1691
1200	889	973	1075	**1200**	1358	1564	1844
1300	963	1054	1164	**1300**	1471	1695	1998
1400	1038	1136	1254	**1400**	1585	1825	2152
1500	1112	1217	1344	**1500**	1698	1955	2305
1600	1186	1298	1433	**1600**	1811	2086	2459
1700	1260	1379	1523	**1700**	1924	2216	2613
1800	1334	1460	1612	**1800**	2037	2346	2766
1900	1408	1541	1702	**1900**	2150	2477	2920
2000	1482	1622	1791	**2000**	2264	2607	3074

FIXED SPEEDS



07.00 CONTENTS

07.10 GENERAL DESCRIPTION

07.20 LIST OF EFFECTIVE OEB

07.30 STATUS

DEFINITION

An **Operations Engineering Bulletin (OEB)** is issued to rapidly inform operators of any deviations from initial design objectives that have a significant operational impact. An OEB provides the operators with technical information and temporary operational procedures that address these deviations.

TYPE OF OEB

OEBs can either be red or white, depending on their level of priority :
- RED OEBs are issued to indicate that non-compliance with the recommended procedures may have a significant impact on the safe operation of the aircraft.
  RED OEBs are printed on red paper, and are filed in the OEB section of both the FCOM 3 and the QRH.
- WHITE OEBs are issued to indicate that non–compliance with the recommended procedures may have a significant impact on aircraft operation.
  WHITE OEBs are printed on white paper, and are also filed in the OEB section of both the FCOM 3 and the QRH.

Airbus strongly recommends that all Operators rapidly apply the OEB corrective actions as soon as they become available, particularly for red OEBs.
The information in the OEB is recommended by Airbus, but may not be approved by Airworthiness Authorities. However, the procedures of the red OEBs are also issued via Temporary Revisions (TRs) of the Airplane Flight Manual (AFM). If the procedures contained in the red OEB differ from the procedures in the AFM TR, the approved AFM TR remains the reference.

OEB CONTENT AND MANAGEMENT

An OEB :
- Is temporary and usually focuses on one operational subject only
- Is included in the FCOM Chapter 3.07.20. The procedural part of each white or red OEB (OEB PROC) is provided in the OEB section of the QRH, so that the flight crew can easily access the procedures
- Remains applicable until the appropriate corrective actions are completed.

<u>Note</u> : *After installation of the OEB corrective modification/Service Bulletins (SB), if an Operator reinstalls any spare equipment for which there was an associated OEB, it is Operator's responsibility to ensure that this OEB be applied again for the applicable aircraft.*

OEBs IN THE FCOM

OEBs are filed in numerical order.
The content of each OEB includes :
- The reason for issue
- Technical explanations of the deviation from the initial design objectives
- The operational impact if the flight crew does not apply the OEB procedure
- The conditions for applying the OEB procedures :
  · ECAM warning/caution affected by the OEB
  · Cockpit effects
  · Flight phases
  · Specific event.
- The OEB operational procedure(s) to be applied
- The corrective actions that cancel the OEB, if available when the OEB is issued
- The OEB REMINDER codes, if applicable (refer to the OEB REMINDER section for more information).

The OEB chapter also includes a STATUS LIST (FCOM 3.07.30) and a LIST OF EFFECTIVE OEBs (LEOEB) in FCOM 3.07.20 : The LIST OF EFFECTIVE OEBs (LEOEB) is updated and reissued each time an OEB is revised or added to the FCOM, or when there is an OEB validity change.

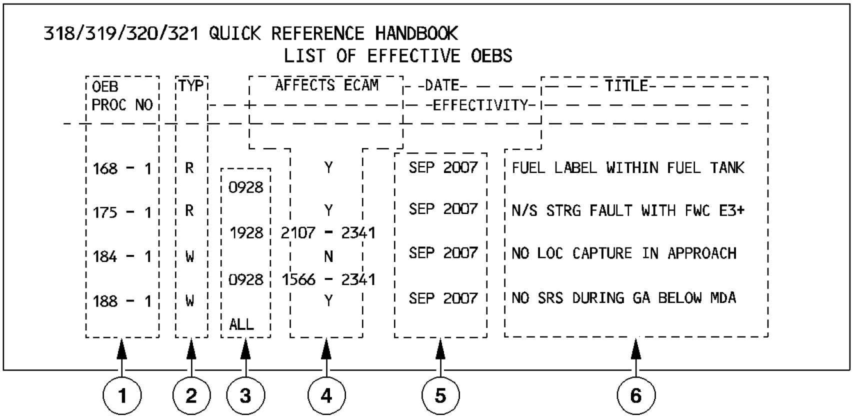
OEB's IN THE QRH

Each FCOM OEB has an associated "OEB PROC" in the OEB section of the QRH, that includes :
- The title of the OEB PROC
- The "AFFECTED ECAMs" (if applicable) :
  This section identifies whether or not one of the possible conditions for applying the OEB PROC is an ECAM warning/caution.
  The flight crew must disregard the ECAM procedure and/or STATUS of the ECAM alerts listed in the "AFFECTED ECAMs" field and must apply the QRH's OEB procedure instead.
  If the Operator uses the OEB REMINDER function and has activated the OEB REMINDER function onboard for the affected ECAM alerts, the ECAM informs the flight crew to refer to the OEB procedure in the QRH by displaying a "REFER TO QRH PROC" and/or "FOR STS REFER TO QRH" line (Refer to OEB REMINDER section for more information).
- The OEB operational procedure(s) that the flight crew must apply.

All OEB PROCs are filed by type of OEB (RED OEB PROC first, then WHITE OEB PROCs), and in numerical order for each type of OEB.

QRH LEOEB

On the first page of the QRH OEB section, there is a “LIST OF EFFECTIVE OEBs” (LEOEB) page, to enable the flight crew to easily review the OEBs before flight.
The LIST OF EFFECTIVE OEBs (LEOEB) is updated and reissued each time an OEB procedure is revised or added to the QRH, or when there is an OEB validity change.



NFC5-03-0710-003-A001AA

① OEB PROC NUMBER

Indicates the number of the OEB PROC (the same number as the associated OEB in the FCOM), and the issue of the QRH OEB PROC.

Note : The FCOM OEB and associated QRH OEB PROCs have the same OEB number in order to be consistent. However, the issue number of the QRH OEB PROC and the FCOM OEB may be different, because a revision of an FCOM OEB does not necessarily result in a revision of the corresponding QRH OEB PROC, that only provides the procedure part.

② TYPE OF OEB

Indicates the type of OEB : “R” is for a RED OEB, and “W” is for a WHITE OEB.
In the QRH LEOEB, the OEB PROCs are listed by type of OEB (RED OEBs first, then WHITE OEBs), and in numerical order for each type of OEB. This enables the flight crew to easily review the OEBs before flight.

③ EFFECTIVITY

Indicates the validity of the OEB PROC, i.e. the aircraft that the QRH OEB PROC is applicable to at the time that the QRH LEOEB is issued.
This information appears just below, and to the right of, the OEB PROC number and TYPE OF OEB for each OEB PROC.

④ "AFFECTS ECAM"

Indicates whether or not some of the operational recommendations provided in the OEB PROC deviate from an ECAM procedure and/or ECAM STATUS. This enables the flight crew to easily review the OEBs before flight, particularly for Operators that use the OEB REMINDER function (Refer to the OEB REMINDER section for more information).

CAUTION

When Airbus provides the Operator with the QRH LEOEB, the information "AFFECTS ECAM : Y" does not necessarily mean that :

- The OEB PROC only affects ECAM alerts : The flight crew must also check in the OEB PROC whether or not they have to memorize some additional operational recommendations that are not related to ECAM alerts.
- For Operators using the OEB REMINDER function, the Operator's maintenance personnel has activated the OEB REMINDER codes for this OEB onboard the aircraft.
  It is the Operator's responsibility to define a suitable process for providing the flight crew with confirmation that the OEB REMINDER codes are activated for the ECAM alerts affected by OEBs.

⑤ DATE

Indicates the date (month/year) at which the QRH OEB PROC number was last issued.

⑥ TITLE

Indicates the title of the QRH OEB PROC (same as the associated OEB included in the FCOM).

REVIEW OF THE OEBs

In accordance with the Standard Operating Procedures, and before each flight, the flight crew must review all OEBs that are applicable to their aircraft. If the OEB conditions are applicable, the flight crew must apply the operational procedure(s) that is in the QRH OEB section.

DISTRIBUTION

OEBs are distributed to all affected Operators. The Operator shall provide flight crews with the content of the OEB without delay.

OEB REMINDER

GENERAL

The OEB reminder function provides operational help to the flight crew by enabling them to clearly identify on the ECAM all procedures and STATUS messages superseded by an OEB procedure.
When a situation causes an ECAM warning/caution to trigger, a message informs the flight crew in real time that there is an OEB for the displayed ECAM warning/caution and/or STATUS, and as a result, that the ECAM procedure and/or STATUS is not applicable. In this case, a specific ECAM message informs the flight crew to refer to the QRH.
Refer to FCOM 1.31.27 OEB REMINDER for more information.

DESCRIPTION

Operator's maintenance personnel can flag the procedure and/or the STATUS that corresponds to the ECAM warning/caution affected by the OEB :
- If the procedure is flagged, the ECAM displays "REFER TO QRH PROC", instead of the procedure
- If the STATUS is flagged, the ECAM displays "FOR STS REFER TO QRH" in addition to the ECAM STATUS message.

OEB REMINDER CODE

The maintenance personnel must enter specific OEB REMINDER code(s) in the FWC OEB database in order to update the ECAM.
These OEB REMINDER codes are provided in the FCOM OEB chapter only, and are sent to the Operator's Flight Operations department along with the associated QRH OEB PROC. This is to ensure that the OEB database is not updated before the OEB procedure is available in the QRH and FCOM onboard documentation.
Good coordination between the Airline's/Operator's Flight Operations department and the Airline's/Operator's Engineering department must be established, in order to :
- Ensure that the QRH OEB section is updated onboard the aircraft before the activation of the OEB REMINDER function for a specific OEB.
- Rapidly send information about the OEB REMINDER codes to the Engineering department for a rapid update of the ECAM.
- Provide the flight crew with confirmation that the OEB REMINDER codes are activated onboard the aircraft for the ECAM alerts affected by OEBs.

CAUTION

As soon as the maintenance personnel has embodied the corrective action that cancels the OEB PROC on a specific aircraft, the Operator must ensure that :
1. Maintenance personnel has deactivated the OEB REMINDER function for the specific OEB, before informing their Flight Operations department of the installation of the OEB correction action.
2. The QRH OEB section onboard the aircraft is updated to remove the specific OEB from the applicable aircraft.

M	OEB-BU NO	-DATE--	-----------TITLE-----------	-----EFFECTIVITY-----
	078-6A	AUG1997	BRAKING MISBEHAVIOUR	ALL
	101-2A	AUG1997	NOSE LANDING GEAR	ALL
	149-3A	DEC2004	DUAL BLEED LOSS	ALL
	162-2A	JAN2008	INCORRECT MORA VALUE	ALL
	169-2A	JAN2008	DUAL FM RESET WITH FIX INFO	ALL
	178-2A	DEC2006	OPERATION OF CTR TK PUMPS	ALL
	188-2A	SEP2007	NO SRS DURING GA BELOW MDA	ALL
	189-1A	MAR2008	RNAV INCORRECT FLIGHT PATH	ALL

M	OEB-BU NO	-DATE--	-----------TITLE-----------	-----EFFECTIVITY-----
	801-1A	JUN2004	INTRODUCTION	ALL
	802-1A	JUN2004	CARBON BRAKES WEAR	ALL
	803-1A	JUN2004	OPS IN WSHEAR/DOWNBURST COND	ALL
	805-1A	JUN2004	CABIN FANS	ALL
	806-1A	JUN2004	AVOIDING TAILSTRIKES	ALL
	808-1A	JUN2004	FQI ACCURACY	ALL
	809-1A	JUN2004	PAX ELEC DEVICE INTERFERENCE	ALL
	810-1A	JUN2004	THRUST ACCEL IN A/THR MODES	ALL
	811-1A	JUN2004	AVOID DISORDER IN THE CKPT	ALL
	812-1A	JUN2004	RALTI ANOM IN ADVERSE WEATHR	ALL
	813-1A	JUN2004	FMGS NAVIGATION DATA BASE	ALL
	814-1A	JUN2004	SPEC FEATURES FMGS FULL STD	ALL
	815-1A	JUN2004	STOWAGE OF 3RD OCCUPANT SEAT	ALL
	816-1A	JUN2004	VMO/MMO DETERMINATION	ALL
	817-1A	JUN2004	OPS OF FLEETS WTH/WHOUT CPIP	ALL
	819-1A	JUN2004	CHARACT & PROTECTION SPEEDS	ALL
	820-1A	JUN2004	GROUND SPEED MINI FUNCTION	ALL
	821-1A	JUN2004	MMEL AND MEL USE	ALL
	823-1A	JUN2004	ATTENDANT INFO BULLETINS	ALL
	824-1A	JUN2004	ERRONEOUS SPD/ALT INDICATION	ALL
	825-1A	JUN2004	EGPWS DATABASE	ALL
	826-2A	MAR2007	NAV DATA BASE VALIDATION	ALL
	827-2A	JAN2008	A/C HANDLING IN FINAL APP	ALL
	828-1A	JUN2004	USE OF RUDDER ON AIRCRAFT	ALL
	829-1A	SEP2004	YAW DISTURBANCES AT TO ROLL	ALL
	830-2A	MAR2007	AUTO LANDING PERFORMANCE	ALL

N°	TITLE
"To be filled by the operator, if needed"	

N°	TITLE
"To be filled by the operator, if needed"	

RED OEB – RED OEB – RED OEB – RED OEB – RED OEB – RED OEB – RED OEB

Issued by STL	File in FCOM Vol 3	OEB N°: 78/6 AUG 97 *Associated with QRH OEB PROC N°: 78/1*

- **This OEB covers a significant operational issue. Non-compliance with this OEB should have a significant impact on the safe operations of the aircraft. The Operators shall distribute its content to all flight crews without delay. An extract of this OEB is provided for insertion in the QRH.**
- **It is strongly recommended that all Operators accelerate the incorporation of all corrective Service Bulletins, as soon as they are available.**

SUBJECT: BRAKING MISBEHAVIOURS

APPLICABLE TO: A320 ALL

R **CANCELLED BY:** SB 32-1125 (Mod 23901)

REASON FOR ISSUE:

A - Several cases of uncommanded braking during taxi phase have been experienced. One case has been reported by an A310 operator during landing phase.

B - Cases of asymmetrical braking have also been experienced when braking on YELLOW hydraulic system.

EXPLANATION:

This OEB is applicable to all aircraft equipped with a dual valve (also called alternate brake dual distribution valve - BDDV) P/N A 25434005, serial number W 416 or subsequent.

A) The uncommanded braking which may occur after any brake pedals release is due to a jamming of the BDDV in the open position leading to braking pressure being supplied by the YELLOW hydraulic system.

B) The asymmetrical braking which may occur when braking on YELLOW
R hydraulic system could be due to an internal leakage in the BDDV.

RECOMMENDATIONS

The following recommendations should be taken into account:

A- UNCOMMANDED BRAKING :

1. AT TAKE OFF BEFORE POWER SET:

- Check hydraulic pressure on the yellow triple indicator :
  - IF RESIDUAL PRESSURE IS INDICATED :
    - Depress several times the brake pedals until release of residual pressure
      - **If residual pressure remains, the take off must be cancelled and the valve has to be changed.**

2. DURING FLIGHT

- Avoid any action on brake pedals

3. DURING APPROACH AFTER LANDING GEAR EXTENSION

- Check hydraulic pressure on the yellow triple indicator
  - IF RESIDUAL PRESSURE IS INDICATED :
    - Depress several times the brake pedals until release of residual pressure
      - If residual pressure remains, apply brakes at touchdown. A slight brake deflection (3°) will supersede any previous yellow pressure.

        Note: if antiskid is inoperative maintain a symmetrical braking as soon as the aircraft touches the ground.

B - BRAKING ON YELLOW SYSTEM

If asymmetric braking is experienced:
- modulate braking as appropriate.

CORRECTIVE ACTION:

This OEB is cancelled by retrofit of SB 32-1125 (Mod 23901): LANDING GEAR – WHEELS AND BRAKES – INTRODUCE MODIFIED BRAKE DUAL DISTRIBUTION VALVE

Note: The interchangeability code, given in the Illustrated Part Catalog (IPC), indicates the conditions for interchangeability of equipment. After installation of corrective modification(s)/SB(s), if an Operator reinstalls any equipment affected by this OEB it is the Operator's responsibility to ensure that the recommendations given in this OEB are applied again for the applicable aircraft.

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FLIGHT OPERATIONS SUPPORT

OPERATIONS ENGINEERING BULLETIN

BP N°33, 31707 Blagnac Cedex France

A319/A320/A321

Issued by STL	File in FCOM Vol 3	BULLETIN / ISSUE N° : 101/2 DATE : AUG 97

SUBJECT: NOSE LANDING GEAR

APPLICABLE TO: A320 ALL

R **CANCELLED BY:** SB 32-1107 (Mod 24440)

REASON FOR ISSUE

Cases where landing gear retraction after take-off was delayed, have been reported.

EXPLANATION

The nose landing gear shock absorber may be slow to extend due to the clogging of a restrictor inside the shock absorber.

As long as the shock absorber is not fully extended, the landing gear lever is locked in the DOWN position.

R

PROCEDURE

If unable to retract the landing gear after takeoff, make a second attempt approximately one minute later (maximum time to achieve complete extension of the shock absorber).

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FLIGHT OPERATIONS SUPPORT

OPERATIONS ENGINEERING BULLETIN

BP N°33, 31707 Blagnac Cedex France

A318/A319/A320/A321

Issued by STL	File in FCOM Vol 3	BULLETIN / ISSUE N°: 149/3 DATE: December 2004

R **SUBJECT:** **ENGINE BLEED FAILURE LEADING TO**
R **PROBABLE DUAL BLEED LOSS**

APPLICABLE TO: **All A319 / A320 / A321 aircraft**

CANCELLED BY: **Mod 30884 (VSB 342-36-05) or ISB (36-1049) Refer to Corrective Actions**

R **REASON FOR REVISION**

R The title has been changed from “DUAL BLEED LOSS” to “ENGINE BLEED
R FAILURE LEADING TO PROBABLE DUAL BLEED LOSS” for improved
R technical understanding and to clarify that, in single bleed failure cases, this
R OEB is applicable.

REASON FOR ISSUE:

Several dual bleed loss cases, resulting in emergency descents, have been reported by customers.

EXPLANATION:

The loss of one bleed, for whatever reason, may cause the crossbleed valve to open thus leading to an increase in bleed demand on the remaining bleed. At this point, an undetected failure on the second bleed may lead to an overheat, and subsequent loss of the entire bleed system.

This failure mode is corrected by installing the improved Temperature Control Thermostat (TCT P/N 342B030000 or TCT P/N 342D030000 or TCT P/N 342B040000).

If one of the following three warnings is triggered, the associated procedures may help avoid the loss of both bleeds.

AIR ENG 1 (2) BLEED ABNORMAL PR

■ **If wing anti-ice is ON, and both packs are on:**

– PACK (on the affected bleed side)..OFF
One pack must be switched OFF, when the pilot is using wing anti-ice, due to precooler performance.
– X BLEED..OPEN

• **If the precooler outlet temperature of the remaining bleed exceeds 240°C within 2 minutes after the crossbleed valve opening:**
This indicates that an undetected failure affects the remaining bleed.
– X BLEED..SHUT
– WING ANTI-ICE...OFF
AVOID ICING CONDITIONS

STATUS:

The status displayed on the ECAM is correct, unless the precooler outlet temperature exceeds 240°C. If the precooler outlet temperature exceeds 240°C, the applicable status is as follows:

AVOID ICING CONDITIONS.
Note: *If in icing conditions, and if the aircraft's altitude permits, consider switching OFF the remaining pack, reopening the crossbleed valve, and turning ON the wing anti-ice system.*

■ **If wing anti-ice is off, and both packs are on:**

– X BLEED..OPEN
– PACK FLOW...LO (A319/A320)
ECON (A321)
– AFT CRG HOT AIR (if installed)..OFF

• **If the precooler outlet temperature of the remaining bleed exceeds 240°C within 2 minutes after the crossbleed valve opening:**
This indicates that an undetected failure affects the opposite side.
– PACK (on the first affected bleed side).......................................OFF
The remaining pack automatically delivers high flow.

STATUS:

The status displayed on the ECAM is correct.

Note: If the precooler outlet temperature exceeds 240°C, if in icing conditions and if the aircraft's altitude permits, consider switching OFF the remaining pack, reopening the crossbleed valve, and turning ON the wing anti-ice system.

OEB REMINDER

On aircraft equipped with the OEB reminder function, the procedure and the status of the "AIR ENG 1 (2) ABNORMAL PR" warning may be flagged.
The "Refer to QRH PROC" line will then be displayed, instead of the procedure itself.
To flag the "AIR ENG 1 (2) ABNORMAL PR" procedure and status, the following code should be entered in the FWC OEB database:

	Code	WARN	STS
For ENG 1:	36-11-150/082	Y	Y
For ENG 2:	36-11-160/084	Y	Y

AIR ENG 1 (2) BLEED FAULT

– ENG BLEED affected (if not automatically closed) .... OFF
- With the ENG BLEED pushbutton on, the FAULT light remains on.
- With the ENG BLEED pushbutton OFF, the FAULT light goes off, when the failure (overheat or overpressure) disappears.

■ **If wing anti-ice is on, and both packs are on:**

– PACK (on the affected bleed side) .... OFF
One pack must be switched OFF, when the pilot is using wing anti-ice, due to precooler performance.
– X BLEED .... OPEN

- **If the precooler outlet temperature of the remaining bleed exceeds 240°C within 2 minutes after the crossbleed valve opening:**
This indicates that an undetected failure affects the remaining bleed.
– X BLEED .... SHUT
– WING ANTI-ICE .... OFF
AVOID ICING CONDITIONS

STATUS:

The status displayed on the ECAM is correct, unless the precooler outlet temperature exceeds 240°C. If the precooler outlet temperature exceeds 240°C, the applicable status is as follows:

AVOID ICING CONDITIONS.
Note: *If in icing conditions, and if the aircraft's altitude permits, consider switching OFF the remaining pack, reopening the crossbleed valve, and turning ON the wing anti-ice system.*

■ **If wing anti-ice is off, and both packs are on:**

– X BLEED .... OPEN
– PACK FLOW .... LO (A319/A320)
. ECON (A321)
– AFT CRG HOT AIR (if installed) .... OFF

- **If the precooler outlet temperature of the remaining bleed exceeds 240°C within 2 minutes after the crossbleed valve opening:**
This indicates that an undetected failure affects the opposite side.
– PACK (on the first affected bleed side) .... OFF
The remaining pack automatically delivers high flow.

AIR ENG 1 (2) BLEED FAULT (Con't)

STATUS:

The status displayed on the ECAM is correct.

Note: *If the precooler outlet temperature exceeds 240°C, if in icing conditions and if the aircraft's altitude permits, consider switching OFF the remaining pack, reopening the crossbleed valve, and turning ON the wing anti-ice system.*

OEB REMINDER

On aircraft equipped with the OEB reminder function, the procedure and the status of the "AIR ENG 1 (2) BLEED FAULT" warning may be flagged.
The "Refer to QRH PROC" line will then be displayed, instead of the procedure itself.
To flag the "AIR ENG 1 (2) BLEED FAULT" procedure and status, the following code should be entered in the FWC OEB database:

	Code	WARN	STS
For ENG 1:	36-21-010/076	Y	Y
For ENG 2:	36-21-020/078	Y	Y

AIR ENG 1 (2) BLEED LO TEMP

In flight, bleed temperature is too low for correct wing de-icing.
- A/THR .... OFF
- THR LEVER (affected engine) .... ADVANCE

Thrust lever of the affected engine must be advanced with A/THR OFF. This may increase bleed temperature.

■ **IF UNSUCCESSFUL, and the opposite bleed is available:**
- X BLEED .... OPEN
- ENG BLEED (affected) .... OFF
- Associated PACK (if the other pack is on) .... OFF

One pack must be switched OFF, when the pilot is using wing anti-ice, due to precooler performance.

- **If precooler outlet temperature of the remaining bleed exceeds 240°C within 2 minutes after the affected bleed is set to OFF:**

  This indicates that an undetected failure affects the remaining bleed
  - X BLEED .... SHUT
  - WING ANTI-ICE .... OFF

  AVOID ICING CONDITIONS

STATUS:

The status displayed on the ECAM is correct.

<u>Note</u>: *If the precooler outlet temperature exceeds 240°C, if in icing conditions and if the aircraft's altitude permits, consider switching OFF the remaining pack, reopening the crossbleed valve, and turning ON the wing anti-ice system.*

■ **IF UNSUCCESSFUL, and the opposite bleed is unavailable:**
- WING ANTI-ICE .... OFF

AVOID ICING CONDITIONS

STATUS:

The status displayed on the ECAM is correct.

OEB REMINDER

On aircraft equipped with the OEB reminder function, the procedure and the status of the "AIR ENG 1 (2) BLEED LO TEMP" warning may be flagged.
The "Refer to QRH PROC" line will then be displayed, instead of the procedure itself.
To flag the "AIR ENG 1 (2) BLEED LO TEMP" procedure and status, the following code should be entered in the FWC OEB database:

	Code	WARN	STS
For ENG 1:	36-00-330/075	Y	Y
For ENG 2:	36-00-340/077	Y	Y

CORRECTIVE ACTIONS

This OEB is cancelled by installation of modification 30884 (TCT PIN 342B040000) or upon verification of all TCT with the relevant inspection service bulletin (ISB 36-1049).

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FLIGHT OPERATIONS SUPPORT

OPERATIONS ENGINEERING BULLETIN

BP N°33, 31707 Blagnac Cedex France

A318/A319/A320/A321

Issued by STL	File in FCOM Vol 3	BULLETIN / ISSUE N° : 162/2 DATE : Jan 2008

SUBJECT: INCORRECT GRID-MORA VALUE DISPLAYED ON THE NAVIGATION DISPLAY BY THE FMS

APPLICABLE TO: FMGC with FMS2 Honeywell PEGASUS (P1C8 Mod. 31896 or P1I8 Mod. 31897), with the GRID-MORA function (Mod. 32042)

R **CANCELLED BY:** FMGC with PEGASUS H2 – Release 1A
R (H2C12 Mod 38778 or H2I11 Mod 38779)

R **REASON FOR ISSUE 2:**

R This OEB is reissued to update the "CORRECTIVE ACTIONS"
R section, in order to provide the new list of modifications that cancel
R this OEB.

R **REASON FOR ISSUE 1:**

An FMS software anomaly was discovered subsequent to the analysis of airline reports: The FMS may display an incorrect Grid-Mora value on the Navigation Display, when in the following areas:

- Southern latitudes, or
- Western longitudes

EXPLANATION:

The FMS searches the Grid-Mora cells of its Navigation Database to find the highest Grid-Mora value within a 40 nautical mile radius around the aircraft. The Navigation Display then displays this value, when the CSTR option is selected on the EFIS Control Panel, and the selected range is equal or greater to 40 nautical miles.
However, when the aircraft latitude and/or longitude is negative (Southern latitude and/or Western longitude), the FMS incorrectly shifts by 1 degree North and/or 1 degree East the aircraft position that is used when initially determining the applicable Grid-Mora cell. Therefore, the Navigation Display may display an incorrect Grid-Mora value.

This Grid-Mora value is correctly computed and displayed, however, when the aircraft latitude and longitude are positive (Northern latitude and Eastern longitude).

Note: The highest and lowest elevations that may be displayed on the Navigation Display by the Peaks function of the EGPWS (if installed) are not impacted by this misbehavior, and are correctly computed.

PROCEDURE:

If the aircraft latitude is South, or if the aircraft longitude is West, DISREGARD the Grid-Mora value that may be displayed on the Navigation Display.

CORRECTIVE ACTIONS:

R This OEB is cancelled by PEGASUS H2-R1A FMS standard.

~~Issued by STL~~	File in FCOM Vol. 3	BULLETIN / ISSUE N°: 169/2 DATE: Jan 2008

SUBJECT: **DUAL FM RESET UPON RADIAL FIX INFO ENTRY**

APPLICABLE TO: **All A318/A319/A320/A321 aircraft with FMS2 Pegasus (P1C8 Mod. 31896, P1C9 Mod. 32222, P1C11 Mod. 34573 or P1I8 Mod. 31897)**

R **CANCELLED BY**: **FMGC with PEGASUS H2 – Release 1A**
R **(H2C12 Mod 38778 or H2I11 Mod 38779)**

R **REASON FOR ISSUE 2:**

R This OEB is reissued to update the "CORRECTIVE ACTIONS"
R section, in order to provide the new list of modifications that cancel
R this OEB.

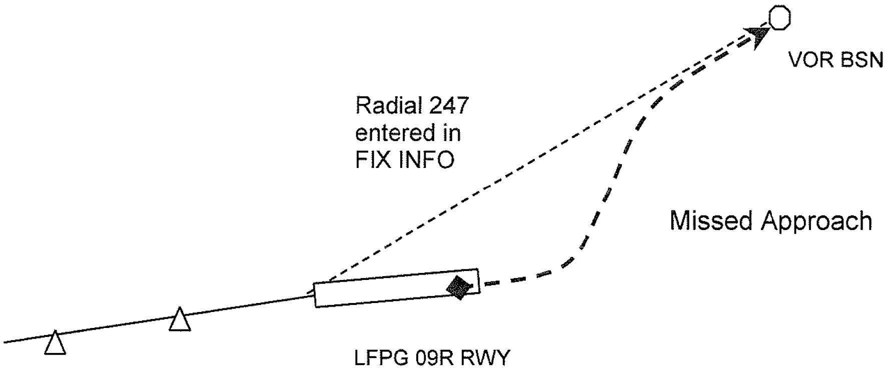
R **REASON FOR ISSUE 1**:

Several Operators reported that both FMS reset immediately after the flight crew inserted a FIX INFO radial that intercepted the F-PLN just prior to the last point of the approach (Missed Approach Point – MAP-, or runway threshold).

Therefore, this OEB is issued to provide the operational recommendations that should be applied, in order to help prevent this situation.

EXPLANATION:

The diagram below illustrates one of the reported events that occurred during the aircraft's approach into Paris CDG airport RWY 09R, after inserting the BSN VOR 247-degree radial in the MCDU FIX INFO page.



In some reset cases, the FM lost the GW/CG information. When the GW/CG were re-inserted, the FM reset again. However, F-PLN data were not lost, and the AP/FD/ATHR remain engaged.

In other reset cases, the FM lost the F-PLN and all other manually-entered data.

Airbus has reproduced the reported scenarios in the simulator. Investigations indicate that the FMS cannot perform the associated prediction computations, when FIX INFO radials intersect the F-PLN just before the last point of the approach. These specific conditions systematically cause the FM reset.

The reset may occur during any flight phase, as soon as the corresponding FIX INFO radial is inserted, and the associated predictions are computed.

Due to the fact that several FM resets may occur consecutively, it may take some time for the FMS to automatically recover.

PROCEDURES:

A) Preventive Procedure:

Do not use the FIX INFO function with any radials that could intercept the F-PLN just before the last point of the approach (less than 0.1 NM).

Note: The last point of the approach corresponds to the runway threshold for an ILS approach, or to the Missed Approach Point (MAP) for a Non-Precision Approach (NPA).

B) Recovery Procedure:

If disengaged, consider reengagement of the AP/FD and ATHR.

While the FMS is recovering, consider using RMP backup tuning for navigation.

1) **If the F-PLN is not lost:**
Normal FMS operation can be recovered by clearing the radial FIX INFO, and then by re-entering the GW/CG.

2) **If the F-PLN is lost:**
When the FMS has automatically recovered, perform the associated procedures (ref. QRH 2.02B).

CORRECTIVE ACTION:

R This OEB is cancelled by PEGASUS H2-R1A FMS standard.

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FLIGHT OPERATIONS SUPPORT

OPERATIONS ENGINEERING BULLETIN

BP N°33, 31707 Blagnac Cedex France

A318/A319/A320/A321

RED OEB – RED OEB – RED OEB – RED OEB – RED OEB – RED OEB – RED OEB

Issued by STL	File in FCOM Vol 3	OEB N°: 178/2 DEC 06 *Associated with QRH OEB PROC N°: 178/1*

- This OEB covers a significant operational issue. Non-compliance with this OEB should have a significant impact on the safe operations of the aircraft. The Operators shall distribute its content to all flight crews without delay. An extract of this OEB is provided for insertion in the QRH.

- It is strongly recommended that all Operators accelerate the incorporation of all corrective Service Bulletins, as soon as they are available.

SUBJECT: **OPERATION OF CENTER TANK PUMPS**

APPLICABLE TO: **All A318 and A319 aircraft, and A320 aircraft fitted with center tank.**

R **CANCELLED BY:** **Mod 37508 / SB 28-1159 (Refer to "Corrective**
R **Actions")**

R **REASON FOR ISSUE 2:**

R Operators must pay attention to Issue 2 of this OEB, even if corrective
R actions to cancel Issue 1 have already been performed:

R – Issue 1 of this OEB dealt with the possible screw detachment issue on a
R specific batch of Eaton fuel pumps (serial number (SN) 6137 and
R above). The corrective modification Mod 36734 / SB 28-1153, which is
R applicable to this batch of pumps, cancels Issue 1 of this OEB.

- Issue 2 of this OEB is published after additional investigations, launched to assess the integrity of the Eaton fuel pumps with SN 6136 and below. The results revealed that all Eaton fuel pumps (i.e. all SNs), not modified in accordance with SB 28-1153, are potentially subject to the screw detachment issue.

Therefore, all Eaton fuel pumps, with part numbers (P/Ns) 568-1-27202-005 or 568-1-27202-002, must be modified in accordance with Airbus SB 28-1159 (pumps SN 6136 and below) or 28-1153 (pumps SN 6137 and above).

Even if Issue 1 of the OEB is no longer applicable to some aircraft, these aircraft may still have Eaton pumps with SN 6136 or below. Therefore, the flight crew must apply the operational restrictions and procedures detailed in this OEB, until all applicable fuel pumps have been modified.

This OEB is also being reissued:

- To clarify that the flight crew does not need to apply the operational procedures related to center tank pumps, if the Operator confirms that:
  - The center tank pump P/Ns end in –05R or –02R, or
  - The center tank pumps are manufactured by Intertechnique, or
  - The center tank is deactivated, and is kept empty for the entire flight.
- To enhance the current in-flight procedure by specifying that, if a low pressure caution is triggered for only one center tank pump, the flight crew can keep the other center tank pump running until both pumps have low pressure. This will enable the flight crew to empty the center tank after the failure of one pump.

<u>REASON FOR ISSUE 1:</u>

One of the screws holding the gas return connector on the top of a fuel pump manufactured by Eaton Aerospace Limited became detached and fell into the stator/rotor area. Detachment of this screw reduces the integrity of the pump's flame trap, and no longer ensures the complete segregation between the electrical components of the pump and the fuel vapor environment in the fuel tank.

This OEB is issued to provide the operational recommendations to be applied, in order to manually control the center tank pumps. The procedures ensure that the center tank pumps remain immersed in fuel when they are started, and that they do not start automatically when they come in contact with fuel vapors in the tank.

EXPLANATION:

One operator reported the tripping of a circuit breaker in flight. This circuit breaker was associated with a fuel pump manufactured by Eaton Aerospace Limited (formerly FR-HiTEMP Limited). Investigation revealed that one of the two screws holding the gas return connector to the top of the motor housing became detached. This screw then fell into the stator/rotor area, and caused the circuit breaker to trip. Loss of this screw allows the pump's integral flame trap to be bypassed.

R Therefore, if an Operator identifies that any of the fuel pumps of their
R aircraft is affected (refer to the Airbus Operators Information Telex (OIT)
R reference SE 999.0128/06), <u>then the affected pump must only be started</u>
R <u>when it is entirely immersed in fuel.</u> <u>When started, the pump will be able to</u>
R <u>operate normally to empty the fuel tank.</u> As a result, there should be a minimum of 2 000 kg (4 500 lb) of fuel in the center tank, or 700 kg (1 550 lb) of fuel in each inner cell of the wing tank, when the pump is started.

This affects the operation of the center tank pumps during the flight, because in the automatic mode of operation, the pumps are automatically:

- Started after engine start, and stopped two minutes later;
- Started, when the slats are retracted during climb;
- Stopped and started as a consequence of the operation of Fuel Recirculation System in the wing tanks (IDG cooling in the engines).

The operation of the wing tank pumps in flight is not affected, because the pumps are started before the flight when there is always more than 700 kg (1 550 lb) of fuel in the inner cell. The pumps run continuously during the flight, unless they are manually turned off.

It may be necessary to redistribute fuel during the refueling, ground transfer and defueling process. It will be necessary to manually control the center tank pumps, if the center tank is used during the flight.

R **OPERATIONAL PROCEDURES:**

R The flight crew should perform PROCEDURE A, as indicated below.
R However, the flight crew may apply PROCEDURE B instead, only if
R maintenance and/or engineering personnel confirm(s) that this aircraft has:

R – Center tank pumps with P/N 568-1-27202-05R or 568-1-27202-02R, or
R – Center tank pumps manufactured by Intertechnique (P/N P99C38-601 or
R P99C38-605), or
R – The center tank deactivated, and kept empty for the entire flight, in
R accordance with AMM center tank deactivation procedure (Chapter 28-
R 21-00 P.Block 401).

R **PROCEDURE A**

FUEL LOADING

Refueling

Before refueling, all fuel pumps must be turned OFF, in order to prevent them from automatically starting during the refueling process.

- If the total Fuel On Board (FOB) after refueling is less than or equal to 12 000 kg (26 500 lb), or more than 15 000 kg (33 000 lb), automatic refueling process can be followed.
- If the total FOB after refueling is between 12 000 kg (26 500 lb) and 15 000 kg (33 000 lb), manual refueling is necessary.
  - 2 000 kg (4 500 lb) of fuel must be put in the center tank;
  - The remaining quantity shall be split in the wing tanks;
  - If the wing tanks are full, put the remainder of the fuel in the center tank.

  After fuel distribution, the wing tanks may not be full when there is fuel in the center tank. This is acceptable for the flight.

If the fuel quantity in the center tank is below 2 000 kg (4 500 lb), the fuel
R must be considered unusable, and the center tank pumps must be turned
R OFF for the entire flight.

If the total FOB after refueling is more than 12 000 kg (26 500 lb), then the takeoff Center of Gravity (CG) must be determined using the revised fuel index data, and checked within the revised operational takeoff CG envelope, as explained in the Flight Operations Telex (FOT) Ref. STL
R 999.0047/06 Revision 1. If the revised fuel index data and the revised operational envelope are not used, the following table shall be used to check the takeoff CG:

	Move the forward limit of the operational takeoff CG envelope by	**Move the takeoff CG by**
FOB ≤ 12 000 kg (26 500 lb)	No change	No change
12 000 kg (26 500 lb) < FOB ≤ 15 000 kg (33 000 lb)	2% MAC aft, for A318 & A320 1% MAC aft, for A319 No change for A319CJ	2% MAC forward, for all aircraft
FOB > 15 000 kg (33 000 lb)	2% MAC aft, for A318 & A320 1% MAC aft, for A319 No change for A319CJ	No change

Ground Fuel Transfer

Do not start a fuel transfer from the center tank, if it contains less than 2 000 kg (4 500 lb) of fuel. Do not start a fuel transfer from an inner cell of a wing tank, if it contains less than 700 kg (1 550 lb) of fuel. If a tank has less than the required quantity, it is necessary to add fuel (via a transfer from another tank or refueling) to enable a transfer to take place.

Defueling

When performing a pressure defuel of the center tank, make sure that the center tank contains at least 2 000 kg (4 500 lb) of fuel. If it has less than the required quantity, then transfer fuel to the center tank. Defuel the aircraft normally, and turn OFF the center tank pumps immediately after the FAULT light on the corresponding pushbutton-switch comes on. When defueling the wing tanks, do not start the fuel pumps if the fuel quantity in the inner cell is below 700 kg (1 550 lb). If the fuel on the aircraft is not sufficient to achieve the required fuel distribution, then transfer fuel or refuel the aircraft to obtain the required fuel quantity in the wing tank.

CENTER TANK PUMPS OPERATION

WARNING

Do not turn on the center tank pumps if the center tank contains less than 2 000 kg (4 500 lb) of fuel, even if it is requested by another procedure.

Before and during refueling:

- ALL TK PUMPS .... OFF

■ **IF THE TOTAL FOB AFTER REFUELING IS LESS THAN OR EQUAL TO 12 000 KG (26 500 LB)**

After refueling:

- CTR TK .... CHECK EMPTY

  If fuel remains in the center tank, it must be considered unusable.
- L and R TK PUMP 1 and 2 .... ON
- CTR TK PUMP 1 and 2.. MAINTAIN OFF
- FUEL MODE SEL ....MAN

■ **<u>IF THE TOTAL FOB AFTER REFUELING IS MORE THAN 12 000 KG (26 500 LB)</u>**

After refueling:

- CTR TK QUANTITY .... CHECK
  Check that the center tank contains at least 2 000 kg (4 500 lb) of fuel.

■ **<u>CASE 1</u>: If the fuel quantity in the center tank is between 2 000 kg (4 500 lb) and 3 000 kg (6 500 lb):**

After refueling:

- L and R TK PUMP 1 and 2 .... ON
- CTR TK PUMP 1 and 2 .... MAINTAIN OFF
- FUEL MODE SEL .... MAN

In flight:

- **When <u>FUEL</u> AUTO FEED FAULT is triggered on the ECAM, or the fuel quantity in one wing tank (inner + outer) is below 5 000 kg (11 000 lb):**
  - CTR TK PUMP 1 and 2 .... ON

R • **If <u>FUEL</u> CTR TK PUMP 1(2) LO PR caution triggers:**
R - CTR TK PUMP 1(2) .... OFF

R **CAUTION**
R Turn OFF the associated CTR TK PUMP without delay.

R • **If no fuel leak:**
R - FUEL X FEED .... ON

R • **When <u>FUEL</u> CTR TK PUMPS LO PR caution triggers, or**
R **when the center tank is empty:**
- CTR TK PUMP 1 and 2 .... OFF
R - FUEL X FEED .... OFF

CAUTION
Turn OFF both CTR TK PUMPS without delay.

■ **<u>CASE 2:</u> If the fuel quantity in the center tank is above 3 000 kg (6 500 lb):**

After refueling:

- ALL TK PUMPS .... ON
- FUEL MODE SEL .... CHECK AUTO

The flight crew should note on the computerized flight plan the estimated position or time when the center tank fuel quantity will drop below 3 000 kg (6 500 lb).

In flight:

- CTR TK QUANTITY .... MONITOR

- **When the fuel quantity in the center tank is between 2 000 kg (4 500 lb) and 3 000 kg (6 500 lb):**
  - FUEL MODE SEL .... MAN
  - CTR TK PUMP 1 and 2 .... OFF

  R *<u>Note:</u> If the fuel quantity in the center tank inadvertently goes below 2 000 kg*
  R *(4 500lb) prior to being checked, and the CTR TK PUMPS have not*
  R *been turned OFF, the flight crew must perform the following steps:*
  - *If the fuel in the center tank is required for the flight, leave the CTR TK PUMPS in ON position. Turn FUEL MODE SEL to MAN. When <u>FUEL</u> CTR TK PUMP 1 or PUMP 2 or PUMPS LO PR is triggered on the ECAM, or the center tank is empty, turn OFF both CTR TK PUMPS without delay. Do not apply the subsequent procedures.*
  - *If the fuel in the center tank is not required for the flight, turn OFF both CTR TK PUMPS and do not turn them back on for the rest of the flight. Consider the center tank fuel unusable. Do not apply the subsequent procedures.*

- **When <u>FUEL</u> AUTO FEED FAULT is triggered, or the fuel quantity in one wing tank (inner + outer) is below 5 000 kg (11 000 lb):**
  - CTR TK PUMP 1 and 2 .... ON

  - R **If <u>FUEL</u> CTR TK PUMP 1(2) LO PR caution triggers:**
    - R CTR TK PUMP 1(2) .... OFF

    R **CAUTION**
    R Turn OFF the associated CTR TK PUMP without delay.

    - R **If no fuel leak:**
      - R FUEL X FEED .... ON

  - R **When <u>FUEL</u> CTR TK PUMPS LO PR caution triggers, or**
    R **when the center tank is empty:**
    - CTR TK PUMP 1 and 2 .... OFF
    - R FUEL X FEED .... OFF

    CAUTION
    Turn OFF both CTR TK PUMPS without delay.

PROCEDURE B

Apply PROCEDURE B instead of PROCEDURE A, only if maintenance/engineering personnel confirm(s) that this aircraft has:

- *Center tank pumps with P/N ending in –05R or –02R, or*
- *Center tank pumps manufactured by Intertechnique, or*
- *The center tank deactivated, and kept empty for the entire flight.*

FUEL LOADING

Refueling

Before refueling, all wing tank pumps must be turned OFF.

Ground Fuel Transfer

Do not start a fuel transfer from an inner cell of a wing tank, if it contains less than 700 kg (1 550 lb) of fuel. If a tank has less than the required quantity, it is necessary to add fuel (via a transfer from another tank or refueling) to enable a transfer to take place.

Defueling

When defueling the wing tanks, do not start the fuel pumps if the fuel quantity in the inner cell is below 700 kg (1 550 lb). If the fuel on the aircraft is not sufficient to achieve the required fuel distribution, then transfer fuel or refuel the aircraft to obtain the required fuel quantity in the wing tank.

CORRECTIVE ACTIONS:

Operators must identify if any fuel pumps are affected, in accordance with Airbus SB 28-1159. If the Operator confirms that the aircraft does not have Eaton fuel pumps with P/Ns 568-1-27202-005 or 568-1-27202-002, then the operational procedures and restrictions mandated by this red OEB can be canceled.

If the Operator identifies any affected Eaton fuel pump, either on an aircraft or as a spare part, then the affected pump(s) must be modified in accordance with Airbus SB 28-1159 or 28-1153. After all affected pumps of an aircraft have been modified, the operational procedures and restrictions mandated by this red OEB can be canceled for that aircraft.

Note: The interchangeability code, given in the Illustrated Part Catalog (IPC), indicates the conditions for interchangeability of equipment. After installation of corrective modification(s)/SB(s), if an Operator reinstalls any equipment affected by this OEB it is the Operator's responsibility to ensure that the recommendations given in this OEB are applied again for the applicable aircraft.

AIRBUS®

OEB

FLIGHT OPERATIONS SUPPORT

OPERATIONS ENGINEERING BULLETIN

BP N°33, 31707 Blagnac Cedex France

A318/A319/A320/A321

Issued by STL	File in FCOM Vol 3	BULLETIN / ISSUE N°: 188/2 DATE: SEP 07

SUBJECT: NO SRS ENGAGEMENT DURING GO AROUND BELOW MDA

APPLICABLE TO: All A318/A319/A320/A321 aircraft

R **CANCELLED BY:** Flight Guidance (FG) "I11" standard part
R of FMGC S4I11 (mod 37252), P1I11 (Mod
R 37311) or FG "C12" standard part of FMGC
R S4C12 (mod 37935), P1C12 (mod 37934).

R **REASON FOR ISSUE 2**:

R This OEB is reissued to inform operators that this OEB is also
R cancelled for aircraft that have the FG "C12" part of FMGC S4C12 or
R P1C12.

R **REASON FOR ISSUE 1**:

One Operator reported a case where the flight crew initiated a Go Around slightly below the Minimum Descent Altitude (MDA), and the aircraft did not pitch up as expected. The flight crew performed a non precision approach (a VORDME approach) using the FINAL APP managed guidance mode with the AP1 (Autopilot) engaged during the final approach.

This OEB is issued to provide flight crews with an operational procedure to avoid such aircraft behavior

The operational procedure provided in this OEB applies to all Non Precision Approaches, for both conventional approaches and RNAV approaches, flown in FINAL APP managed guidance mode.

EXPLANATIONS:

Note: The following behavior does not occur when the flight crew uses lateral managed guidance only (NAV-FPA or NAV-V/S).

The following occurs when the flight crew uses the FINAL APP managed guidance mode, and engages either AP1 or FD1 (AP OFF) ((Flight Management and Guidance Computer 1 (FMGC1) is the master):

During a non-precision approach, when the aircraft is reaching MDA (MDH) minus 50ft, or the Missed Approach Point (MAP), the FMGC automatically commands an AP/FD disconnection, in order to automatically disengage the FINAL APP managed guidance mode. After the AP/FD disconnection, the FD engages again, either in heading-vertical speed (HDG-V/S), or track-Flight Path Angle (TRK-FPA) mode, with the current aircraft targets.

If the flight crew initiates a go-around below MDA (MDH) during a short period of time (approximately 600 milliseconds) after the AP/FD disconnection, no FMGC takes over to engage the go-around guidance modes, as expected. This is due to the fact that both FMGCs are not entirely synchronized when the AP/FD automatically disconnects.

As a result, the GA TRK lateral guidance mode and the SRS vertical guidance mode do not engage during the go-around.
In addition, the FD remains in a basic guidance mode (i.e. HDG-V/S or TRK-FPA), and provides the flight crew with pitch down orders that are not appropriate.

Investigation has demonstrated that if the flight crew disengages the FINAL APP managed guidance mode during the final stage of the approach, the SRS and the GA TRK guidance modes engage as expected, when the flight crew initiates a go-around slightly below MDA(MDH).

PROCEDURE:

During a non precision approach, when using the FINAL APP managed guidance mode:

- **At DA(DH) or MDA(MDH), or earlier in approach if visual conditions are obtained, DISENGAGE the FINAL APP mode by de-pressing the APPR pushbutton on the FCU.**

When the flight crew de-presses the APPR pushbutton in order to disengage the FINAL APP managed guidance mode, a basic vertical guidance mode, either V/S or FPA, engages.

This ensures that the SRS and GA TRK guidance modes correctly engage, if the flight crew initiates a go-around slightly below MDA (MDH).

~~Issued by STL~~	File in FCOM Vol 3	BULLETIN / ISSUE N°: 189/1 DATE: MARCH 2008

SUBJECT: ERRONEOUS VERTICAL PROFILE DURING RNAV, LOC AND LOC B/C APPROACHES.

APPLICABLE TO: All A318/A319/A320/A321 aircraft with Honeywell FMS

CANCELLED BY: Honeywell FMS2 "Release 1A" Standard (Mod 38778 on CFM aircraft, or Mod 38779 on IAE/PW aircraft), or a future standard for legacy FMS (Mod TBD).

REASON FOR ISSUE:

This OEB is issued to provide Operators with the operational recommendations to apply in cases where the flight crew performs an RNAV or a LOC or LOC Back Course (B/C) approach with the MAP located before the runway (RWY) threshold.

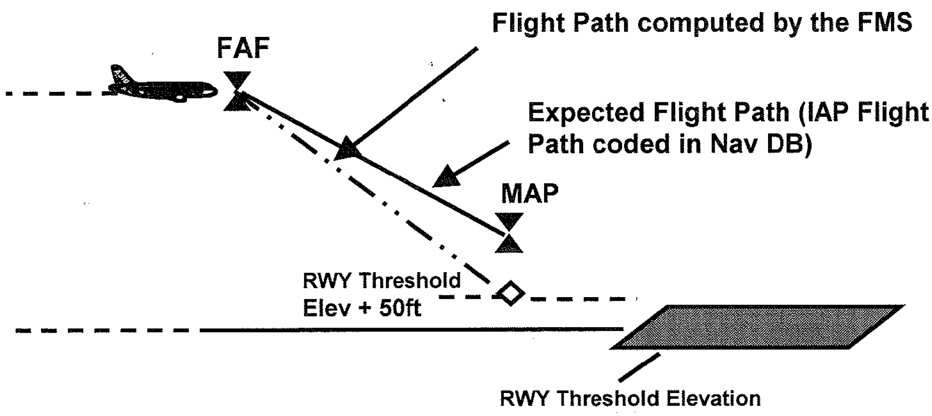
This is because in such cases, the FMGC does not compute the vertical flight path correctly. As a result, it may cause the aircraft, when flown in managed vertical guidance, during an RNAV approach, to fly a vertical flight path lower than the published one on the approach procedure chart.
This anomaly also applies to the vertical deviation indication symbol, VDEV.

These recommendations were originally published in FCOM Standard Operating Procedures section 3.03.19. Due to the fact that more and more RNAV procedures are being published in the Instrument Approach Procedures (IAP), Airbus found it necessary to publish this OEB in order to highlight these recommendations.

EXPLANATION:

When the FMGC identifies an IAP that is labelled as RNAV in the navigation database, and that is labelled as RNV on the MCDU, it builds the final approach vertical flight path assuming that there is an altitude constraint at the MAP equal to the runway threshold elevation plus 50 feet.

As a result, when the MAP is located before the runway (RWY) threshold, the FMGC computes an erroneous vertical flight path for the final approach, an erroneous crossing altitude at the MAP, and displays an erroneous vertical deviation indication (VDEV symbol) on the PFD, when flying the approach.
This VDEV anomaly also applies to the LOC and LOC B/C approaches with the MAP located before the runway (RWY) threshold.



MAP: Missed Approach Point
FAF: Final Approach Fix

Therefore, for RNAV approaches, when the MAP is located before the runway threshold, the flight crew cannot use flight guidance in FINAL APP mode, and they must disregard the VDEV symbol.

The flight crew must fly the LOC and LOC B/C approaches in selected vertical guidance mode (FPA or V/S mode), and they must disregard the vertical deviation symbol (VDEV).

Note that approaches labelled as "GPS" on the MCDU are not affected and can be flown in FINAL APP mode regardless of the MAP position.

PROCEDURE:

For RNAV approaches:

For any approach labelled as RNV on MCDU:

- **VERIFY on the approach chart and on the MCDU that the MAP is at the runway threshold**
  On the MCDU FPLN page, if the last waypoint of the active FPLN, displayed in green, is identified as a runway (e.g. LFBO32L), it means that the runway threshold is the MAP.

  - **If the MAP is located at the runway (RWY) threshold, use of the vertical managed guidance mode (FINAL APP) is possible**

  - **If the MAP is not located at the Runway (RWY) threshold:**

    - **DO NOT USE vertical managed guidance (FINAL APP)**
    - **USE NAV mode for lateral guidance**
    - **USE SELECTED vertical guidance mode only (FPA is recommended)**
    - **DISREGARD the VDEV symbol, and crosscheck the final descent using altitude versus distance to the MAP.**

Note: *Approaches labelled as "GPS" on the MCDU can be flown in FINAL APP mode, regardless of the MAP position.*

For LOC, or LOC back course (B/C) approaches:

- CHECK the position of the MAP on the approach chart

  - **If the MAP is located at the runway (RWY) threshold, the VDEV symbol can be used to assist the flight crew in flying the vertical flight path in selected mode.**

  - **If the MAP is located before the runway (RWY) threshold:**

    - **DISREGARD the VDEV symbol, and crosscheck the final descent using the altitude versus the distance to the MAP.**

N° 801/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

INTRODUCTION

FCOM Bulletins were created to provide complementary technical/operational explanations related to the information included in the Flight Crew Operating Manuals (FCOMs).

The objective of FCOM Bulletins differs from that of Operations Engineering Bulletins (OEBs). OEBs are issued to rapidly address specific problems that have an operational impact. They are created, as needed, in order to quickly transmit technical and procedural information, and are normally issued in response to a detected irregularity or an abnormal aircraft/system behavior.

FCOM Bulletins are periodically issued to address one or several subjects and include supplementary explanations concerning procedures, system descriptions, performance, and regulations.

They are updated as the need arises and are filed in FCOM BULLETINS Section of Volume 3.

N° 802/1

DATE : JUN 04

File in FCOM BULL Section

ISS.A

SUBJECT : CARBON BRAKES WEAR

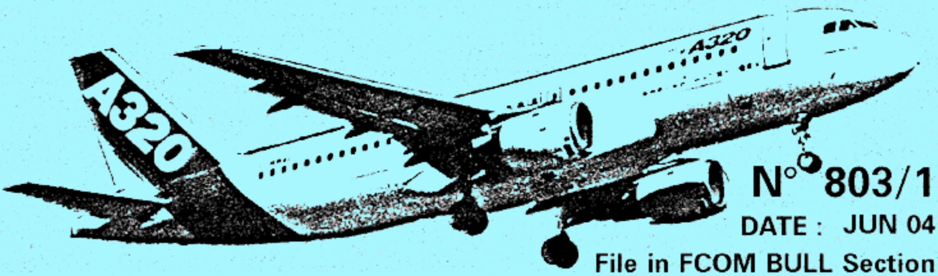
- Steel-brakes are such that wear is directly proportional to the energy applied. In other words, the strongest the brake demand, the greatest the wear.

  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° 803/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

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,

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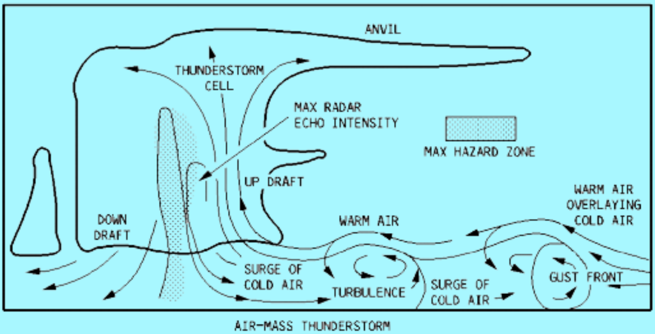
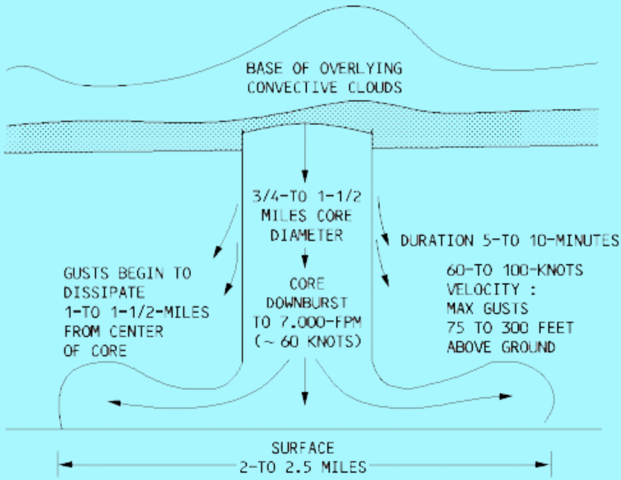


AIR-MASS THUNDERSTORM

– 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.

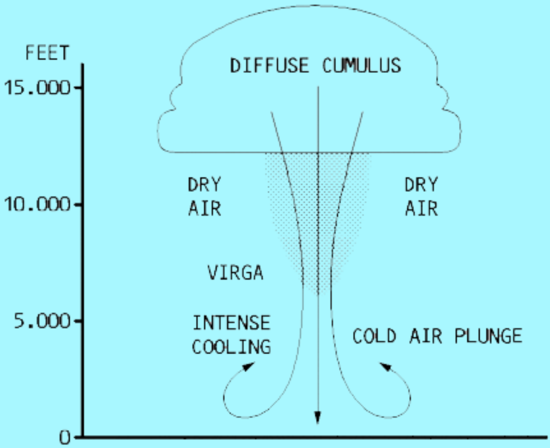


APPROX TRANSIT TIME AT 150-KNOTS AVERAGE GROUND SPEED : 45 SECONDS

WET MICROBURST CROSS-SECTION

Microbursts can take 2-5 minutes to develop maximum intensity and may then be sustained for an equal period of time. They tend to develop in groups which may be merged, delaying dissipation to 30 minutes. Present knowledge contends that approximately one in a hundred heavy rain thunderstorms produce microbursts. It was determined that microbursts can also occur in relatively dry conditions. Once it gains sufficient downward momentum, a downflow with evaporative cooling accelerates to the earth's surface to induce a «dry microburst» with very light or non-existant precipitation, called virga. «Wet microbursts» are expected to occur in the wet regions of the world. Dry microbursts are commonly seen in the dry areas and most likely below cumulus cloud when dew point is 30 ∘ C or more below ambient temperature.
Changes in meteorological conditions associated with both macro and microbursts tend to be very complicated.

CONDITIONS	MACROBURSTS	MICROBURSTS
Air temperature	: ISA + 15 ∘ decreasing	ISA + 15 ∘ increasing or decreasing
Dew point spread	: increase (20-40 ∘ C)	increase (20-40 ∘ C)
Surface pressure	: rise or fall (up to 2/3 mb)	rise or fall (up to 2/3 mb)



DRY MICROBUST CROSS-SECTION IN VIRGA

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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 :

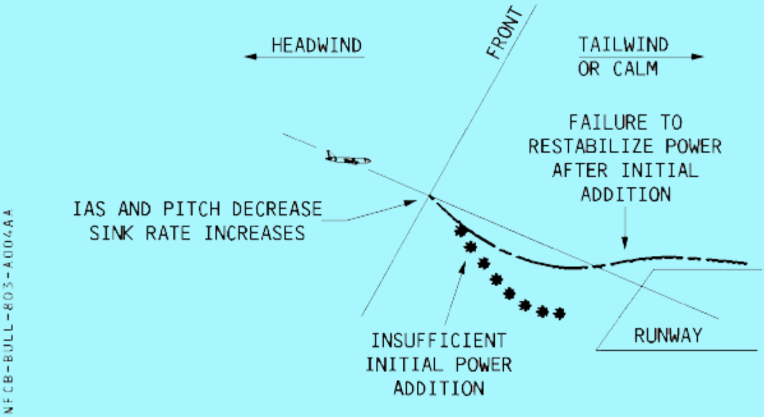
- less power necessary suggesting a strong headwind,
- more power necessary suggesting a strong tailwind,

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



· airspeed decreases, lift decreases,
· A / C nose begins to pitch down,
· A / C begins to drop below the glide slope,

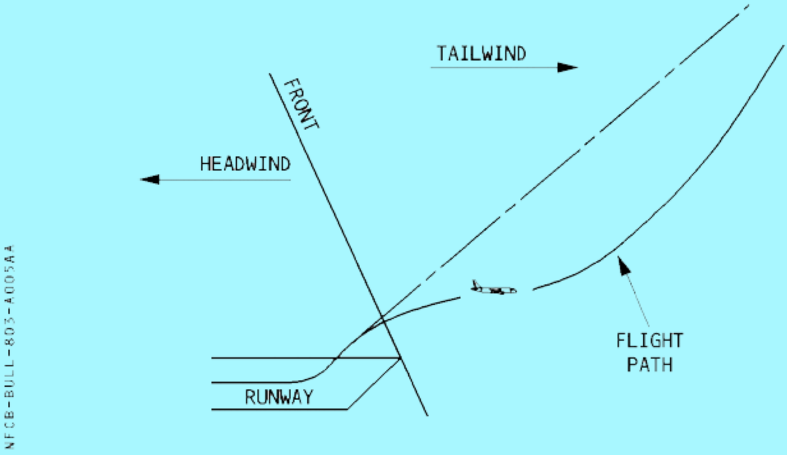
In this case the A/C is both slow and low in a « power deficient » state.

Consequences :

. If the pilot pulls the nose up to recapture the glide slope without selecting sufficient power : the A / C will loose altitude very rapidly and may even reach the ground before the power deficiency is corrected, resulting in a hard landing.

. or if sufficient power is set to regain the glideslope before reaching the ground : the « double negative » problem may arise if the pilot does not quickly retard the throttles after glide recapture, i.e. throttles set too high for a stabilized approach in a no-wind condition leading to a long and fast landing.

TAKE OFF WITH A TAILWIND SHEAR



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

Consequences :

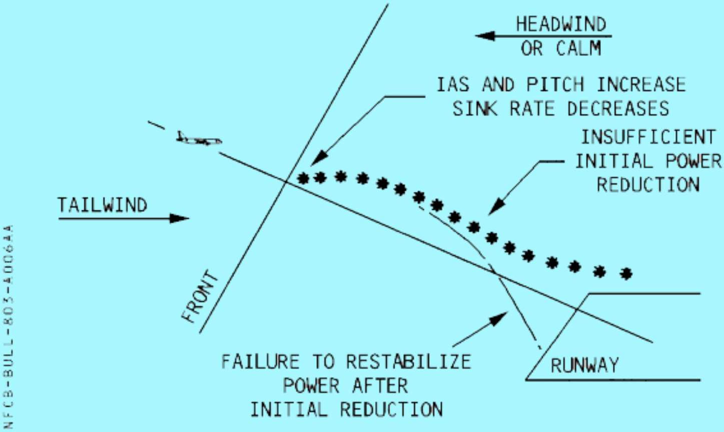
. Because of aircraft inertia, attitude and ground speed will be initially maintained upon encountering windshear but airspeed will decrease, causing a reduction in lift which will result in a downward acceleration and a nose down pitching moment.

. If there is no pilot action, the aircraft will descend below its nominal flight path.
Because of aircraft stability, original angle of attack and airspeed will eventually be recovered, but on a reduced flight path.

INCREASED PERFORMANCE

Tailwind to headwind
Calm to headwind
Tailwind to calm
Headwind to increased headwind

APPROACH WITH A HEADWIND SHEAR



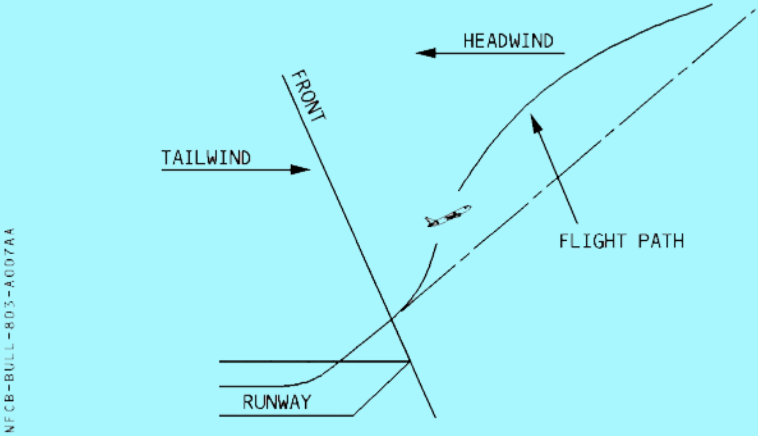
The reverse of the previous case prevails :
. airspeed increases, lift increases,
. A / C nose begins to pitch up,
. A / C balloons above the glide slope,
In this case the A / C is both fast and high in a « power excessive » state.

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

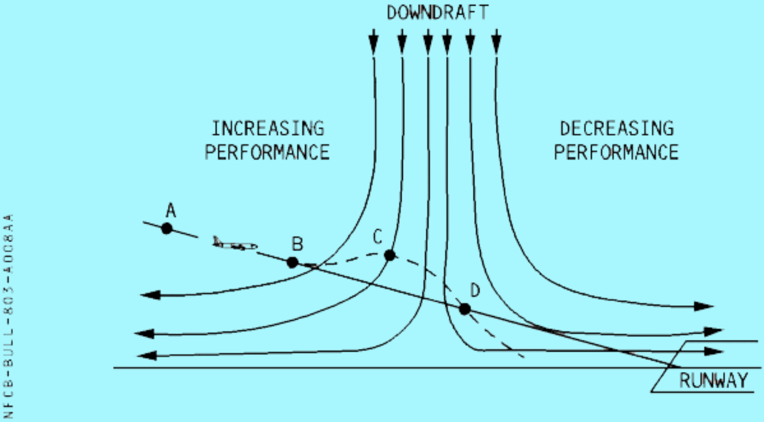
. A headwind shear usually leads to increased aircraft performance.

. 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.

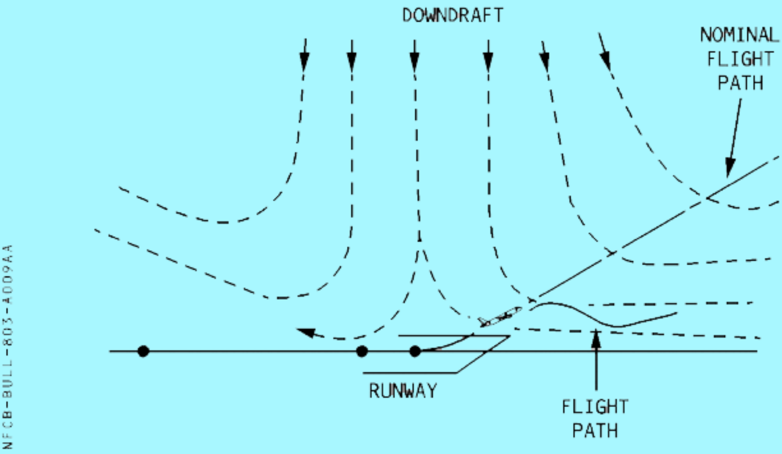
. at point C the « moment of truth » occurs :

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 rapidily and ground impact may become difficult to avoid.

Consequences :

. a go-around initiated at point C or sooner would probably be successful since the A/C is fast and high at this point,

. gradual groundspeed decay shortly after point B coupled with rapidly increasing airspeed could have allowed detection of signs of impending downdraft.



. 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

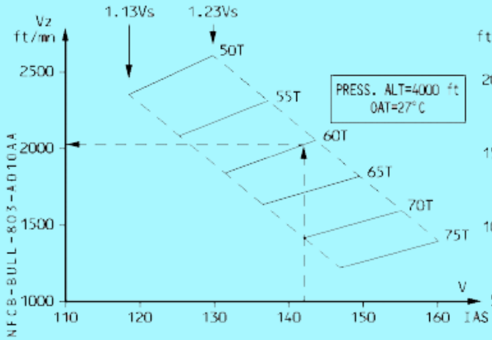
In case of tailwind shear, the aircraft oppose a level flight acceleration capability. For example, an A320 powered with CFM56-5A1 engines (a / c weight = 60 000 kg (132 300 lb), FLAPS 3, pressure altitude = 0 ft, OAT at ISA) is able to maintain an horizontal flight in a 4 kt / s decreased performance 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

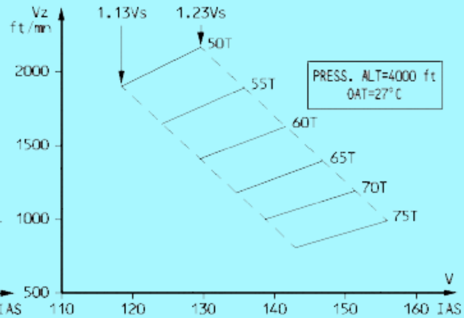
In downburst conditions, level flight will be maintained with the climb gradient maintainability. In the following example (CFM 56-5A1, a/c weight = 60 000 kg (132 300 lb) pressure altitude 4 000 ft, OAT = 27° C, V = 142 kts), the aircraft has the capability to maintain level flight in a 2 040 ft / mn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

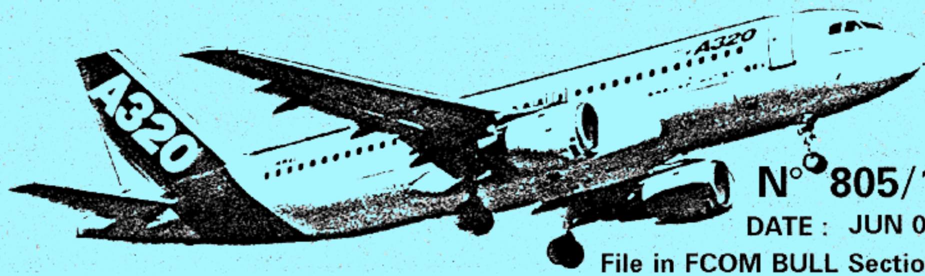
For information, a typical example :

CFM 56-5A1



IAE V2500-A1





N° 805/1

DATE : JUN 04

File in FCOM BULL Section

ISS.A

SUBJECT : CABIN FANS

CABIN FANS

Several airlines have requested a procedure to reduce cockpit noise during transit i.e to switch off cabin fans.

SYSTEM

Cabin fans are used to recirculate cabin air into the mixing unit. This is to increase the volume of air which can be moved

- into the cabin.
- into the avionic ventilation system when the AIR COND inlet valve is open.

PROCEDURE

To reduce cockpit noise during transit, cabin fans can be switched to OFF provided avionic ventilation system is in normal configuration (BLOWER and EXTRACT pb not set at OVRD). Cabin fans should be selected ON when passengers are on board.

A318/A319/A320/A321 FCOM BULLETIN

N° 806/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

SUBJECT : AVOIDING TAILSTRIKES

Note : This FCOM Bulletin has been revised to include information relative to the A318.

Inadvertent tailstrikes may occasionally occur, and may result in expensive structural damage.

Several tailstrikes have been reported throughout service life.

They are very often associated with such adverse conditions as crosswind, turbulence, windshear, etc.

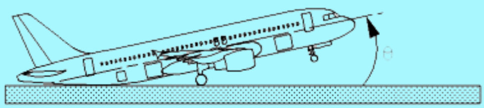
A/C GEOMETRY LIMITS

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).

Example :

NFCB-BULL-806-A001AA



	Pitch attitude Θ			
Main Gear Oleo Position	A318	A319	A320	A321
Fully extended	17.3°	15.5°	13.5°	11.2°
Fully compressed	15.7°	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 A318, 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)
A318	17.3°	3.2°	7.8°	9.5°
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 touchdown, assuming a deceleration of 8 knots during flare (VAPP – 8), and a flight path of – 1° at touchdown (approximately 3 feet/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°).

TAILSTRIKE FACTOR AT TAKEOFF

Early rotation, over-rotation, excessive pitch rate, or a combination of these three factors are the main causes of tailstrikes 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 crosschecked, or an 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 tailstrike incidents (one engine-out, aircraft out of trim, additive inputs from both pilots, early rotation, etc.).

Certification requires demonstration of a safe takeoff at V_R-10 knots (2 engines) and V_R-5 knots (1 engine).
The pitch and the pitch rate, obtained during these tests, are for information purposes only, and are not certified limits.

Aircraft	Weight (kg)	CG	Config.	Rotation speed	θ° Per Sec	θ° At lift-off
A318 CFM	60 145	15.6 %	Conf 2	V_R-10 knots 2 engines	5.9°/s	10.6°
	61 725	15.4 %	Conf 3	V_R–5 knots 1 engine-out	5.3°/s	9.8°
A319 CFM	62 550	21.4 %	Conf 2	V_R-10 knots 2 engines	5.8°/s	12.5°
	63 440	21.3 %	Conf 2	V_R–5 knots 1 engine-out	5.9°/s	12.8°
A320	67 200	17.8%	Conf 2	V_R-10 knots 2 engines	5.8°/s	9.5°
	65 300	16.5%	Conf 2	V_R-5 knots 1 engine-out	5.4°/s	9.0°
A321 IAE	75 950	14.9 %	Conf 2	V_R–10 knots 2 engines	6.3°/s	8.5°
	73 720	15 %	Conf 2	V_R–5 knots 1 engine-out	5.4°/s	9.0°

Note : V_R represents the speed at aircraft rotation, in order to obtain V_2 at 35 feet, in the event of an engine failure.

Normal rotation of 3°/second prevents a tailstrike, 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.

TAILSTRIKE AT LANDING

Industry statistics show that tailstrikes 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 tailstrikes, the main reasons for this being :

a) Allowing speed to decrease well below Vapp before flare.

Flying at a too low speed means high a AOA and high pitch attitude, thus reducing ground clearance. When reaching the flare height, the pilot will have to significantly increase the pitch to reduce the sink rate. This may lead the pitch to go beyond the critical angle.

b) Prolonged hold-off for a smooth touchdown

As the pitch attitude increases, the pilot needs to focus further ahead to assess the aircraft's position in relation to the ground. The attitude and distance relationship can lead to a pitch attitude increase beyond the critical angle.

c) Too high flare

A high flare can result in a combination of decreased airspeed and long float. Since both lead to increased pitch attitude, the result is reduced tail clearance.

d) Too high a sink rate, just prior reaching the flare height.

In case of a too high sink rate close to the ground, the pilot may attempt to avoid a firm touchdown by commanding a high pitch rate.
This action will significantly increase the pitch attitude and, as the resulting lift increase may be insufficient to significantly reduce the sink rate, a firm touchdown may occur. In addition, the high pitch rate may be difficult to control after touchdown, particularly in case of bounce.

e) Bouncing at touchdown

In case of bouncing at touchdown, the pilot may be tempted to increase the pitch attitude so as to ensure a smooth second touchdown. If the bounce results from a firm touchdown associated with a high pitch rate, it is important to control the pitch so that it does not further increase beyond the critical angle.

APPROACH AND LANDING TECHNIQUES

A stabilized approach is essential for achieving successful landings. It is imperative that the flare height be reached at the appropriate airspeed and flight path angle. A/THR and FPV are effective aids to the pilot.

The Vapp should be determined with the wind corrections, given in FCOM/QRH, using FMGS functions.

As a reminder, when close to the ground, the wind intensity tends to decrease and the wind direction to turn (direction in degrees decreasing in northern latitudes).

Both effects may reduce the headwind component close to the ground, and the wind correction to Vapp is there to compensate this effect.

When close to the ground, high sink rates should be avoided, even in an attempt to maintain a close tracking of the glideslope. Priority should be given to attitude and sink rate. If a normal touchdown 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 an 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 the A318/A319/A320 : 10°
For the 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.

A318/A319/A320/A321 FCOM BULLETIN

N° 808/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

SUBJECT : FQI ACCURACY

INTRODUCTION

The FQI system installed on Airbus aircraft use probes to measure the quantity of fuel in the different fuel tanks.

Each FQI probe consists of two fixed concentric tubes which form the plates of a capacitor. The dielectric of this capacitor is provided by air and fuel which have different dielectric constants. Therefore the capacitance of a vertically installed probe varies with the fuel level and gives an indication of fuel quantity in the tank.

FQI ACCURACY ON AIRBUS INDUSTRIE PRODUCTS

The accuracy of any measuring device such as the FQI system, is dependant on various parameters.

There are bias and random errors that can affect FQI system accuracy. Errors can involve tank manufacturing tolerances, FQI computer inaccuracies, error in density determination, probe-mounting tolerances, water that causes FQI over-reads, wing deflection, aircraft reference improperly taken into account.

The following figure gives, the Airbus Industrie standard specifications for FQI system accuracies on the A319/A320/A321

– **Accuracy : ± 1 % of max tank capacity ± 1 % of actual fuel quantity.**

– Supplier :
  – A319/A320 : Smiths and Intertechnique managed by **Smiths**
  – A321 : BFE Goodrich and Sextant managed by **BFE Goodrich.**

– New probes compared to A310/A300-600

– Density sensors measuring all in-tank fuel as opposed to up-lifted fuel only for A310/A300-600

– Attitude correction from IRS in addition to fuel surface probe cutting.

Each aircraft is checked on ground prior to delivery to be within the tolerances shown on the following graphs (Figure 1).

FAR/JAR 25.1337 requires that "each fuel quantity indicator is calibrated to read "zero" during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply..."
Tolerances are reduced when there is low level in the tanks in order to achieve an under-reading of the FQI as required by the regulations.

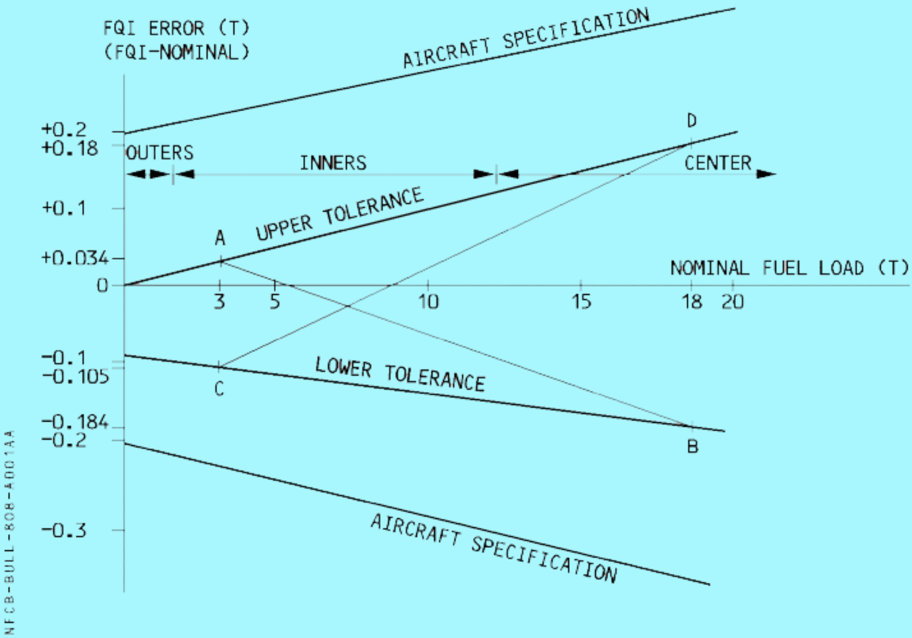


FIGURE 1

UNDERSTANDING FQI DISCREPANCIES

ON GROUND

Refueling personnel sometimes report discrepancies at the end of refueling, between the uplifted quantity based on FQI (total after refuel–total before refuel) and the uplifted quantity from the bowser (litres × measured density).
These discrepancies may be due to the following tolerance considerations.

Max discrepancy ($\triangle$) = **Fuel load [per bowser]** – **Fuel added [FQI end** – **FQI start]**
= ± **FQI error** (end) ± **FQI error** (start) ± **Bowser Qty** and **Density error** + **APU fuel burn** (during refueling)

Example (A320-200) :

Actual FOB before refueling = 3 tonnes (6600 lbs)
Actual FOB after refueling = 18 tonnes (39600 lbs)

- **Bowser quantity and density error**

– Volume tolerance is generally lower than ± 0.5 %

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

Total bowser quantity and density error = ± 15 000 × 0.75 % ≃ ± 115 kg. (253 lbs)

- **APU fuel used**

When comparing bowser data versus FQI data as indicated above, the reported discrepancy includes the fuel used by the APU between FQI readings before and after refueling.

Depending on external conditions and generator load, the APU fuel consumption on ground is between 100 (220) and 150 kg/h (330 lb/h). For a refueling time of 30 minutes, APU burn would be at least **50 kg (110 lb).**

- **FQI errors**

The three following cases should be considered.

1) Significant FQI system changes have been performed (FQI computer, probes change etc...) on the aircraft since delivery or its last FQI ground calibration.

   The FQI accuracy to be taken into consideration should be the one given by the aircraft specification i.e. ± 1 % of maximum tank capacity ± 1 % of actual fuel quantity.

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

FQI at start = 3 tonnes ± 220 kg (6600 lb ± 484 lb)
FQI at end = 18 tonnes ± 370 kg (39600 lb ± 814 lb)

$\triangle 1 = \pm 220$ kg ± 370 kg ± 115 kg ± 50 kg ($\triangle 1 = \pm 484$ lb ± 814 lb $\pm$ 253 lb $\pm$ 110 lb)

$\triangle$ 1 max $\simeq \pm$ 755 kg (1661 lb)

2) No FQI system modification has been performed since the last FQI calibration. All FQI readings are within the ground tolerances (refer to Figure 1).

Maximum positive $\triangle$ is obtained when FQI presents the maximum over-reading at start and the maximum under-reading after refuel, i.e. when the particular aircraft calibration curve runs from A to B.

Maximum positive $\triangle$ = 15,000 – [(18,000 – 185) – (3,000 + 35)] + 115 + 50 = + 385 kg

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

Maximum negative $\triangle$ = 15,000– [(18,000 + 180) – (3,000 – 105)] – 115 + 50 = –350 kg

$\triangle$ 2 max $\simeq \pm$ 385 kg (847 lb)

3) Particular aircraft FQI calibration curve is available.
In this case, although the reported discrepancy can be of the same magnitude as $\triangle$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.

$\triangle$ 3 max $\simeq \pm$ 165 kg (363 lb)

- **Conclusion**

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

$\triangle$1 max= [FQI over-read (start)] – [FQI under-read(end)] + bowser error + APU burn

– Difference can be significant when FQI over/underreadings before and after refueling are very different.

– An aircraft presenting a $\triangle \simeq 0$ does not confirm its FQI system is more accurate than another aircraft with a difference. It suggests (bowser error and APU burn not taken into account) that over/underreadings before and after refueling are very close but not necessarily equal to 0.

IN FLIGHT

As a routine, crews should check the fuel on board (FOB) plus fuel used (FU) against the block fuel during flight. This would detect fuel leaks and provide a more reliable basis of calculation in case of either FQI or FU failure during flight.

Discrepancies have been observed during routine checks. These discrepancies are made up from the three following inherent errors :

- BLOCK FUEL (error constant throughout flight)
- FU (error increasing during flight)
- FOB (error decreasing during flight).

Example : A320 with 18 tonnes

- BLOCK FUEL : 18 tonnes → error = ± 370 kg (814 lb)
- FOB : 3 tonnes → error = ± 220 kg (484 lb)
- FU : 15 tonnes → error = ± 225 kg (495 lb)

In an extreme case :

Block Fuel = FOB + FU ± 815 kg (1793 lb) + APU FU if any

and this with no system fault.

Consequently, it is important to know the FQI tolerances to understand discrepancies.

Notes

1) FU indication accuracy, which is an integration of the FF, is estimated to be better than ± 1.5 %. The error of the fuel flow (FF) meter is dependent upon fuel flow rate and temperature conditions. For normal cruise conditions, this error is around ± 1 %.

2) FQI errors for both Block Fuel and FOB are as per the specification because ground calibration curve is not applicable in flight. Block Fuel error, ground tolerances may be used if applicable (refer to 3.1). In this case, Block Fuel error is ± 185 kg (407 lb) instead of ± 370 kg (814 lb).
   If the particular ground calibration curve is known, there should not be any substantial error on Block Fuel.
   Possible discrepancy due to FOB and FU errors remains significant :

Block Fuel = FOB + FU ± 450 kg (990 lb) + APU FU if any

3) APU fuel used in flight, which is not recorded, is between 40 (88) and 100 kg/h (220 lb/h).

4) With the Flight Management and Guidance System (FMGS), FOB is also available on the appropriate page of the FMGS. FOB is computed by the FMGS using both FQI and FF data.

   In the event of a FQI failure, the FMGS will continue to display FOB by means of the last available FOB and by FF integration.

USE OF MANUAL MAGNETIC INDICATORS

It often happens that when a discrepancy has been detected either on ground or in flight as explained above, some airline procedures request to make a check of the FOB after refueling or after landing by means of the Manual Magnetic Indicators (MMI).

It has to be highlighted that MMI readings involve several measurements and interpolations (on rods, on clinometers, on charts) in addition to the MMI indication accuracy itself.

This is why the accuracy of a MMI reading is approximately ± **5 %** and thus **worse than FQI** system accuracy.

Therefore, MMI readings should not be used to check FQI system. They should only be used when the FQI system is inoperative.

REDUCING FQI DISCREPANCIES

FQI system accuracy continue to improve. Operational accuracy goals have been established by ARINC in cooperation with airframe and equipment manufacturers and in agreement with airline requirements.

The discrepancies described are inherent in the FQI system.

- **Both on-ground and in-flight reported discrepancies are generaly due to FQI errors on Block Fuel.**

  The Block Fuel maximum error should be reduced. This will depend on a responsible judgement based on knowledge of a particular aircraft FQI calibration curve ; i.e. assuming no FQI modification following aircraft delivery, this curve will be reasonably constant (on ground) and thus, for a given FQI reading, real Block Fuel can be deduced.

  This calibration may be done by any operator while it is not applicable to the correction of in-flight reading.

  A FQI calibration procedure is a maintenance function and will be introduced in the AMM in the future.

- FU (fuel used) is the primary parameter to determine fuel consumption (max error = ± 1.5 %). Nevertheless, on certain high-fuel-capacity aircraft, the FOB error (decreasing during flight) may become lower than FU error (increasing during flight) by end of flight.

  Example : A320 with 19 tonnes (41 800 lb) maximum capacity.

  - BLOCK FUEL = 18 tonnes (39 600 lb)
  - FOB = 3 tonnes $\pm \frac{1}{100}$ (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 × (± 1.5 %) = 15 t ± 225 kg

    (FU = 33000 lb × (± 1.5 %) = 33000 ± 495 lb)

In this example, when FOB is less than 3 tonnes (6600 lb), FOB error may be assumed to be lower than FU error. Furthermore :

- If Block Fuel is confirmed as per a particular calibration curve :
  - When FOB > 3 tonnes (6600 lb) :
    Use FU parameter to determine both FOB and FU
  - When FOB < 3 tonnes (6600 lb) :
    Use FOB parameter to determine both FOB and FU

OPERATIONAL CONSIDERATIONS

Some economic aspects relating to FQI accuracy are approached here and should be considered when operating an aircraft.

TECHNICAL DELAYS

Incorrect application of MMI check, may cause a possible delay.

Knowing the FQI calibration curve helps to understand and reduce discrepancies.

EXTRA FUEL LOADED

- Crews uplift more fuel than required for a particular flight, as a contingengy factor, when they are unsure of the FQI accuracy.
- An under-reading FQI leads also to carrying extra fuel.
- 1 extra tonne will increase fuel consumption up to 1.2 %, depending on airframe and flight conditions.

PAYLOAD PENALTY

Extra fuel loaded due to uncertainty of FQI may lead to decreasing the payload.

Payload = TOW + TAXI fuel – OEW – Fuel loaded
TOW = Take-Off Weight
OEW = Operating Empty Weight

We have seen, that adding 130 kg (286 lb) of fuel can allow the payload to be increased by 870 kg (1914 lb) on a 4 hours flight.

- When the payload is **limited by MTOW** as TOW cannot be increased, **any extra fuel** will **decrease** and replace payload by the **same amount.** Also, **any defueling will significantly decrease the payload.**
- When the payload is limited by the max fuel capacity :
  - if the FQI under-reads, the payload could be increased
  - if the FQI over-reads, the payload should be decreased

For example, an inaccuracy of ± 130 kg (286 lb) on fuel can affect the payload by ±870 kg (1914 lb).

Again, knowing your FQI calibration curve allows to adjust the payload.

Note : *Although not approved by DGAC/JAA as it is a non compliance item, using the 2 % thermal expansion volume as extra-fuel could be authorized by national airworthiness authorities to increase max fuel capacity.*
In this case the FQI reading is limited somewhere above high level until fuel quantity falls below this value.

CONCLUSION

Airbus Industrie has always improved FQI systems, because it is essential for crews to have a reliable and accurate fuel quantity indication system.

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

It is important on certain flights with certain aircraft fitted with a FQI system presenting large over-/underreadings, to know the particular FQI ground calibration curve.
Crews should know this curve and FQI tolerances in order to :

- understand and reduce FQI discrepancies
- avoid delays
- save fuel
- adjust the payload.

FQI calibration should be done when deemed necessary by each operator as this will be profitable for both operational and economic aspects.

A318/A319/A320/A321 FCOM BULLETIN

N° 809/1

DATE : JUN 04

File in FCOM BULL Section

ISS.A

SUBJECT : ELECTRONIC INTERFERENCE FROM PORTABLE EQUIPMENT CARRIED ON BY PASSENGERS

- Airlines often wonder whether they should allow passengers to operate electronic devices in the cabin without any limit.

  Federal Aviation Regulation (FAR) section 91.19 allows passengers to operate :

  " – Portable voice recorders
  – Hearing aids
  – Heart pacemakers
  – Electric shavers
  – Any other portable electronic device that the operator of the aircraft has determined will not cause interference with the navigation or communication system of the aircraft on which it is to be used."

  It is obvious that the myriad portable devices that now exists or that may be available in the future cannot be tested.

- As far as aircraft specific electrical flight controls and engine control computers on Airbus aircraft are concerned, there is no chance of their operation being affected by passenger-operated electronic devices, due to the high level of protection applied to these systems.

- Nevertheless, this question arises for navigation and communication receivers and is applicable to any aircraft.
  A study has been conducted by an RTCA (Radio Technical Commission for Aeronautics) special commitee.

- The conclusion is that the probability of a passenger-operated device interfering with the ILS localizer during a typical flight is about one in a million.
  Airbus Industrie recommendations is that no portable device should be used during take-off and landing.

- Concerning radio phones Airbus Industrie recommends to prohibit the use of those devices.

N° 810/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

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.

N° 811/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

SUBJECT : AVOID DISORDER IN THE COCKPIT

REASON FOR ISSUE

The purpose of this FCOM Bulletin topic is to remind pilots of the importance of maintaining an orderly cockpit environment and highlight the hazards caused by misplaced objects.

BACKGROUND INFORMATION

Many hazards are caused by placing objects in improper places in the cockpit. The most common being the following.

- Coffee cups placed on the glareshield or pedestal, unexpected turbulence or unintentional knocking by the crew may cause fluid to be spilled onto the cockpit control panels causing damage to the equipment which may have an immediate effect on the flight or at best lead to an early and expensive overhaul of the equipment.
- Books placed on the glareshield. These may fall off and operate some switches/ pushbuttons or even damage equipment.
- Books placed on the pedestal. These may cause switches or pushbuttons to be activated, especially if they have to be pushed around while operating other controls.
  At worst the rudder trim might be activated or even a fuel lever pushed off, at best a radio selection could be deselected.

RECOMMENDATIONS

It is highly recommended that all objects are placed and stored at their designated place in the cockpit.
Cups should be placed in the cupholders provided.
Books should be kept in the library space provided and put back as soon as you have finished using them.
A rubbish sack should be provided behind the crew seating and used for all rubbish.
Meal trays should be collected by flight attendants as soon as possible, or be placed on the floor behind the crew when finished.

A318/A319/A320/A321 FCOM BULLETIN

N° 812/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

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

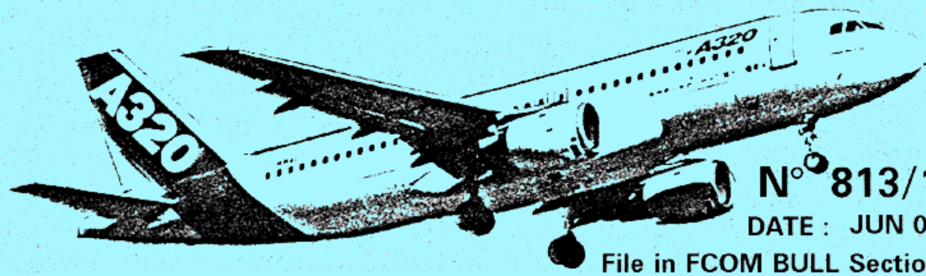
Very few cases of spurious radio altimeter indications have been reported to Airbus. Radio altimeter sensitivity issues have been tuned to the limits of improvement. There is no practical solution to cure the phenomenon without reducing system performance to an unsatisfactory level. Crews need to be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



N° 813/1
DATE : JUN 04
File in FCOM BULL Section
ISS.A

SUBJECT : FMGS NAVIGATION DATA BASE

REASON FOR ISSUE AND SCOPE

The aim of this FCOM Bulletin is to highlight the importance of the Navigation Data Base accuracy and therefore the importance of its update and its correctness.
As any NAV data base discrepancy or false coding may induce navigation errors and lateral or vertical misguidances, this FCOM Bulletin provides flight crews with operational recommendations.

INCORRECT NAV DATA BASE CASES

NAVIGATION DATA BASE DISCREPANCIES

- Numerous in service events have been reported during the last few years, which are caused by 3 different types of Navigation Data Base discrepancies :
  - Nav data base not updated on time,
  - Incorrect coding or impossibility of coding of published procedures.
  - Coding errors.

NAV DATA BASE NOT UPDATED ON TIME

When a Nav Data Base is not updated on time, this may lead to incorrect position or misguidance :

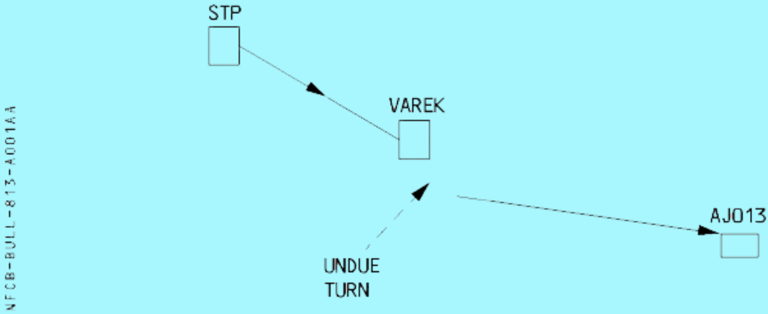
– 1st example
STAR MEN2 (LFBO) was modified but not incorporated in the Nav D.B. As a result the STAR displayed on the ND was not the published one.

– 2nd example
TRANS between STAR VAREK and NDB03 was not coded at Ajaccio (LFKJ). Misguidance was the consequence.

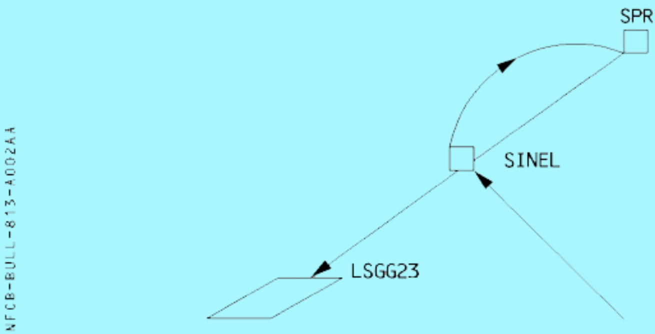
NAV DATA BASE INCORRECT CODING

Incorrect coding in the NAV D.B. induces misguidance in SID or STAR :

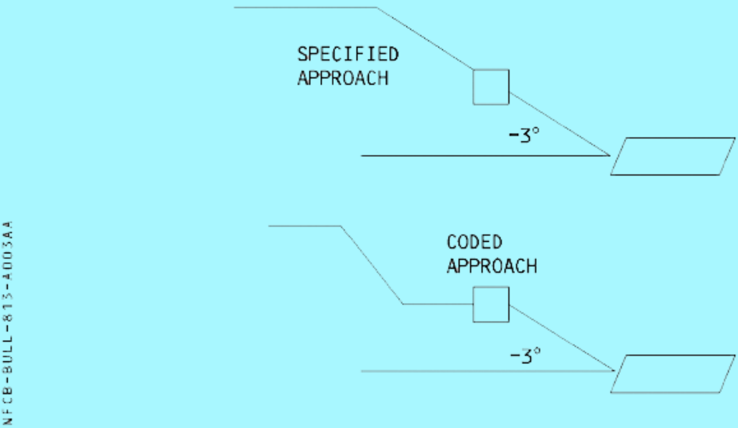
- 1st example
  STAR VAREK at Ajaccio (LFKJ).
  The leg STP-VAREK was coded as a TF (track to fix) and the following leg was coded as a CF (course to fix). Due to the imprecision of the magnetic variation in the area, both legs were not lined up and the a/c had to turn, after VAREK WPT, to capture the next leg.



- 2nd example
  STAR PERIK 1 and GORON 1 AT Genova (LSGG).
  These STARs end at WPT SINEL located in the middle of the APPR 23.
  This creates a F-PLN discontinuity and the procedure is not flyable. The Nav D.B. error is linked to both coding and procedure concept.



– 3rd example
On several non precision approaches, the final descent angle is coded for the last leg only instead of the last 2 legs. Again this creates a level off segment which does not exist.



CODING ERRORS

Coding errors generally have very similar effects on the FMGS system and may induce position errors as well as misguidance.

– 1st example
Erroneous position of runway threshold at LFMT RWY 32R inducing a lateral offset during non precision approach

– 2nd example
ILS/DME coded as an ILS only preventing autotuning of the DME in approach (IWW and IGG at EGKK).

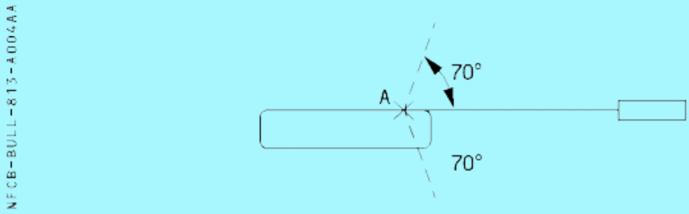
PROBLEMS LINKED TO ARINC 424 SPECIFICATION

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

For example :
No specific field reserved for THR RED/ACC ALT. As a result, it is not possible to link such information to a company route (e.g noise abatement). Defaulted value is provided instead.

SYSTEMATIC CODING OF HF LEG IN PROCEDURES

When a Final Approach procedure displays a Holding Pattern, this pattern is systematically coded in the APPR VIA or STAR as an HF leg ; this means that this holding is always taken into account in the F-PLN, assuming one turn ; in certain cases, this is realistic but in most circumstances, it is not.



If the HF leg is of no use, it corrupts all predictions and performance computations. Furthermore if a holding pattern is ATC required, by then the crew has all means to insert it into the F-PLN, and be then provided with realistic estimates.

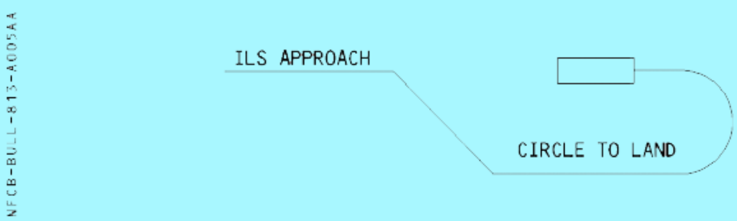
As a consequence, realistic coding of procedure turns should be requested.

CIRCLE TO LAND

At many airports approaches are defined only in one direction ; while the landing runway may be in the other direction.

If the weather is poor, a defined instrument approach is carried out down to circle to land MDA, and then a circle to land trajectory is flown.

Circle to Land feature is not part of current ARINC specification ; this forces the crews to improvise in order to get a realistic trajectory on the ND, and to get proper predictions on CDU.



RECOMMENDATIONS

In order to control and correct NAVIGATION Data Base all pilots are encouraged to report to their flight operations any misbehaviour which may have been induced by an incorrect data base.

This can be done during normal operations :

* during preflight by checking the consistency of the MCDU F-PLN versus ATC F-PLN. Refer to current FCOM ;
* in flight by performing the navigation accuracy assessment on a regular basis as described in the FCOM procedures and techniques chapter, or VOL 4.

CONCLUSION

Tomorrow, the increasing number of RNAV approaches will require faultless Nav Data Base procedures since it will not always be possible to monitor the guidance by using raw data.

On a short term basis, the Nav Data Base improvement is a matter of step by step error detection which mainly requires pilot attention during preflight and in flight.

On a longer term basis, the Nav Data Base improvement requires decisions and actions of concerned agencies/ authorities and Nav Data Base manufacturers.

It has to be reminded that the aircraft constructor has no control over the data base used by each operator.

A318/A319/A320/A321 FCOM BULLETIN

N° 814/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

SUBJECT : SPECIFIC FEATURES OF THE FMGS FULL STANDARD

Note : This FCOM bulletin is only valid for aircraft equipped with FMGS full standard.

The FMGS full standard was introduced in 1992. During the first months of service, questions have been raised on particularities of the system.

1. ALTITUDE PREDICTIONS NOT ACCURATE ON GROUND

Predicted altitudes indicated on the F-PLN A page are not accurate until take off ; an error of a few hundred feet may be noticed on predicted altitudes at all waypoints until lift off.

Explanation

The predictions are computed using simplified model for the take off run. This causes a minor error on the altitude predictions. Predictions are continuously updated during the take off roll and once airborne, they are accurate.

2. SPURIOUS "FMS1/FMS2 SPD TGT DIFF" MSG

When changing of CRZ FL using the FCU altitude knob, the message "FMS1/FMS2 SPD TGT DIFF" may come up.

Explanation

The new FCU altitude is sent by the master FMGC to the slave, therefore predictions are not computed at the same time on both FMGCs ; a speed target difference may occur during a very short period, triggering the message.

Procedure

Disregard the message.

3. "IRS ONLY NAVIGATION" MSG TRIGGERED AT DESCENT PHASE SWITCHING

When the A/C is in IRS ONLY NAV mode, the message "IRS ONLY NAVIGATION" is triggered when the a/c starts the descent.

Explanation

The system logic is triggered when the FMGS navigation mode has been in inertial only for more than 10 minutes in cruise or when the a/c is transitionning to descent phase without radio updating.
If the FMGS is in IRS only navigation mode at descent phase switching, the message is immediately triggered, reminding the crew that the A/C is operating without radio position.

Procedure

Perform a NAV ACCY CHECK.

4. VERTICAL DEVIATION DIFFERENT ON BOTH SIDES

In descent or approach the vertical deviation (V DEV) indicated on the PFD and PROG page may differ on side 1 and 2.

Explanation

The vertical deviation (V DEV) is computed independently on side 1 and 2 ; if FM 1/2 position ground speed or other data used for V DEV computation differ slightly from side 1 and 2, a small difference of V DEV will be observed during descent and/or approach.

5. INCREASE OF VERTICAL SPEED IN DES MODE

The vertical speed may increase noticeably for a short period of time during descent with DES mode engaged. The V/S regains the normal value when intercepting the path.

Explanation

When the A/C is above path and an increase of speed target is required manually or automatically, the V/S will increase temporarily until the vertical profile is intercepted.

6. VLS COMPUTATION

6.1 The VLS computed by the FMGS uses the same algorithm and performance table as the FAC. Nevertheless some differences may be observed due to the fact that the FAC computes the VLS from flight parameters and the precision of the computation provides an accuracy of ± 3 kt (PFD VLS).

6.2 In CONF3, the performance table used to compute the VLS assumes the gear up although the table provided in the QRH and VOL2 assume gear down. A VLS difference of 2 kt can be observed between performance table and FAC/FMGS in CONF3.

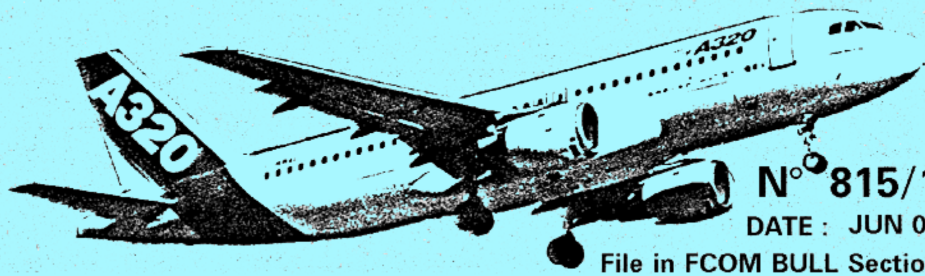
7. A/C POSITION INVALID

When a fast realignment is performed, the message A/C POSITION INVALID is triggered. The message disappears when the realignment is completed.

Explanation

During an IRS alignment, the ADIRS send no data to the FMGS and the FMGS cannot process any position.

The POS MONITOR page is empty and the msg "A/C POSITION INVALID" is automatically triggered. Once the IRS are realigned, the ADIRS provide data to the FM and a mix IRS position is recomputed ; the message disappears.



N° 815/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

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.

N° 816/1

DATE : JUN 04

File in FCOM BULL Section

ISS.A

SUBJECT : VMO / MMO DETERMINATION

GENERAL

VMO / MMO determination

VMO (the design cruising speed) is the maximum operating speed that the crew may fly within the normal flight envelope. It is not authorized to fly intentionnally above this limit.

VD is the design dive speed. VMO and VD must comply with load requirements (gust loads, manoeuvering loads). For example, the aircraft must be able to sustain a load factor of 2.5 up to VD. The range between VMO/VD considers normal reaction time to the crew to use standard recovery techniques for returning the aircraft to normal attitude at a speed of VMO/MMO.

The A319/A320/A321 are protected by the High Speed Protection law which automatically makes the recovery if VMO is exceeded (between VMO and VMO + 6) as shown in the following table.

HIGH SPEED / MACH TABLE

MD = .89	VD = 381 kt	VD = VMO + 31kt
MMO + 0.04	VMO + 20 kt	Structural inspection required. (AMM. 05.51.17)
MMO + 0.01	VMO + 6 kt	Upper limit for entry into HSP
MMO + 0.006	VMO + 4 kt	Overspeed warning
MMO = .82	VMO = 350 kt	Max operating SPEED/MACH and lower limit for entry into HSP
MMO – 0.006	VMO – 3 kt	Max upper speed range in DES mode.
MMO – 0.02	VMO – 10 kt	Managed speed target limit (ECON mode)

Depending upon the speed trend, the autopilot will disconnect at or below VMO + 6 kt / MMO + 0.01 and an automatic pitching up will allow VMO to be regained.

Per design, in DES mode or OP DES mode, autopilot authority is limited to 0.1 g compared to 0.15 g in EXPEDITE. This limitation was required by the launching customers for passenger's comfort.
Due to the load factor limitation, some flight paths or environment conditions depending on their magnitude, may not be counteracted by the autopilot leading to VMO / MMO overshoot.

A short exceedance of few knots above VMO has no consequences on the aircraft.
Nevertheless, an intentional exceedance is not authorized :

- by regulation.
- Because above VMO / MMO the HSP (high speed protection) may be activated automatically. Any pilot input to recover the target speed may be added to the HSP order, leading to a load factor incompatible with passenger's comfort.

For this reason, it is recommended to be smooth on the stick when manually recovering from a VMO / MMO exceedance. In order to prevent this exceedance during descent, a procedure has been described in FCOM 4.05.60.

A318/A319/A320/A321 FCOM BULLETIN

N° 817/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

SUBJECT : OPERATION OF FLEETS WITH/WITHOUT CPIP

INTRODUCTION

In order to continuously improve the man/machine interface, Airbus developed continuous product improvement programmes (CPIP), the modifications of which are available for retrofit and are commonly introduced on all new A320/A321 and on A319.
This FCOM bulletin details the differences which crews should be aware of.

DEFINITION

Basic aircraft :
The A320 equipped with full standard FMGS without CPIP (continuous production improvement programme) nor ENERGY MANAGEMENT.

Advanced standard :

The A319/A320/A321 with CPIP 1+2+3, LOW ENERGY warning and ENERGY MANAGEMENT. This standard is basic on the A319/A321 and A320 in current production and can be retrofitted to all A320.

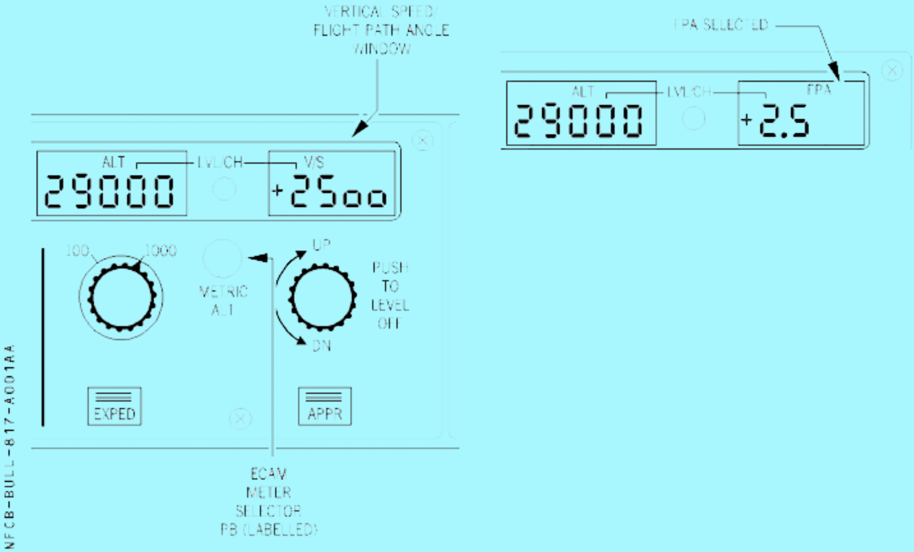
MODIFICATION DESCRIPTION

CPIP1 (FCU MODIFICATION)

- Altitude selection change inhibited during push/pull action. This modification prevents any change of altitude during mode engagement.
- HDG and V/S preselection time increased from 10 to 45 seconds.
- V/S/FPA click differentiation for rapid selection :
  1 click = 1° FPA
  2 clicks = 100 ft/min V/S

CPIP2 (FCU MODIFICATION)

- V/S/FPA "push to level off" function.
  When pushing the V/S/FPA selector knob, V/S/FPA target is set to zero.
- 4 digits for V/S target.
  The V/S and FPA target are displayed in the window as followed :
  V/S : 4 digits
  FPA : 2 digits
- HDG/TRK target is synchronized when switching from HDG to TRK or vice versa.
- SPD/MACH, HDG/TRK, METRIC ALT switching pushbuttons are labelled.



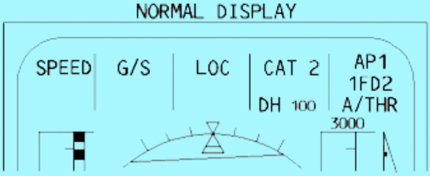
LOW ENERGY WARNING (FAC and FWC modification)

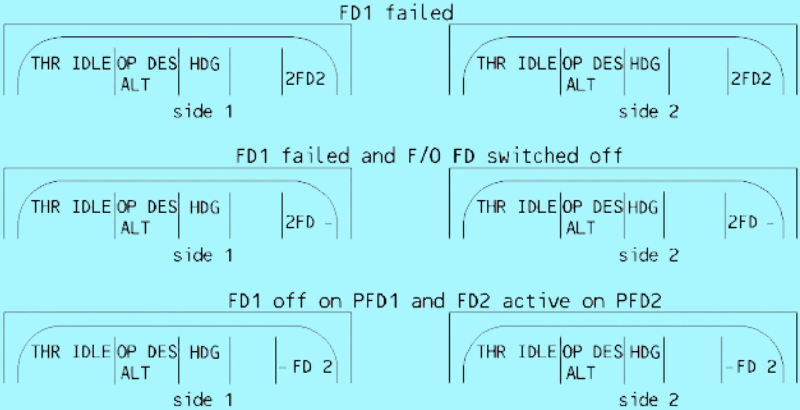
The low energy warning consists of an aural warning "speed speed speed" triggered every 5 seconds. This warning is available when conf ⩾ 2 and 100 ft < RA < 2000 ft ; it indicates that the energy level is not sufficient to recover to a positive flight path angle with only pitch command. The thrust must be increased. This warning is generated before the alpha floor is triggered.

CPIP3 : FMA IMPROVEMENTS (DMC AND FWC MODIFICATION)

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

NORMAL DISPLAY





NFCB-BULL-817-A002AA

– 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

NFCB-BULL-817-A003AA

- All AP/FD modes are displayed as abbreviations (no dashes) : (e.g. NAV, ALT CRZ, ALT CSTR).
- V/S or FPA target are displayed in the FMA : e.g. V/S:+0800
- Message and msg colours are changed as follows :
  "MORE DRAG" white message instead of "AIRBRAKES"
  "CHECK APP SEL" white message instead of "CHECK APP GUIDANCE"
  "SET MANAGED SPD" white message instead of "SET AUTO SPEED"
  "SET GREEN DOT SPD" white message instead of "SET VFTO"

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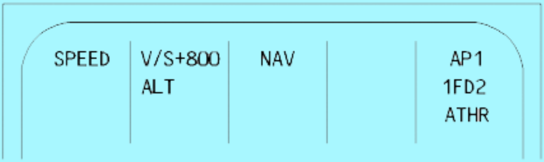


ENERGY MANAGEMENT IMPROVEMENT

(FAC, FWC, DMC, FADEC modification)

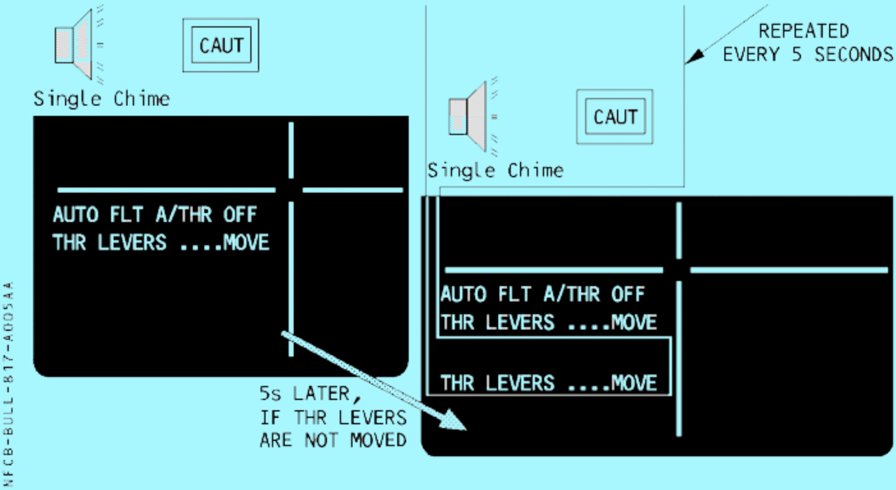
The ENERGY MANAGEMENT package is related to A/THR logic modification and additional ECAM announcements. The package eases the normal procedure of A/THR disconnection and improves the crew information on the current thrust setting.

A/THR disconnection using the instinctive disconnect pushbutton

When the instinctive disconnect pushbutton is depressed :

* Thrust is immediately set to the thrust corresponding to the thrust lever position. (Thrust lock no longer effective).
* A gong sounds and the master CAUTION light illuminates for 3 seconds.
* AUTO FLT A/THR OFF is displayed on the ECAM for 9 seconds maximum.

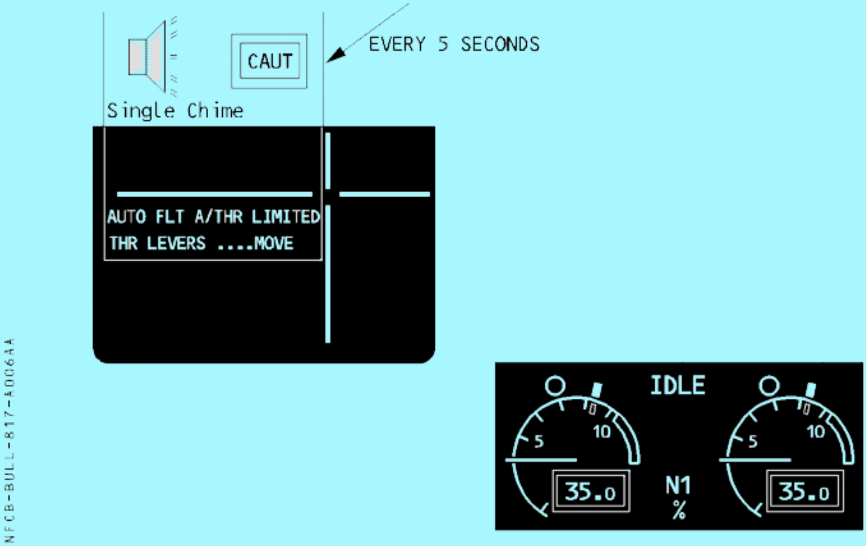
A/THR disconnection due to a failure or an action on the ATHR FCU P/B when illuminated green :



- THRUST LOCK is active until the thrust levers are moved out of corresponding detent (or alpha floor activates).
- Annunciation is enhanced as follows :
  - * Repetitive gong and master CAUTION light
  - * THR LK amber displayed on both PFDs
  - * AUTO FLT A/THR OFF displayed on ECAM
  - * Blue "THR LEVERS.....MOVE displayed on ECAM
  - * With a five second delay, flashing "ENG THRUST LOCKED"

Thrust levers set below CL detent :

* Repetitive gong and master CAUTION light
* "AUTO FLT A/THR LIMITED" and "THR LEVER...MOVE" displayed on ECAM.
* LVR CLB displayed on FMA



IDLE announcement on ECAM.

When thrust is set automatically or manually at IDLE thrust, IDLE legend flashes green for 10 seconds then steady on ECAM EWD (adjacent to N1/EPR scale).

OPERATIONAL CONSIDERATIONS

- **FCU Modification (CPIP1 and CPIP2)**

The introduction of FCU modifications does not significantly modify the published procedures :

- V/S push to level off function
  V/S = 0.0 selection may still apply ; the "push to level off" function is a easier action. In both cases, the crew must crosscheck with FMA.
- Different digits for V/S and FPA
  The procedure which consists of crosschecking (and announcing) V/S or FPA value obtained on PFD remains mandatory.
- Synchronisation of HDG/TRK target
  This allows the switching from HDG to TRK or vice versa with bank angle.
  Airbus still recommends the switching with wings level.

LOW ENERGY WARNING

This feature provides an advanced warning to the crew before alpha floor is triggered. Standard procedures are unchanged and flight envelope remains the same.
Alpha floor and alpha protection are identical.

CPIP3

The announciations of the FMA are self explanatory. The procedure remains the same :

- Any mode change is to be checked and announced.
- When a new target is selected and activated through the FCU, the resulting guidance has to be checked on the PFD.

ENERGY MANAGEMENT

The main feature of the ENERGY management is the suppression of the thrust lock when the A/THR instinctive disconnect pushbutton is used.

The A/THR disconnection technique remains unchanged (described in Vol 3 Suppl Techniques 3-04-70), and may be summarized as follows :

- When A/THR is to be disconnected :
  - * Move the thrust levers out of the applicable detent, to the current or desired thrust level
  - * Depress the instinctive disconnected pb.

The new ECAM features facilitate the crew action but do not modify the procedures.

N° 819/1

DATE : JUN 04

File in FCOM BULL Section

ISS.A

SUBJECT : CHARACTERISTIC AND PROTECTION SPEEDS

INTRODUCTION

The different speeds displayed to the crew on the main cockpit interfaces : PFD, MCDU, ND are computed by the FACs, the FMGCs and the ADIRS.

PFD	MCDU PERF PAGE
FAC COMPUTATION Computed on current aircraft status and configuration.	FMGC COMPUTATION Computed for take off, go around and landing.
VLS F S "O" Green Dot Vαprot Vαmax Vsw (stall warning speed)	VLS of the selected landing configuration. F S "O" Green Dot

Each FAC computes its own speeds which are displayed on the relevant PFD.

FAC 1 on side 1
FAC 2 on side 2

Each FMGC computes its own speeds displayed on the relevant MCDU :

FMGC 1 on side 1
FMGC 2 on side 2

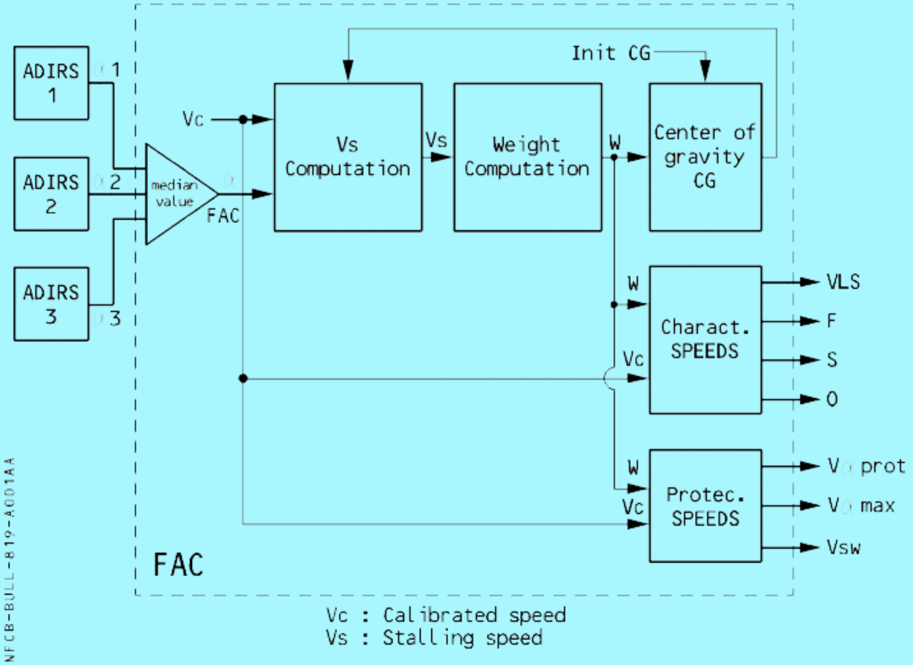
The algorithms used to compute the characteristic speeds are the same in both FAC and FMGC but as the inputs are different, the resulting values may differ.

CHARACTERISTICS SPEEDS COMPUTED BY THE FAC

The FAC computes its characteristic speeds with 2 main inputs from ADIRS (Angle of Attack (α) and calibrated airspeed (Vc)). It also uses THS position, SFCC data and FADEC data.

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

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

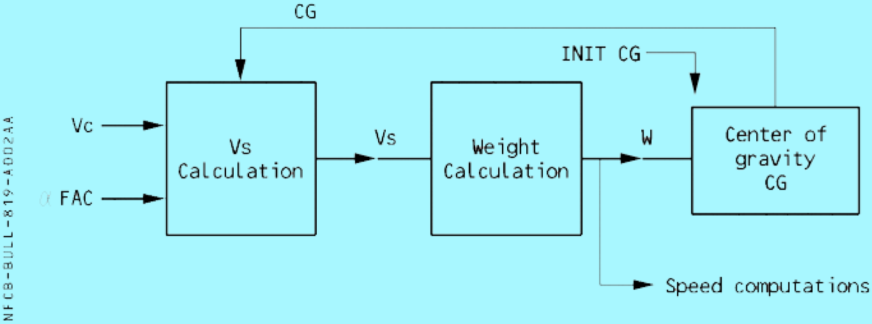


AOA DETERMINATION

The angle of attack value used to compute the characteristic speeds is the mean value of the 3 AOAs (Vote).

Accuracy of the AOAs is a paramount factor in the weight calculation.
0.3 degree of error in the AOA results in a 3 ton error in weight.

WEIGHT COMPUTATION



The weight is computed provided the following conditions are met.

- Aircraft altitude below 14600 ft and speed (Vc) below 240 kt
- Bank angle less than 5°
- Speedbrakes retracted
- No dynamic maneuver (vertical load factor lower than 1.07 g)
- No change of aircraft configuration and not in conf full.

When one of these conditions is not met, the last calculated weight value is considered and updated for the fuel consumption based on actual engine N1.

CHARACTERISTIC SPEEDS COMPUTATION

A320

VLS is computed from Weight and Vc and corrected for the current CG.

- If the current CG is forward of 15 %, 15 % CG is used to compute the speeds.
- If the current CG is between 15 % and 25 %, the speeds are computed using an interpolation between 15 % and 25 % CG.
- If the current CG is aft of 25 %, 25 % CG is used for speed computation.
  F, S, and Green dot are independent of CG.

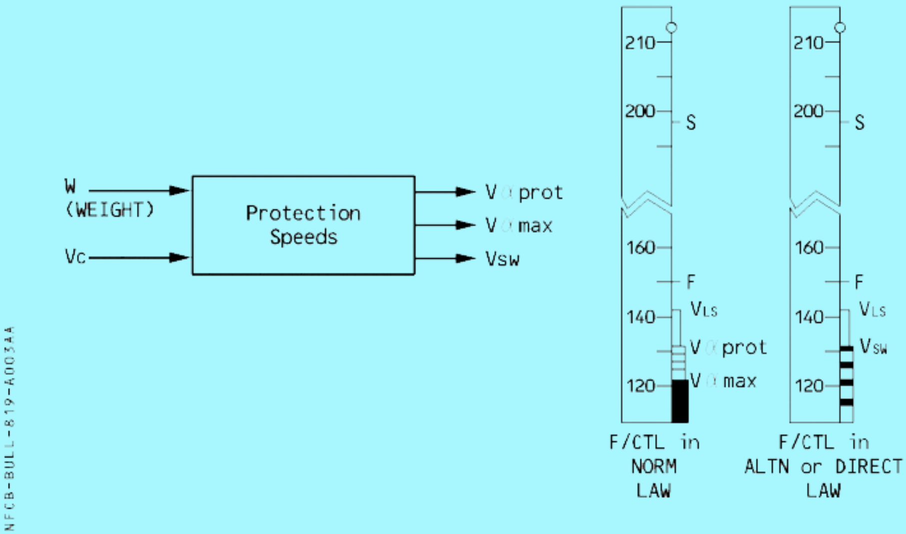
VLS, F, S and Green Dot are computed for a forward CG. No CG correction is applied for A319/A320 VLS as it has a negligible effect.

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.



TOLERANCE OF FAC COMPUTED SPEEDS

Due to the data accuracy used to compute the characteristic speeds, and specifically the AOA accuracy, the precision of the computation is specified to be within 2.5 %.

During acceptance flight, the tolerances are as following :

Clean aircraft	Green Dot	± 5 kt
	VLS	± 4 kt
	Vαprot	± 5 kt
	Vαmax	± 5 kt
Conf full	VLS	± 3 kt
	Vαprot	± 5 kt
	Vαmax	± 5 kt

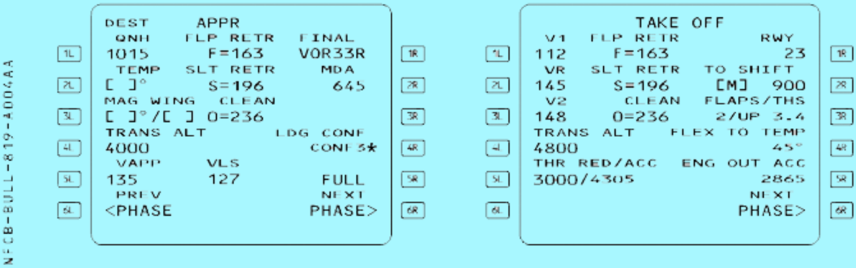
CHARACTERISTICS SPEEDS COMPUTED BY THE FMGC

Characteristic speeds computed by the FMGC are based on a predicted GW, CG (and selected configuration for landing) at a given time at landing for example.

GW and CG values are computed from entered ZFW and ZFWCG corrected for the predicted FOB and CG variation.

When the Approach phase is activated, the characteristic speeds are recomputed using the actual weight and CG.

The performance model used to compute the characteristic speeds, is accurate enough to provide speed errors of less than ± 2 kt from the certified speeds.



THE MOST FREQUENT QUESTIONS ON SPEED COMPUTATION

– **Why are the characteristic speeds computed by the FAC subject to inaccuracy greater than FMGC computation ?**

Answer :

The precision of the AOA measurement is usually the cause of speed differences.
An error of 0.3 ° in AOA measurement causes a weight inaccuracy close to 3 tons.

– **Is the FMGC computation more accurate than the FAC computation ?**

Answer :

Algorithms are the same but the initial data are different.
The FAC computes current dynamic speeds.
The FMGS computes characteristic speeds for given phases (and configuration for landing).
Usually, the FMGC characteristic speeds for landing are more accurate due to the tolerance of FAC inputs, if the ZFW was correct initially.

Note : To determine the GW at landing, the FMGC uses the ZFW entered by the crew and adds the fuel on board.

A significant difference between PFD and MCDU characteristic speeds may also indicate an error in the ZFW as entered by the crew.

– **Why are there two characteristic speed calculations ?**

Answer :

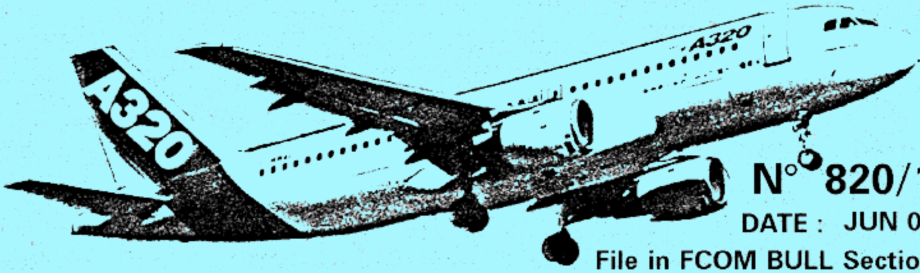
- The computation done by the FAC is independent of any manually entered data and provides permanent speed values displayed on the PFD.
- During approach, the comparison of characteristic speeds allows the crew to detect any speed discrepancy which may affect approach and final phases ;

– **When a difference exists between computed speeds from FAC and FMGC, what are the best speeds to be relied on ?**

Answer :

Whenever differences are observed, Airbus recommends to rely on QRH values.
Refer to FCOM 4.06.20 p 7.

A318/A319/A320/A321 FCOM BULLETIN



N° 820/1
DATE : JUN 04
File in FCOM BULL Section
ISS.A

SUBJECT : GROUND SPEED MINI FUNCTION

GENERAL

When an approach is flown in managed speed mode, the crew will notice that the target speed (magenta) displayed on the PFD, is variable during the approach.
This approach target speed, also called IAS target, is computed in the FMGS using the "ground speed mini function".

The purpose of the Ground speed mini function is to take advantage of the aircraft inertia, when the wind conditions vary during the approach. The aircraft flies a target speed during the approach and the energy of the aircraft is maintained above a minimum level ensuring standard aerodynamic margins over stall.

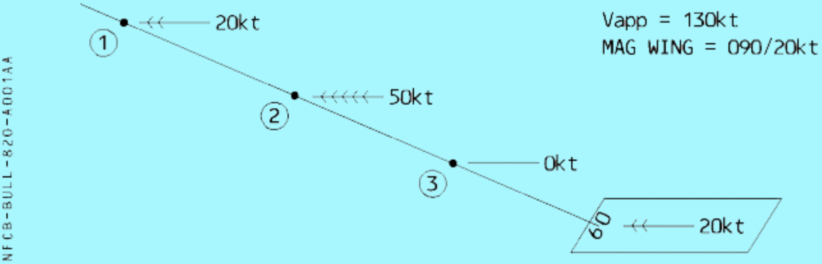
If the A/THR is active in SPEED mode, it will automatically follow the IAS target, ensuring efficient thrust management during the approach.

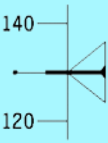
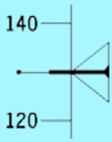
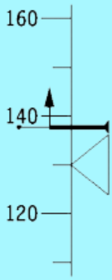
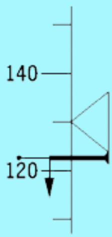
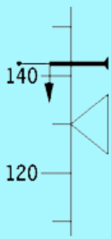
PRINCIPLE

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

During the approach, the FMGS continuously computes the IAS target to keep the ground speed at or above the "Ground Speed Mini", based upon the actual winds.
This IAS target is limited to VAPP
The IAS target is displayed on the PFD speed scale in magenta, when approach phase and managed speed are active. It is independent of the AP/FD and/or the A/THR engagements.

The following examples provide a comparison between the ground speed mini function versus the conventional selected speed hold function, in terms of speed target, and thrust management during an approach where winds are varying.



Conventional selected speed hold function	GS mini function
(1) Headwind 20 kt  N1 = 55% Speed Target 130 kt	**(1) Headwind 20 kt**  N1 = 55% IAS target 130 kt
(2) Headwind increases to 50 kt  * Current speed increases * Speed Trend is going up. * Thrust will be reduced to IDLE in order to match the speed target which remains unchanged.	**(2) Headwind increases to 50 kt**  * IAS target and current speed increases. * Speed trend is going up. * Thrust will be increased
(3) Headwind decreases to 0 kt  * Current Speed drops down * Speed Trend goes down. * Thrust is initially low and can be close to IDLE. ===> A/C energy is low. Thrust has to be significantly increased.	**(3) Headwind decreases to 0 kt**  * Current speed drops down from a higher speed. * Target speed drops down to VAPP * Speed trend goes down. * Thrust is initially high. ===> A/C energy is high. Thrust has to be smoothly reduced.

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

BASIC COMPUTATION

Wind is a key factor in the ground speed mini function.

TOWER WIND

It is the MAG WIND entered in the PERF approach page. It is the average wind as provided by the ATIS or the tower. Gusts are not inserted ; they are taken into account during ground speed mini computation.

TOWER HEADWIND COMPONENT

Component of the MAG WIND relative to the FMS runway axis.
The FMS Runway axis is the landing runway axis entered in the F-PLN and indicated on the PERF APPR page.

CURRENT WIND COMPONENT

Component of the actual wind measured by ADIRS, relative to the aircraft axis.

The three following formulae explain how the approach speed target (IAS target) is computed using the ground speed mini function. Note that this computation is different for the A320 and the A319, A321 or A320 with the modification which reduces VAPP (mod 25225).

VAPP COMPUTATION

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

Wind correction limit : mini 0 kt, maxi 15 kt

VAPP may be changed manually by the crew if desired.

The 5 knots increment to VLS is an Airworthiness requirement when autoland is used. (CAT2 – CAT3)

Tower headwind component is counted positively.

In case of a tower tailwind, the wind correction is zero and VAPP = VLS + 5.

GROUND SPEED MINI COMPUTATION

The ground speed mini value is not displayed to the crew, but it is of interest to understand its principle.

GS mini = VAPP – TWR HEADWIND COMPONENT

- The TWR HEADWIND COMPONENT is counted positively.
- Its minimum value is 10 knots
- If the TWR HEADWIND COMPONENT is below 10 knots or if there is a TWR TAILWIND COMPONENT, GS mini = VAPP –10

APPROACH SPEED TARGET COMPUTATION (IAS target)

Approach speed target, also called IAS target is computed as the higher of :

- VAPP
- GS mini plus current wind component

IAS target = MAX(VAPP, GS mini + CURRENT WIND COMPONENT)

CURRENT HEADWIND COMPONENT is counted positively. CURRENT TAILWIND COMPONENT is counted negatively.
No max value limitation exists.

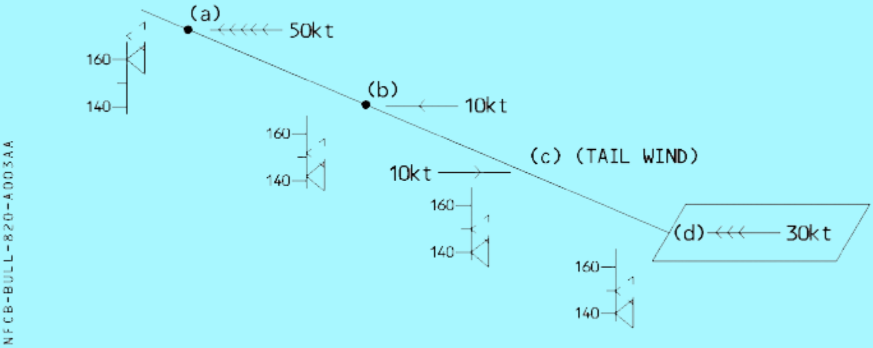
EXAMPLES

NORMAL APPROACH

- Approach on Runway 09 - FMS Runway 09
- TWR wind on PERF APPR page : 090/30
- VLS = 130 kt

COMPUTATION	A320 (basic configuration)	A320 (with Mod 25225) A319 – A321
VAPP	VAPP = 130 + 5 + $\frac{1}{3}$ of 30 = 145 kt	VAPP = 130 + MAX (5, $\frac{1}{3}$ of 30) = 140 kt
GS Mini	GS Mini = 145 – 30 = 115 kt	GS Mini = 140 – 30 = 110 kt

Current wind in Approach	IAS target (◁) A320 (basic configuration)	IAS target (◁) A320 (with Mod 25225) A319, A321
(a) 090/50	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

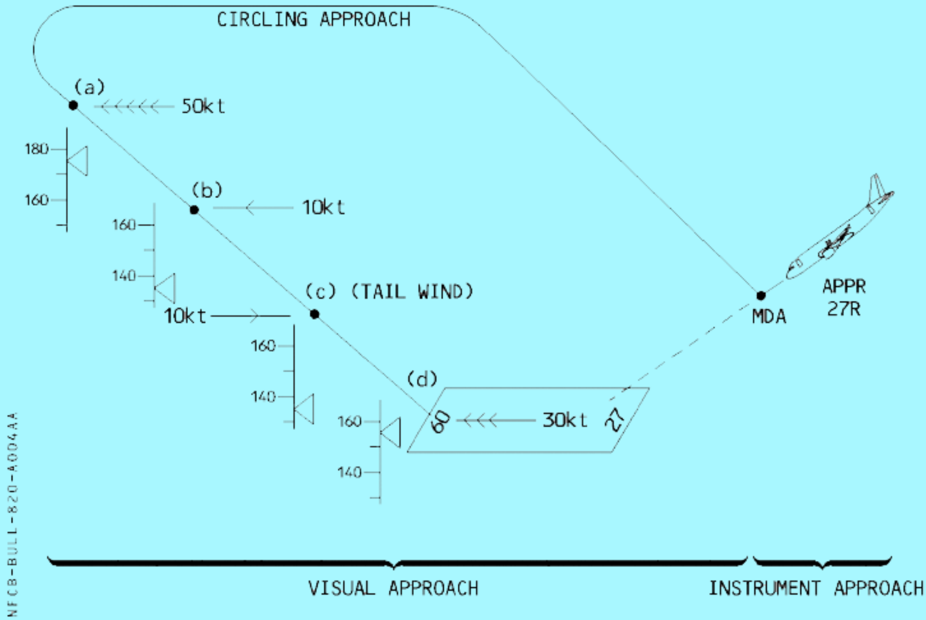
Winds a) 090/50 kt
b) 090/10 kt
c) 270/10 kt
d) 090/30 kt (TWR wind on PERF APPR)
VLS = 130 kt

The 3 formulae give the following results :

1. VAPP = 130 + 5 + Zero* = 135 kt for A320 basic configuration
= 130 + MAX (5kt, Zero*) = 135 kt for A320 with Mod 25225, A319, A321
* wind is considered as tail wind because RWY 27 is selected in the F-PLN.

2. GS Mini = 135 – 10 = 125 kt (10 kt default wind value)

3. IAS target = MAX (135, 125 + current headwind component).



The IAS target is function of the runway which is selected in the active flight plan.

Let us consider that the aircraft is actually on Final Approach onto Runway 09, the approach target speed in final will vary as follows in case Runway 27 or Runway 09 are inserted in the FMS F-PLN :

	A320 (basic configuration)	A320 (Mod 25225) A319, A321
Runway 27 selected in the F-PLN	Runway 09 selected in the F-PLN	Runway 09 selected in the F-PLN
VAPP = 135 kt GS MINI = 125 kt	VAPP = 145 kt GS MINI = 115 kt	VAPP = 140 kt GS Mini = 110 kt

SELECTED RUNWAY IN F-PLN	VAPP VALUE (PERF APPR PAGE)	GS MINI	ENCOUNTERED WINDS	IAS TARGET IN FINAL FOR RUWAY 09
(1) RUNWAY 09 A320	145 kt	115 kt	(a) 090/50 (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

N° 821/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

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.

N° 823/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

SUBJECT : PUBLICATION OF SOME ATTENDANT INFORMATION BULLETINS

EMERGENCY LIGHTING SYSTEM

REASON FOR ISSUE :

Some cases of exit signs not illuminating during takeoff, landing and on ground have been reported.
In normal operation with the "EMER EXIT LT" switch 4WL (25VU) in "ARM" position and the "NO SMOKING" switch 190RH (25VU) in auto position the exit signs extinguish only when the "NO SMOKING" signs extinguish at landing gear retraction and illuminate again at landing gear extention.

Investigation revealed that the emergency power supply unit could remain frozen after power transfer.

PROCEDURE :

During taxi and before landing check exit signs for proper illumination.
If one or more exit signs are not illuminated, perform a reset of the emergency power supply by :

I) From attendant panel
- Press the "EMERGENCY" push button 120RH once on flight attendant panel.
- Wait approximately 4 seconds
- Press the "EMERGENCY" push button 120RH again to recover normal configuration.

or

II) From the cockpit
- Select the "EMER EXIT LT" switch on panel 25VU to "ON" position
- Select the "EMER EXIT LT" switch to "ARM" position.

If normal operation is not recovered, maintenance action is due before the next flight unless the dispatch is authorized by the MEL.

DELIBERATE INHIBITION OF AMBIENT LAVATORY SMOKE DETECTORS

(A/C WITH MOD 22561)

EXPLANATION :

When the smoke detector grill is removed and foreing objects like tissue paper or plastic bags are packed around the detector (see graphic overleaf), the result will have a serious impact on the detection system. The detector may not be able to "sample" the air.

PROCEDURE :

The cabin crew is recomended to inspect the lavatory smoke detectors for tampering before every flight. If foreign bodies or sign of tampering are found, line maintenance should be informed.

VACUUM TOILET RINSE VALVE LEAKAGE (A/C WITH MOD 26145)

EXPLANATION

An increase in vacuum toilet rinse value leakage has been experienced. Leakage at the vacuum toilet rinse valve in the forward lavatory may lead to water flooding in the cockpit with possible water spillage in the avionic bay.

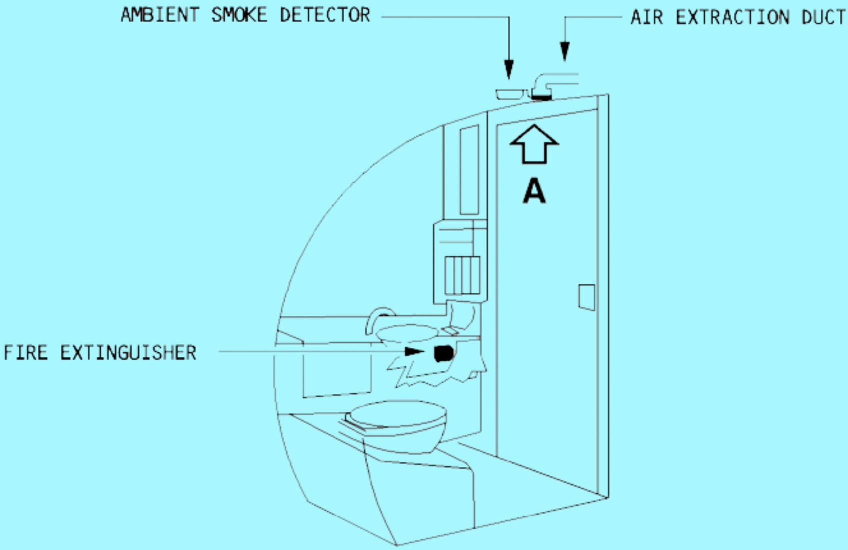
ACTION

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

PROCEDURE

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

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



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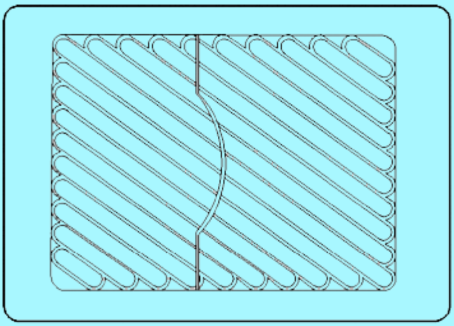
AIR INTAKE SCREEN (GRILL)



NFCB-BULL-823-AD01AA

This grill is a cover for the ambient smoke detector and the air extraction duct. The view shown is how the grill would appear when looked at from below.
This grill can be removed. Foreign objects (tissues, plastic bags) have been found packed around the ambient smoke detector.

A318/A319/A320/A321 FCOM BULLETIN

N° 824/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

SUBJECT : ERRONEOUS AIRSPEED/ALTITUDE INDICATIONS

BACKGROUND

Two recent fatal accidents on non-Airbus aircraft and several reported incidents attributed to unreliable speed and/or altitude indications have prompted the need to improve flight crew awareness to identify and tackle failures described in this bulletin.

Most failures modes of the airspeed/altitude system are detected by the ADIRS and lead to the loss of the corresponding cockpit indications and the triggering of the associated ECAM drills.

However, there may be some cases where the airspeed or altitude output is erroneous without being recognized as such by the ADIRS. In these cases the cockpit indications are apparently normal but false and pilots must rely on their basic flying skills to identify the faulty source and take the required corrective actions. When only one source provides erroneous data, the straightforward cross check of the parameters provided by the 3 ADR's allows the faulty system to be identified. This identification becomes more difficult in extreme situations when two, or even all three, sources provide erroneous infomation.

This FCOM Bulletin provides the following information :

1 – Recall of pitot/static system layout

2 – Situations which may lead to erroneous airspeed/altitude indications

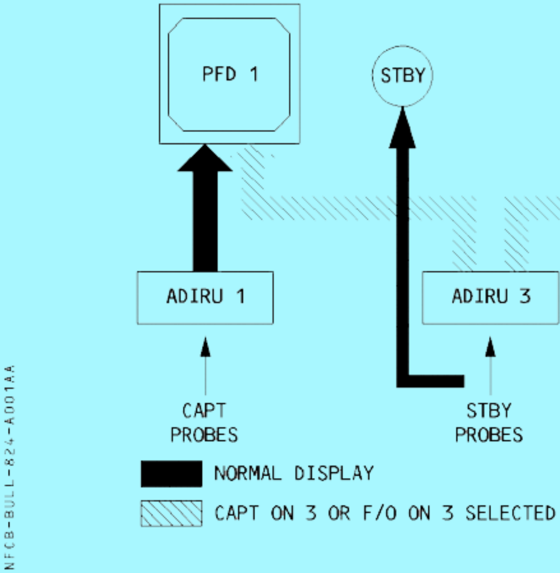
3 – Consequences of various failure cases

4 – Recall of AI recommended operational procedures

DISPLAY ARCHITECTURE

The CAPT side pitot and static probes supply the ADIRU 1 which is used, normally, for display on CAPT PFD.
The F/O side pitot and static probes supply the ADIRU 2 which is used, normally, for display on F/O PFD.

The STBY pitot and static probes supply the ADIRU 3, which can be used for display on either PFD in case of failure. They also supply directly the stand-by instruments.



MAIN REASONS FOR ERRONEOUS AIRSPEED-ALTITUDE DATA

The most probable reason for erroneous airspeed and altitude information is obstructed pitot tubes or static sources. Depending on the level of obstruction, the symptoms visible to the flight crew will be different but on all cases the data provided by the obstructed probe will be false. Since it is highly unlikely that the probes on an aircraft be obstructed at the same time, by the same amount and in the same way, the first indication available to flight crews of erroneous airspeed-altitude data will most probably be a discrepancy between the various sources.

CONSEQUENCES OF OBSTRUCTED PITOT TUBES OR STATIC PORTS

All aircraft systems using anemometric data have built-in fault accommodation logics. The fault accommodation logics are not the same for the various systems but all rely on voting principles whereby when one source diverges from the average value it is automatically rejected and the system continues to operate normally with the remaining two sources. This principle applies to flight controls and flight guidance systems.

Normal situtation

Each ELAC receives the speed information from all ADIRU.
It compares the 3 values.
Pressure altitude information is not used by the ELAC.

Each FAC (Flight Augmentation Computer) receives the speed information from all ADIRU.
It compares the 3 values.
Same check is performed by the FMGC on speed and altitude information.

If one ADR output is erroneous and the two remaining ADR are correct :

The ELAC, the FAC and/or the FMGC eliminate it without any cockpit effect (no caution, normal operation is continued), except that one display is wrong and CATIII dual can no more be available on the FMA.

If two ADR outputs are erroneous but different, and the remaining ADR is correct, or if all three are erroneous but different :

The autopilot and the autothrust are disconnected (whichever autopilot is engaged).
The ELAC triggers the F/CTL ADR DISAGREE ECAM caution.
It reverts to Alternate law (without high and low speed protection).
On both PFD, "SPD LIM" flag is shown, no V_{LS}, no V_{SW} and no V_{MAX} is displayed.

This situation is latched until an ELAC reset is performed on the ground without any hydraulic pressure.

However, when one ADR is correct but the other two ADR provide the same erroneous output or when all three ADR provide consistent and erroneous data, the systems will reject the "good" ADR and will continue to operate normally using the two "bad" ADR. This condition can be met when, for example, two or all three pitot tubes are obstructed at the same time, by the same amount and in the same way. Flight through cloud of volcanic ash, takeoff with two pitots obstructed by foreign matter (mud, insects).

The human being (the pilot) tends to use the same type of "fault accommodation" principles to detect an erroneous IAS/altitude indication. Flight crews will tend to reject the outlier information if the two other outputs are consistent. This choice is, in the great majority of cases, correct, but all flight crews should be aware of very extreme and unlikely situations where two (or even three) speed/altitude indications can be consistent and wrong.

BEWARE OF INSTINCTIVELY REJECTING AN OUTLIER ADR

The following chart provides a, non-exhaustive, list of the consequences on the airspeed and altitude indications of various cases of partially or totally obstructed pitot tubes and static ports. It should be noted that the cases described below cover extreme situtations (e.g totally obstructed or unobstructed drain holes) and that there could be multiple intermediate configurations with similar, but not identical, consequences.

FAILURE CASE	CONSEQUENCES
Water accumulated due to heavy rain Drain holes unosbtructed	Transient speed drop until water drains IAS fluctuations IAS step drop and gradual return to normal
Water accumulated due to heavy rain Drain holes obstructed	Permanent speed drop
Ice accretion due to pitot heat failure or transient pitot blocked due to severe icing Unobstructed drain holes	Total pressure leaks towards static pressure IAS drop until obstruction cleared/fluctuation if transient erratic ATHR if transient
Ice accretion due to pitot heat failure or pitot obstruction due to foreign objects Obstructed drain holes	Total pressure blocked Constant IAS in level flight until obstruction cleared In climb IAS increases In descent IAS decreases Abnormal AP/FD/ATHR behavior : a) AP/FD pitch up in OPN CLB to hold target IAS b) AP/FD pitch down in OPN DES to hold target IAS
Total obstruction of static ports on ground	Static pressure blocked at airfield level Normal indications during T/O roll After lift-off altitude remains constant IAS decreases after lift-off IAS decreases when aircraft climbs IAS increases when aircraft descends

From the information given in the preceeding chart, it is clear that no single rule can be given to identify conclusively all possible cases of erroneous airspeed/altitude indications. However, any case of erroneous speed/altitude indications will always be associated to one (or more) of the following cues :

a) Fluctuations of airspeed indications
b) Abnormal correlation of the basic flight parameters (IAS, pitch attitude, thrust, climb rate)
   - IAS increasing with large nose-up pitch attitude
   - IAS decreasing with large nose down pitch attitude
   - IAS decreasing with nose down pitch attitude and aircraft descending

c) Abnormal AP/FD/ATHR behavior
d) Undue stall warning or overspeed warnings
d) Reduction of aerodynamic noise with increasing IAS
e) Increase of aerodynamic noise with decreasing IAS

RECOMMENDED PROCEDURES

The procedures described below are intended to provide flight crews with general guidelines to be applied in case of suspected erroneous airspeed/altitude indications.

FOLLOW ECAM ACTIONS If failure undetected : CROSS-CHECK ALL IAS/ALTITUDE SOURCES : 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.

N° 825/1

DATE : JUN 04

File in FCOM BULL Section

ISS.A

SUBJECT : EGPWS DATABASE

Purpose

Airbus has received some reports of EGPWS warnings that were unduly triggered due to airport data missing from the database.
It is the Airlines responsibility to identify the airport(s) where the terrain data is missing from the database. During operation around such airports, the enhanced function must be switched off (TERR pushbutton OFF on overhead panel) when the aircraft position is less than 15NM from the runway.

The purpose of this bulletin is to provide the operators and the flight crews with additional information regarding the EGPWS database and the EGPWS system reaction when the airport/terrain data is not included in the database.
The FCOM 3.01.34 and the Aircraft Flight Manual (AFM) refer, providing limitations of the system.

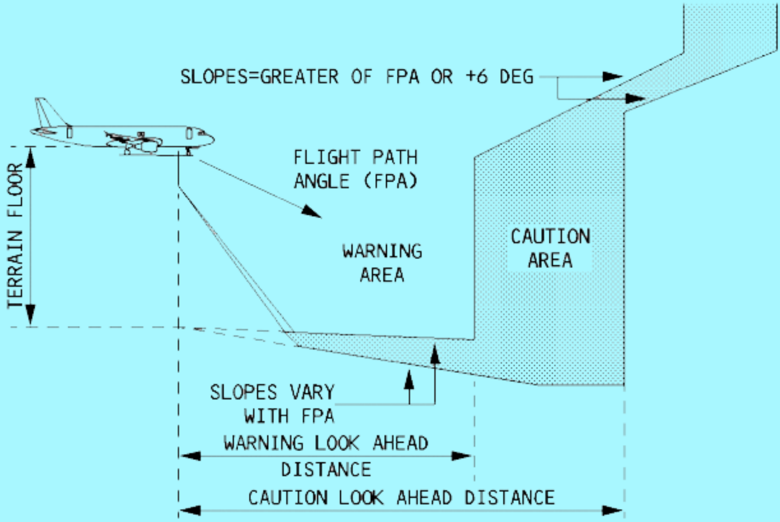
1. The Enhanced GPWS functions

The purpose of the Enhanced Ground Proximity Warning System (EGPWS) is to alert the crew of potential hazardous conditions with regards to Controlled Flight into Terrain (CFIT).

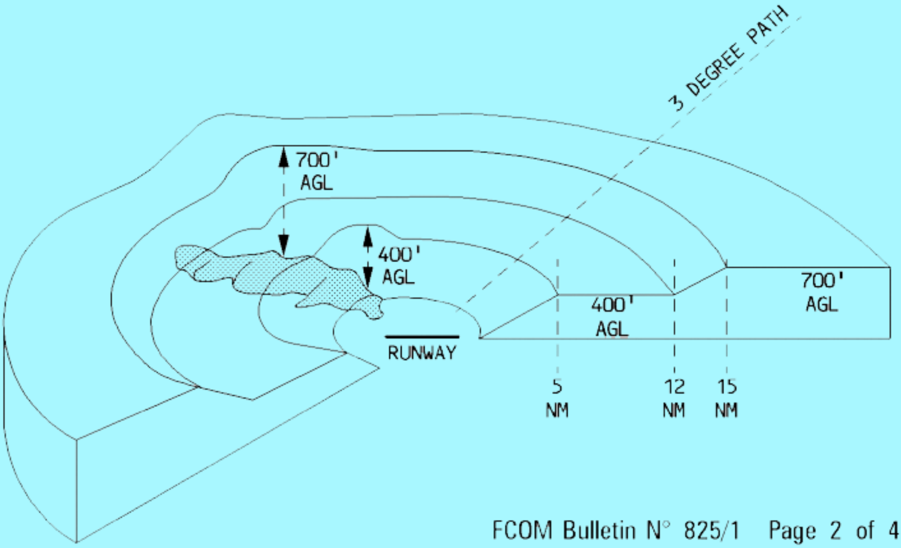
Two enhanced functions have been added to the basic modes of the GPWS. These functions are the following :

– Terrain Awareness and Display (TAD)
– Terrain clearance Floor (TCF)

- The Terrain Awareness and Display (TAD) function compares the aircraft FMS position with the local terrain in the database. It also computes two envelope boundaries ahead of the aircraft. When terrain data conflicts with one of these envelopes, specific aural and visual alerts are triggered.
  This function also provides terrain data display on the Navigation Display (ND)



- The Terrain Clearance Floor (TCF) function computes a terrain clearance envelope around the airport runway. It is based on current aircraft location, nearest runway center point position included in the database and radio height. When the aircraft enters this envelope, an alert "TOO LOW TERRAIN" is produced even if the aircraft is in landing configuration. This alert protects against an attempt to land where there is no airfield. This can be the case for example when descending by mistake on a wrong vertical path during a non-precision approach. This function operates during any flight phase.



2. The EGPWS database

The terrain database divides the Earth surface into grid cells. These cells are recorded upon the WGS-84 geographic coordinate system for longitude and latitude data. Each cell records the highest terrain altitude in the respective terrain area.
The resolution of the grid varies upon the geographic location, ranging from :

- 0.25 NM x 0.25 NM
- 0.5 NM x 0.5 NM
- 1 NM x 1 NM
- 2 NM x 2 NM
- 5 NM x 5 NM

The highest resolution (0.25NMx0.25NM) is used around the airports. This is to avoid producing alerts during normal procedures (the terrain database has to reflect as closely as possible the actual terrain). The lowest resolution (5NMx5NM) is used outside airports where such a coarse terrain database cannot interfere with normal en-route trajectories. The database also contains the position of the airport runway center point. This concerns all hard surface runways (wathever the surface type is) longer than or equal to 3500 ft.

Additionally, the database gives the possibility of incorporating data regarding man-made obstacles in the vicinity of the major airports.

3. EGPWS reaction when airport data is missing from the database.

When an airport/terrain data is not yet covered by the database, the TCF envelope cannot be defined. The system uses the lowest map resolution (5NMx5NM) as no airport is detected. Therefore, early and unexpected TAD cautions and warnings are triggered. The red EGPWS legend of the GPWS/G/S pushbutton comes on, the aural warnings "TERRAIN AHEAD" and "TERRAIN AHEAD, PULL-UP" sound and the terrain image pops up on the Navigation Display. When within 15NM, it is recommended to switch off the enhanced functions (EGPWS TERR pushbutton switched to OFF on overhead panel) for operations from/to runways not incorporated in the database (FCOM 3.01.34 refers).

4. The EGPWS database update

The database update is under the responsibility of the vendor.
The vendor may use one or more sources of data for a particular airport :

1) Data from in-country government and/or regulatory agencies.
2) Data from airlines that have surveyed an airport while establishing layout, approach/departure procedures, etc.
3) Data from commercial vendors who also produce data sets for FMS and other navigational systems.
4) Data from commercial and military surveying agencies that make such information publicly available.
5) Airport layout and physical properties from high-resolution maps and/or digitized data sources.
6) Airport layout and physical properties from imagery.

Some difficulties may be encountered in some areas to compile and validate airport data

For an official indication of the latest EGPWS database, as well as a list of covered airports, please review the manufacturer document, EGPWS Terrain Database Airport Coverage list. This document can be acquired by contacting.

Christine STAHL, Database Manager,
Allied Signal – 1500 NE 36th Street
REDMOND WA USA 98073
Telephone : (1)(425) 885-8847
Fax : (1)(425) 885-2994
Email : christine.stahl@allied.signal.com
Internet : WWW.egpws.com

5. Conclusion

The enhanced functions of the EGPWS are not reliable when operating around airports which are not included in the database. In this case, these functions must be switched off (TERR pushbutton off on the overhead panel).
It is the airlines responsibility to identify with the database manufacturer the airports where terrain data is missing.

Airbus strongly recommends to the airline to report to the database manufacturer and to their local airworthiness authorities any EGPWS warning occurence due to airport data missing from the database. It is also recommended that airlines request that their national authorities publish the necessary data in order that the database manufacturer can extend the database coverage to all operated airports.

N° 826/2

DATE : MAR 07

File in FCOM BULL Section
ISS.A

This FCOM BULLETIN supersedes Bulletin N° 826/1 dated JUN 04

SUBJECT : USE OF MANAGED GUIDANCE IN APPROACH AND NAV DATABASE VALIDATION

0. REASON FOR ISSUE 2 : This bulletin is revised to introduce new recommendations on the navigation database validation taking credit of the D0200A approval. Furthermore, some additional recommendations on RNAV approaches have been included.

1. BACKGROUND

The purpose of this FCOM Bulletin is to highlight SOP recommendations on the use of managed guidance in approach.

The current body of published Instrument Approach Procedures (IAP) includes "old style" procedures, based on conventional radio navaids which cannot always be coded in the navigation database, in a suitable manner for satisfactory FMGS guidance in approach.

Note : RNAV procedures are usually designed and coded for optimum FMGS guidance in FINAL APP mode.

For conventional NPA using FMS managed lateral and vertical guidance, if the navigation database has been obtained from approved suppliers compliant with the requirements of ED76/D0200A, the validation of the approach coded in the database can be deferred to the flight crew, checking the FM F-PLN (on MCDU and ND) against the published approach chart.

Note : Conventional radio navaids must be available and monitored during the approach, and must be considered as the primary means of navigation.

For RNAV approaches using FMS managed lateral guidance only, based on the provisions of AMC 20 XZ (draft), if the navigation database has been obtained from approved suppliers compliant with the requirements of ED76/DO200A, the validation of the approach lateral flight path coded in the navigation database can be deferred to the flight crew, checking the FM F-PLN (on MCDU and ND) against the published approach chart.

Note : When flying an RNAV approach using NAV mode associated with selected vertical guidance (FPA, V/S), the distance to the runway or the MAP versus altitude is the primary means of vertical navitation, the vertical deviation on the PFD may be unreliable.

For RNAV approaches using FMS managed lateral and vertical guidance, the vertical flight path coded in the navigation database must be validated by the operator.

Validation of the navigation database should ensure that the IAP is of an eligible type, and is correctly coded so that the aircraft in FINAL APP mode will fly a constant flight path angle from the FAF to the runway with the required obstacle margins.

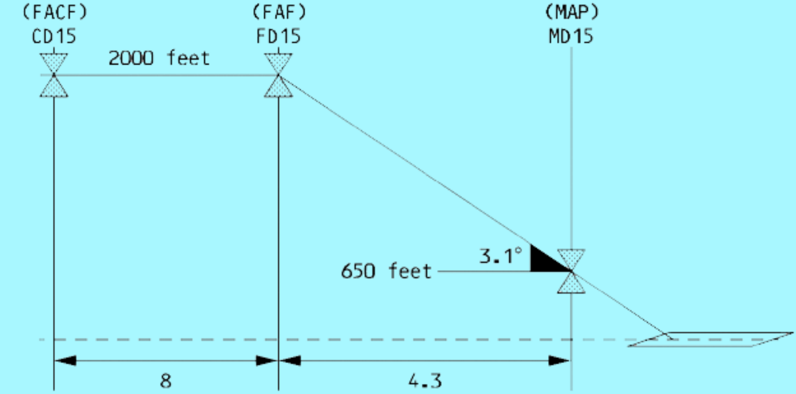
Different methods or processes can be used to validate the IAP that is coded in the navigation database.

One method is to fly each approach in a simulator (or equivalent device), or with the aircraft when weather conditions are good. An IAP that is regularly and correctly flown in FINAL APP mode can be considered as validated.

Another method is to use a dedicated software to read the navigation database diskette. The listing or display of the coded IAP is then assessed by comparing it with the approach chart. The airline should keep an up-to-date record of the IAPs that are approved for the use of
R FINAL APP mode.

2. IAP AND CODING REQUIREMENTS

A number of FMGC coding guidance requirements have been identified, and must be considered, when performing navigation database validation for the use of managed guidance in approach. As an example, the following drawings show the coding of an VOR DME IAP (with the MAP before the runway), and the associated MCDU display. Refer to drawings on next page.



FACF = Final Approach Course Fix FAF = Final Approach Fix
MAP = Missed Approach Point

= Waypoints with associated altitude constraints

	UTC	SPD / ALT	
.....	....	....	....
C144°			
CD15L	....	....*	2000
C144°	TRK144°	8	
MD15L	....	....*	2000
C144°		4	-3.1°
MD15L	....	....	650
....			

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The final approach consists of a sequence of at least two waypoints. However, it more often consists of 3, or 4, waypoints.

In the above example, the 3 waypoints are the FACF, the FAF, and the MAP. Sometimes, the MAP is located at, or after, the runway threshold. We will see that it is important for the crew to identify the MAP position. 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 the MCDU often differs from the identification shown on the approach chart.

The lateral F-PLN coding requirements

The FACF and the FAF must be aligned with the approach course.
If the FACF and the FAF are collocated, the course change at the FAF should be small. A sharp turn would prevent the aircraft from overflying the FAF, and the final descent would start before the FAF, without the aircraft being established on the final approach course.

For aircraft equipped with Honeywell FMS, approach procedures, including a PI-CF Leg (PROC T displayed between 2 approach waypoints on the MCDU F-PLN page), are not permitted with AP or FD managed guidance.
These approaches must be flown in selected guidance, using published approach chart and navaid raw data.

The vertical F-PLN coding requirements

An altitude constraint must be coded at each approach waypoint.
Any waypoint of the approach should not be common to a STAR or a VIA waypoint with different altitude constraints. Combining altitude constraint may lead to erroneous vertical flight path guidance.
An AT or ABOVE constraint can be used for an SDF.
When the **MAP is located at, or before, the runway threshold, an FPA (≠ 0°) must be coded at the MAP, or at the runway threshold (RW). This FPA will appear on the MCDU,**
R **between the MAP and the FAF, or any previous SDF in the final approach.**

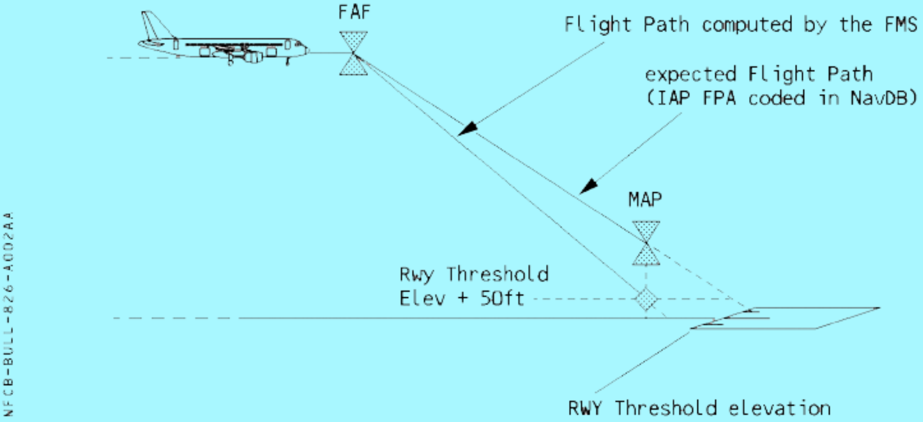
When the **MAP is located after the runway threshold, an FPA = 0° must be coded at the MAP.**
For these "old style IAP", with the MAP after the runway threshold, and depending on the position of the approach axis relative to the runway, FMGC guidance may start the final approach descent slightly before the FAF. In most cases, the crossing altitude difference at the FAF is not significant (less than 50 feet). But, sometimes, this difference may be higher. Therefore, as it is not acceptable for the use of FINAL APP mode, we recommend validating the IAP with a MAP after the runway threshold, either in a simulator (or equivalent device), or with the aircraft in good weather conditions.
An FPA (≠ 0°) must be coded for each SDF that is on the final approach descent.
R **The MAP of an RNAV IAP must be located at the runway threshold.**

R **Additional vertical requirements for RNAV approaches (for Honeywell FMS only)**

R The MAP of RNAV approaches must be located at the runway threshold.

R Whenever the FMGC identifies an IAP labelled RNAV, it constructs the vertical flight profile
R assuming that there is an altitude constraint at the MAP equals to the runway threshold plus
R 50 ft. If the MAP is located significantly before the runway threshold, the FMGC computes
R an incorrect vertical flight path, and will display a wrong vertical deviation indication (VDEV)
R on the PFD.
R Consequently, the MAP crossing altitude on the FPLN page will be incorrect compared to the
R published value.
R As a result, an RNAV IAP with a MAP located before the runway threshold must not be
R validated to be flown with the full FMS managed mode FINAL APP.

Note : The approaches labelled "GPS" are not affected and can be flown in FINAL APP mode.



3. FLIGHT CREW PROCEDURES

The SOP (FCOM 3.03.19) for Non Precision and RNAV approaches are applicable. The following recommendations are provided to highlight specific vertical navigation aspects, when FINAL APP mode is used.
As applicable, the crew should first check that the Airline has approved the approach for FINAL APP mode use.

3.1 Approach F-PLN verification

Before starting the approach, the crew must check the FMS F-PLN (on the MCDU, and on the ND in PLAN mode with the 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
- Waypoints and associated altitude constraints
- IAP must not include a Procedure Turn (PROC T indicated on the MCDU)
- Distance from the FAF to RW, or FAF to MAP
- Approach angle (shown on the MCDU line above the related waypoints) :
  - **If MAP, after the runway threshold : FPA = 0° at MAP**
  - **If MAP before or at runway threshold : FPA ≠ 0° at MAP**
  - **For each Step Down Fix, an FPA ≠ 0° must be defined**
- **IAP does not include a PI-CF leg (PROC T displayed on the MCDU)**
- **MAP of an RNAV IAP must be located at the runway threshold.**

  Note : The MAP of a GPS IAP can be located before the runway threshold.

- Altitude at the MAP, or at the runway threshold :
  – If the crossing altitude at MAP is not shown on the approach chart, crosscheck consistency with the distance to the runway and the approach angle.

3.2 Limitations to approach F-PLN modifications

When performing an IAP, using NAV and FINAL APP modes, the active F-PLN, extracted from the navigation database, can be modified, provided the following limitations are observed :

1. F-PLN modifications :

- No lateral modification of the F-PLN from FACF (inclusive) to RW or to MAP.
  A modification is permitted before FACF, provided the resulting change in the flight path course is not so large that it prevents the aircraft from being laterally-stabilized on the final approach course before reaching the FAF.

- No altitude constraint modification from FACF to MAP. Even in case of a very low OAT, no altitude correction can be entered in this way. This may require that a minimum OAT be defined, so that the vertical flight path will clear obstacles with the required margin. This minimum OAT should be given to the crew, when appropriate. In the future, for RNAV approaches, the 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 benefit from managed speed, and have a correct location of the DECEL point, it is recommended to enter Vapp as a SPD CSTR at FAF.

2. DIR TO...

- DIR TO FACF is permitted, provided the resulting change in flight path course at FACF is not so large that it prevents the aircraft from being laterally-stabilized on the final approach course before reaching the FAF.

- DIR TO FAF is permitted, provided the resulting change in flight path course at FAF is small.

- For aircraft with FMS2 : DIR TO/INTERCEPT TO FAF is permitted, provided the RADIAL IN corresponding to the final approach course (approach course + 180°) is selected, and that the interception angle is not so large that it prevents the aircraft from being laterally-stabilized on the final approach course at the FAF.

3. Lateral F-PLN interception in HDG/TRK :

- F-PLN must be intercepted before the FACF, and the interception angle should not be so large that it prevents 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 that the correct "TO" waypoint is displayed on the ND.
– The intercept path in HDG/TRK must not cause premature sequencing of the FAF. The FAF should be sequenced in NAV mode, when established on the final approach course.

4. Vertical F-PLN interception :

- The crew should manage the descent, so that the vertical F-PLN is intercepted before the FAF, at the latest.

3.3 Approach monitoring

Except for RNAV IAP, approach navaids should be tuned and the associated raw data shoud be displayed and actively-monitored. This active monitoring should include vertical navigation, using altimeter readings versus DME distances or the equivalent.
For RNAV IAP, vertical navigation can be monitored by using the distance to the RW, or to the MAP displayed on the ND, and the altimeter reading.
After passing the FAF, when stabilized on the final descent, the crew should check that the X-TRK and V-DEV are correct, and that the FPV is consistent with the approach angle.

When APPR is selected on the FCU, the crew must verify the :

- Correct FMA display (APP NAV green, FINAL blue)
- Correct TO waypoint on the ND
- Blue descent arrow at FAF and the correct F-PLN
- Correct Vertical Flight Path deviation indication

When passing the FAF, the crew must verify :

- Correct altitude indication
- Correct FMA display (FINAL APP green)
- Correct TO waypoint on the ND
- Correct blue track on the 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 must be discontinued, when one of the following warnings occurs :

- GPS PRIMARY LOST, if GPS accuracy is required,
- NAV ACCUR DOWNGRAD, during an RNAV approach,
- FM/GPS POS DISAGREE, if GPS is installed and is not deselected, and if no navaid raw data is available to revert to selected modes.
- FM1/FM2 POS DIFF, unless 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 their Flight Operations. The report must be fully-documented to enable further investigation and corrective actions : It should, therefore, include the following information :

- Approach designation and airport
- Aircraft type, MSN, GW, wind/temperature
- Navigation database cycle
- Pilot selections, FMA, ND, MCDU displays
- Description of anomaly, flight path
- DFDR/QAR reading

A318/A319/A320/A321 FCOM BULLETIN

N° 827/2

DATE : JAN 08

File in FCOM BULL Section
ISS.A

SUBJECT : AIRCRAFT HANDLING IN FINAL APPROACH

R **Reason for Issue 2** :

R This bulletin is revised in order to clarify that below 100 feet, moving the thrust levers above
R the CL detent will not result in A/THR disconnection for aircraft equipped with S1C10, P1C11,
R S2I9, P1I10 FMGC Standards and subsequent standards.

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 prerequisite for a successful final approach and landing is to stabilize the aircraft on the final approach trajectory in pitch, thrust, airspeed, and bank angle.

This signifies that the :

- Aircraft is established on the :
  - Final approach trajectory, and only minor heading corrections are necessary (except for indirect or curve 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 ;
- The target speed is maintained on the desired descent path, with the appropriate thrust (not stabilized at idle).

Airbus policy requires that stabilized conditions be reached at 1,000 feet Height Above Threshold in IMC, and 500 feet 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 may not be desirable close to the ground, if the aircraft level of energy is low.

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 Standard Operating Procedures (FCOM 3.03.18 and 3.03.19) state 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 2.5 degrees nose down, or greater than 10 degrees nose up.
- Bank angle becomes greater than 7 degrees.
- Descent rate becomes greater than 1000 feet/minute.
- 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 on the Longitudinal Axis

The pilot's objective, with respect to the longitudinal axis, is to control the airspeed and the vertical flight path. For thrust and speed control, it is recommended to use FMGS managed speed, in order to benefit from the minimum GS function.

The A/THR is, in particular, best suited to tracking a moving target speed, when flying in managed speed mode. Statistically, the A/THR provides the best protection against airspeed excursions and its use is, therefore, recommended even in turbulent conditions, unless thrust variations become excessive.

A/THR response to airspeed variations is the result of a design compromise between performance and comfort, and it is optimized when the AP is engaged. Therefore, in turbulent conditions and when flying manually, the pilot may sometimes find it to be too slow or lagging. If conditions are such that a large speed decrease with engines at idle is anticipated, the pilot may, above 100 feet RA, move the thrust levers slightly above the CL detent to reduce the A/THR response time. This will temporarily deactive and arm the A/THR. As soon as positive acceleration is achieved, and before the thrust becomes too high, the pilot should move the thrust levers back to the CL detent to resume A/THR operations.

Note : 1. *Above 100 feet, this possibility should be used in exceptional circumstances, and should not become a routine flying technique.*

2. *Below 100 feet, moving the thrust levers above the CL detent, will result in A/THR*
R *disconnection (Refer to the FCOM 1.22.30). This is not applicable to aircraft fitted*
R *with the S1C10 ; P1C11 ; S2I9 ; P1I10 FMGC standards and onwards.*

3. *In an OEI situation, moving the thrust lever(s) above the MCT detent(s) should be done carefully, so as not to trigger the GA mode.*

If conditions are such that a large speed decrease with engines at idle is anticipated, then the PF may take over thrust manually to recover the speed target and continue the approach in manual thrust.

it is not recommended to use the speedbrakes in the final approach. In final approach, the drag 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 will progressively shift from vertical flight path control to safe pitch attitude and vertical speed, to start the flare in good conditions. The PF will primarily control the attitude and the vertical speed to perform a safe flare.

If the vertical speed is too high, prior to starting the flare, the vertical deceleration that can be achieved during flare may be insufficient to avoid a hard landing. The aircraft may touch down with an excessive residual vertical speed and pitch rate, which may lead to bouncing and exposure to tailstrike.

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 vertical speed and pitch attitude become the primary objectives, 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 degrees/second. However, the aerodynamic capacity of the roll surfaces, when fully deflected, is much higher : That is, up to about 40 degrees/second. This means that, if the aircraft is flying through turbulence that produces a roll rate of 25 degrees/second to the right, the aircraft still has the capacity to roll to the left at a rate of 15 degrees/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. On conventional aircraft, due to the control wheel inertia, the pilot needs considerably more time to reach the flight control stop.

The flight control system of Airbus fly-by-wire aircraft partially counteracts roll movements induced by the effect of gust, even with the sidestick in the neutral position. The PF must ensure that the overall corrective orders maintain the desired aircraft lateral axis. He/she will minimize lateral inputs and will resist applying sidestick order 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.

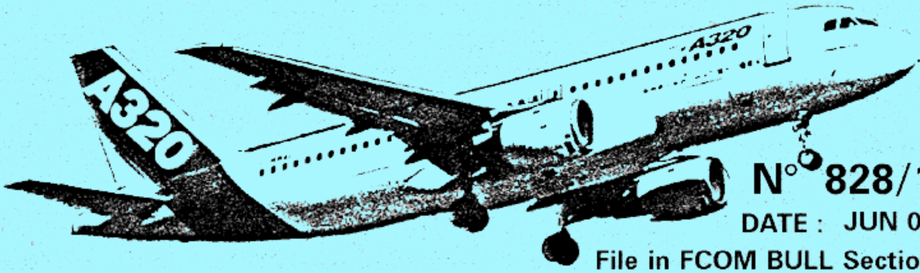
Use of rudder, combined with roll inputs, should be avoided, since this may significantly increase the pilot's lateral handling tasks. Rudder use should be limited to the "de-crab" maneuver in case of crosswind, while maintaining the wings level, with the sidestick in the roll axis. (Refer to the FCOM's 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.
- Promptly react to any pitch down at low height, to avoid ducking under.
- Reach the flare height with the correct pitch attitude and sink rate.
- In turbulent conditions, it is recommended to use the A/THR, unless the PF is not satisfied by the A/THR response.
- Refrain from excessive sidestick roll activity. Order "longer-term" roll corrections.
- Restrict rudder use to "de-crabbing" in crosswind.

A318/A319/A320/A321 FCOM BULLETIN



N° 828/1

DATE : JUN 04

File in FCOM BULL Section
ISS.A

SUBJECT : USE OF RUDDER ON TRANSPORT CATEGORY AIRPLANES

REASON FOR ISSUE

On February 8th, 2002, the National Transportation Safety Board (NTSB), in cooperation with the French "Bureau Enquetes Accidents (BEA)", issued recommendations that aircraft manufacturers re-emphasize the structural certification requirements for the rudder and vertical stabilizer, showing how some maneuvers can result in exceeding design limits and even lead to structural failure.

The purpose of this FCOM Bulletin is to re-emphasize proper operational use of the rudder, highlighting certification requirements and rudder control design characteristics.

YAW CONTROL

General

In flight, yaw control is provided by the rudder, and directional stability is provided by the vertical stabilizer.

The rudder and vertical stabilizer are sized to meet the two following objectives :

- Provide sufficient lateral control of the aircraft during crosswind takeoffs and landings, within the published crosswind limits (refer to FCOM's Operating Limitations chapter 3.01.20) ;
- Provide positive aircraft control under conditions of engine failure and maximum asymmetric thrust, at any speed above Vmcg (minimum control speed on ground).

The vertical stabilizer and the rudder must be capable of generating sufficient yawing moments to maintain directional control of the aircraft.

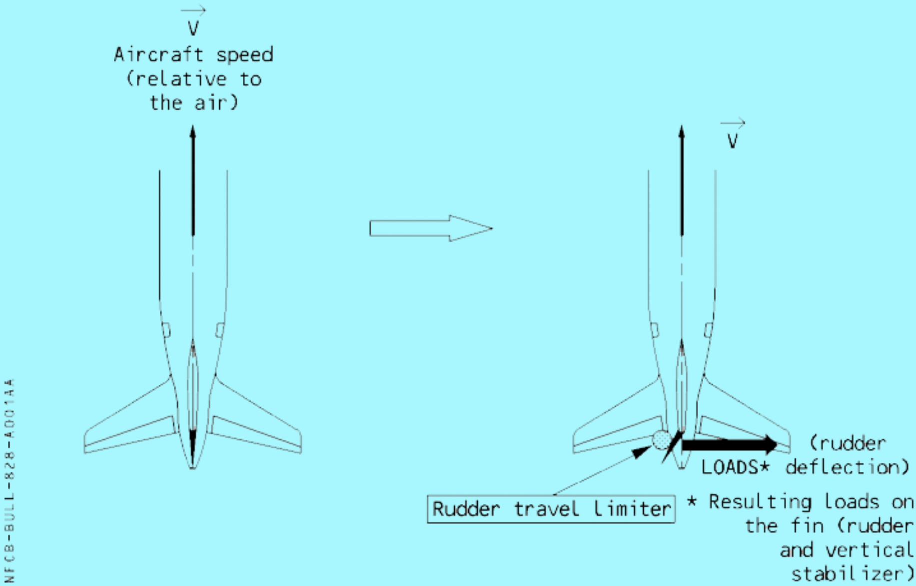
The rudder deflection, necessary to achieve these yawing moments, and the resulting sideslip angles can place significant aerodynamic loads on the rudder and on the vertical stabilizer.

Both vertical stabilizer and rudder are designed to sustain loads as prescribed in the JAR / FAR 25 certification requirements which define several lateral loading conditions (maneuver, gust loads and asymmetrical loads due to engine failure) leading to a required level of structural strength.

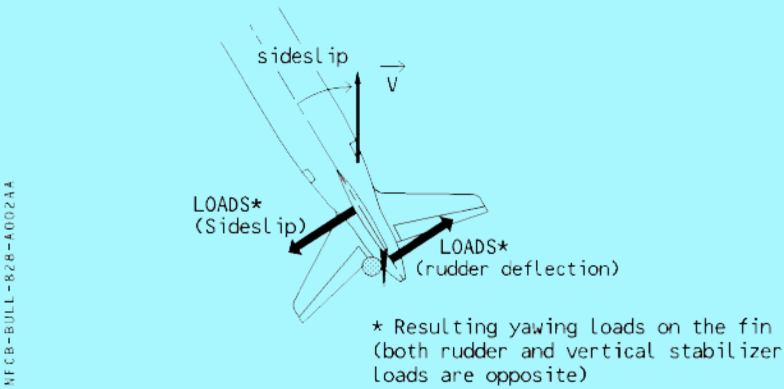
Certification requirements

For certification in accordance with JAR / FAR 25.351, loads on the stabilizer and the rudder are defined, considering yawing maneuvers as shown below, for a range of speeds from VMC (minimum control speed) to VD/MD (maximum design speed), from sea level up to maximum altitude, and over the full range of aircraft weights and Center of Gravity limits :

1 - With the aircraft in unaccelerated and stabilized straight flight, the rudder pedal is suddenly displaced to the maximum available deflection at the current aircraft speed.

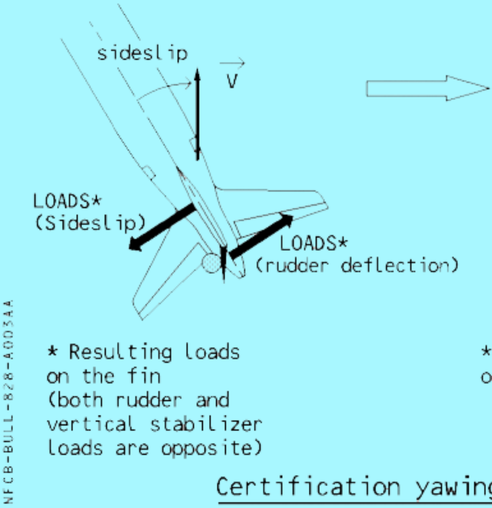


2 - With the rudder deflected as shown above, the aircraft yaws to the resulting overswing sideslip angle, and then stabilizes at a somewhat smaller steady-state slideslip angle.



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

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



Certification yawing maneuver design

JAR/FAR 25 requires the above yawing maneuver to be analyzed over the full range of specified conditions. The most severe loads imposed on the vertical stabilizer and rudder are identified.

The same analysis is performed for lateral gusts, rolling maneuvers and asymmetrical engine failure conditions. The most severe of all these cases and associated loads provides the design basis for the vertical stabilizer and rudder.

The above loads define the limit loads according to JAR / FAR 25 requirements. These loads correspond to the maximum loads that may be expected in service.

According to JAR / FAR 25 requirements, the ultimate loads are defined as the limit loads multiplied by a prescribed safety factor of 1.5 unless otherwise specified.

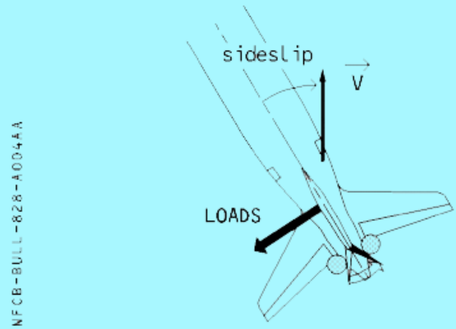
The aircraft structure must be able to sustain limit loads without detrimental permanent deformation and ultimate loads without failure for at least 3 seconds.

Higher loads could lead to structural failure.

CAUTION

Sudden commanded full, or nearly full, opposite rudder movement against a sideslip can generate loads that exceed the limit loads and possibly the ultimate loads and can result in structural failure.

This is true even at speeds below the maximum design maneuvering speed, VA.



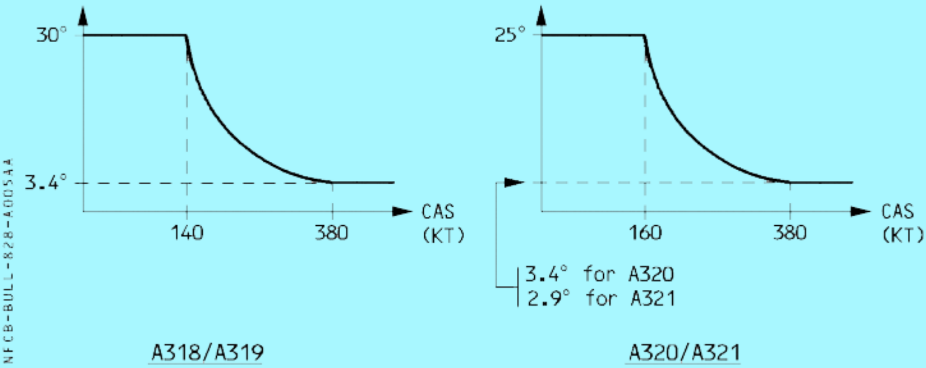
Certification regulations do not consider the loads imposed on the structure when there is a sudden full, or nearly full, rudder movement that is opposite to the sideslip.

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.

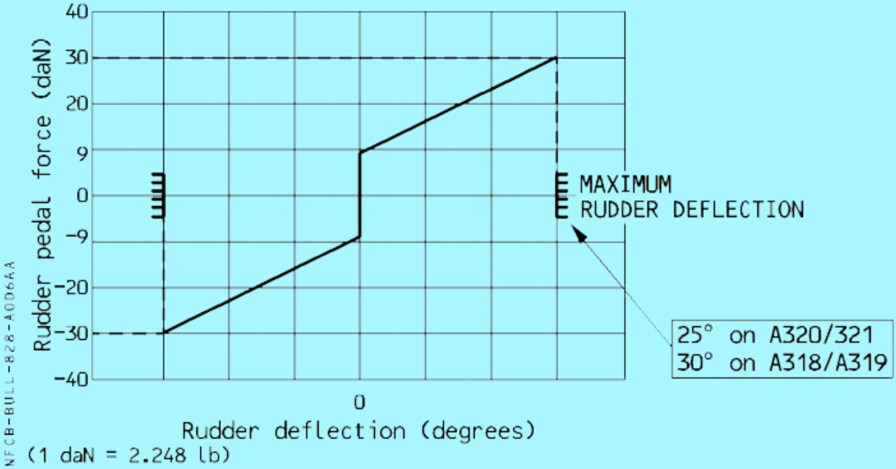
The rudder travel limiter, controlled by the FACs, is designed to progressively reduce the available total rudder travel depending on aircraft speed.
This provides sufficient yaw control within the entire flight envelope, including engine failure and maximum asymmetric thrust, limiting the lateral loads 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".

A318/A319/A320/A321 FCOM BULLETIN

N° 829/1

DATE : SEP 04

File in FCOM BULL Section

ISS.A

SUBJECT : Yaw Disturbances during the Takeoff Roll

Various operators have reported an approximate total of 30 events of "unusual" yaw movement during the takeoff roll.
The large majority of these events took place in extremely hot weather conditions.

Flight crews have used such terms as "lateral jerk", lateral g-load, or "yaw control perturbation", to describe these occurrences.

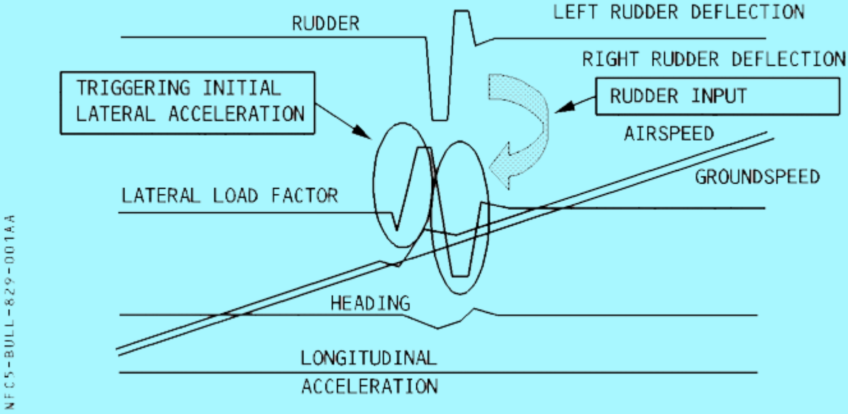
Airbus has conducted extensive investigations, in order to fully understand the origin and cause of these events, and to take into account any contributing conditions, whether it be technical or external.

Description of the Observed Events

The most significant of these events, included the following characteristics :

- An initial sharp lateral disturbance, associated with short, but substantial, lateral acceleration and heading variation
- In most cases, the pilot took immediate action, with a sharp pedal deflection in the opposite direction, in order to correct the heading and the lateral deviation
- This induced a lateral acceleration peak, of approximately the same magnitude, in the opposite direction.

The general characteristics of these events produce the typical DFDR traces, illustrated below :



Analysis of the Events

Simulation tools were specifically developed, in an attempt to reproduce the condition and assess the effects of such failure modes as :

- Sharp rudder deflection (mechanical)
- Sudden differential braking
- Sudden nosewheel movement
- Sudden thrust asymmetry

None of these failure modes could reproduce and explain the typical traces that were observed on the DFDR. This led to the assumption that only external causes were at the root of these events.
This assumption was confirmed, after Airbus experienced a similar event on a test aircraft, equipped with a more sophisticated flight test recording equipment (greater sampling rate than the DFDR).
The data recorded onboard the aircraft during this event was used to estimate the profile of a wind variation, which could have generated the recorded lateral disturbance. This was done by two methods, which both led to the same result. It was found that wind profiles, having a magnitude of less than 15 knots, perfectly matched the simulation of the recorded flight parameters.

All of these tests confirmed that the lateral perturbations were not caused by an aircraft system malfunction, but were always due to external lateral gusts.

Origin of Lateral Gusts

Different situations may create isolated lateral gusts. For example, the jet blast of another aircraft close to the active runway, or the wind between two buildings accelerated by "venturi" effect, may create such lateral gust effects. However, the most probable cause is the presence of thermals or thermal vortices that often develop in hot and dry countries. Sometimes, as these thermal streams get stronger, they create small whirlwinds referred to as "dust devils".

Aircraft Response and Handling

All aircraft can be affected by lateral disturbances and their response, in terms of lateral g, yaw acceleration, and heading variation will depend on the aircraft's aerodynamic characteristics, plus the yaw inertia combined with the dynamics of ground reactions.

Generally speaking, it is easy to maintain the aircraft on the runway centerline via normal use of the rudder. The issue, in these events, is that the disturbance can be quite isolated, and sufficiently strong, to catch the pilot by surprise.

During a takeoff in a gusty crosswind, the pilot may have to cope with the effect of lateral wind variations. In such cases, the pilot will readily control the aircraft on the runway centerline, throughout the takeoff roll, because the aircraft behaves as the pilot expects, and the pilot is prepared to act.

In the reported events, the condition arose suddenly, during the takeoff roll, with very little, or no obvious turbulence. In such circumstances the pilot is less prepared for a such sudden lateral disturbance ; And analysis of these events has revealed that pilots had a tendency to overreact, by increasing rudder input, and consequently increasing the magnitude of the lateral disturbance.

Conclusion

The objective of this FCOM Bulletin is to inform flight crews that they may encounter such lateral disturbances, particularly in areas and in weather conditions where strong thermals have a tendency to develop.

Pilots should, therefore, be prepared to react to these isolated disturbances by using the rudder normally, and avoiding excessive rudder input.

N° 830/2

DATE : MAR 07

File in FCOM BULL Section
ISS.A

SUBJECT : AUTOMATIC LANDING PERFORMANCE

REASON FOR ISSUE 2 :

This FCOM Bulletin is reissued to precise the increase of the automatic landing distance to 300 meters for the example of RW 32 at Leeds (LBA) Airport, in the "AIRPORT/RUNWAYS WITH SPECIAL TERRAIN/RUNWAY PROFILE" section.

REASON FOR ISSUE 1

Abnormal automatic landing behaviors are periodically reported on some airports/runways with specific terrain profile before runway threshold, or specific runway profile.

AUTOMATIC LANDING FLARE MODE

All Airbus aircraft use similar FLARE modes for automatic landing. The FLARE mode is initiated at a given radio altitude (RA), which can be either advanced or delayed in function of the Rate Of Descent (ROD) – measured as a rate of change of RA with time.

Once the FLARE mode is engaged, the flare is commenced by an open-loop elevator input (pre-command), which is adapted to the aircraft GW, CG and GS. The flare is then continued with a closed-loop signal to satisfy ROD and RA targets function of the horizontal distance (or time).

The pitch demand given by the flare pre-command is modified by pitch demands in order to reduce the differences between the actual and the desired RA and ROD. The intent is to reduce both the ROD and the RA as a function of distance or time so that the aircraft touches down with a reasonable ROD in a reasonable distance (or time – typically 7 to 9 sec).
This is effectively what a pilot does during manual flare. As the ground approaches, pitch-up input is introduced to reduce the ROD ; the importance of the input varies according to the pilot's perception of the rate at which the ground is approaching.

AUTOMATIC LANDING CERTIFICATION REQUIREMENTS

The automatic landing certification regulations are complex and impose many requirements on the system. Among performance requirements are limits on touch down vertical speed and touch down distance from runway threshold. These limits are expressed in term of probability to exceed ultimate values ; for touch down vertical speed and distance these limits are :

- The probability to exceed a touch down vertical speed of 10 ft/sec must be less than one per million (10^{-6}),
- The probability to touch down at a distance less than 60 meters from the runway threshold or more than 900 meters must be less than one per million (10^{-6}).

There are similar requirements for the touch down lateral distance from the runway centerline, for the bank angle at touch down and lateral deviation during rollout.

To demonstrate statistically compliance with these requirements, the aircraft manufacturers use a combination of flight tests and simulation tools and must cover the full range of GW, CG and winds in a range of pressure altitude up to the maximum certified altitude for automatic landing (Refer to the AFM).
The automatic landing system performance has been demonstrated during certification with CAT II/III ILS beams with a G/S from 2.5 degrees to 3.15 degrees.

There is no certification requirement to prove that the automatic landing system will perform as expected at all conceivable airports. Certification flight tests are performed on a limited number of airports equipped with a CAT II or CAT III ILS. However, the simulation tests must include specific unusual terrain profile before runway threshold and specific runway slope :

- Runway slope of ± 0.8 %.
- 20 ft step before runway threshold
- Rising terrain slope of 12.5 degrees followed by 60 meters horizontal surface just before runway threshold.

Airbus aircraft meet all these certification requirements.
In addition, Airbus has assessed in simulation the effect of terrain/runway profiles of specific airports known to be somehow problematic ("special terrain/runway profile").

The appendix 8 of FAA AC 120-28D related to irregular terrain assessment as part of the CAT III operational evaluation gives the following background : "FAA type design approval of flight guidance systems provides for generic performance evaluation of autoland capability through simulation with reference terrain conditions, and flight testing at a few particular locations. This is to verify suitability of the design analysis. When an aircraft is type certificated for use of a flight guidance system, it is not the intent, nor is it practical that each model of aircraft be tested at each conceivable locations that it could potentially be used in operations ... While type design certification addresses generic system performance, <u>specific operational review and approval of particular aircraft type/site autoland performance is necessary when minima are predicated on the use of autoland. This is especially important at airports with irregular pre-threshold terrain (e.g., cliffs, valleys, sea walls) in the area of final approach within approximately 1500 ft of runway threshold."</u>

AUTOMATIC LANDING DISTANCE

The automatic landing distance calculation uses a realistic airborne distance obtained from flight tests demonstrations – statistically determined as the mean touch down distance from runway threshold plus 3 times the standard variation of this distance –, which is then added to a ground distance calculated with maximum braking starting at the mean touchdown speed plus 3 times the standard variation of this speed. The combined airborne and ground distances are then multiplied by 1.15 to give the automatic landing distance. Refer to QRH Autoland.
The required landing distance cannot be less than the manual landing distance multiplied by 1.67 (or 1.67 × 1.15 on wet runway) or the automatic landing distance, whichever is the highest.

The airborne mean distance and its statistical variation is determined using data collected for the certification process. A special runway profile (for example hill top double slope) may lead to increase airborne distances.

EFFECT OF TERRAIN/RUNWAY PROFILE

A higher ROD in the last part of the approach (due to terrain profile before runway threshold) will cause the flare mode to engage earlier than usual.
A rising slope before the runway can cause the flare to engage higher, and the aircraft may temporarily float above the runway surface before the pitch is reduced to resume a gentle descent down to the runway leading to a long flare. If, in addition, the runway has a negative slope, the descent will be further prolonged. However, the system will always try to re-establish the aircraft on the flare profile.
In general, runways sloping up are prone to produce firm landings whereas runways sloping down will tend to produce long flares.
Double runway slope with hill top located in the touch down zone may significantly affect the statistical distribution of the touch down point, increasing sometimes the airborne distance.

A flare is a dynamic maneuver, and flares are never exactly the same. To satisfy certification requirements, the RA signal is filtered to avoid irregular variations, and the aircraft reaction in pitch is limited in order to prevent over-reactions in the event of erroneous signal variations. The consequence of these requirements is a more sluggish response to variations in RA signal, which restricts the ability to cope with large variations in terrain/runway profile.

OPERATIONAL DEMONSTRATION

For the purpose of CAT II/III operational demonstration, the airline has to perform a number of automatic landings in good weather conditions on different runways, usually at their home base and main destinations.
To determine if an airport/runway is eligible for CAT II/III operations, the Appendix 1 of JAR OPS 1.440 (h) requires that :

1. "Each aeroplane type/on-board equipment/runway combination must be verified by the completion of at least one approach and landing in Category II or better weather conditions, prior to commencing Category III operations.
2. For runways with irregular pre-threshold terrain or other foreseeable or known deficiencies, each aeroplane type/on-board equipment/runway combination must be verified by operations in Category I or better weather conditions, prior to commencing Category II or III operations".

The appendix 8 of FAA AC 120-28D says : "At typical airports runways that are not considered to be "special terrain", the review and approval process usually consists of verifying the operator's report or performance for a small number of "line landings" using the flight guidance system in weather conditions better than those requiring use of CAT II or lower minima".

Before deciding that an airport/runway is suitable for automatic landing, the operator must seek information on the local characteristics of the runway and verify that the airport is not listed as "special terrain" for CAT II/III operations (e.g., those listed for example in the CAT II/III Status on the FAA web site).

For airports/runways that exhibit special characteristics (pre-threshold terrain, runway profile or a combination of both), a specific operational evaluation is generally necessary. This initial evaluation should consist in 4 to 6 automatic landings in typical wind conditions and representative LW to be performed by a CAT III qualified and experienced pilot (Airline technical pilot, senior training pilot,....).

DFDR data need to be analyzed to verify that the automatic landing system performed adequately. Airbus may support the operator for this data analysis. This initial evaluation should be then complemented by the monitoring of typically 25 automatic landings in line operation.
This evaluation program should be done with the agreement of the operational authorities using for example the guidelines from FAA AC 120-28D Appendix 8.

AUTOMATIC LANDING IN CAT I OR BETTER WEATHER CONDITIONS

Automatic landings need sometimes to be performed in CAT I or better weather conditions for flight crew training purpose or for operational evaluation/demonstration.
Although the automatic landing system performance has been demonstrated during certification with CAT II/III ILS beams, automatic landing is possible on a CAT I ILS, or on a CAT II/III ILS when the ILS protection is not activated (Low Visibility Procedure not enforced), provided :

- The operator has checked that the ILS beam quality and the effect of the terrain profile before the runway have no adverse effect on autopilot guidance. For that, the operator should seek information on terrain discontinuities before runway threshold and runway slope. Information from other operators with the same aircraft type and airport authorities can also be used.
- The flight crew is aware that LOC or G/S 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.

AUTOMATIC ROLLOUT ON CAT II RUNWAYS

For CAT II operations there is no requirement on LOC beam quality for the rollout segment. Automatic rollout in CAT II operations on a runway that is not CAT III qualified remains under the crew responsibility.

- As LOC beam fluctuations independent of the aircraft system may occur, the PF should be prepared to take over directional control if the AP disconnects during rollout, or to immediately disconnect the AP if unsatisfactory rollout guidance occurs.

AUTOMATIC LANDING ABOVE MLW

For some Airbus models, the FCOM OVERWEIGHT LANDING procedure may indicate that automatic landing is certified up to the MLW but that flight tests have been performed successfully up to a higher LW. The FCOM states that in case of emergency, and under crew responsibility, an automatic landing may be performed up to this higher LW, provided the runway is approved for automatic landing.

This means that Airbus has performed a number of automatic landings up to this higher LW for average conditions in term of CG, wind, and runway characteristics. The full range of conditions required by the certification requirements have not been assessed for LW higher than the MLW. However, the tests performed are sufficient to indicate that the possibility of an automatic landing is an option that the flight crew can consider in its decision making resulting from an emergency in particular operational situation.

AUTOMATIC LANDING WITH OUT-OF-DATE ADIRS MAG VAR TABLE

Some Airbus SA and LR aircraft continue to fly a number of years with ADIRS part numbers fitted with out-of-date magnetic variation tables. If the ADIRS magnetic variation differs by more than 2° or 3° (depending of aircraft type) compared to the airport current magnetic variation, the lateral performance of the automatic landing and rollout is significantly affected, which prevents from using the automatic landing system on these airports. Airbus publishes in the FCOM for each year, the list of airports where automatic landing is no more authorized with these ADIRS part numbers.

AIRPORTS/RUNWAYS WITH "SPECIAL TERRAIN/RUNWAY PROFILE"

The consequences of irregular terrain or runway profile on the automatic landing system performance can be quite variable.

For example, the automatic landing RW 03 R in Johannesburg (JNB) had to be suspended for the Airbus SA until certification of a new standard of FMCG (refer to FCOM Limitation section).
Another example is RW 32 in Leeds (LBA) also with Airbus SA where the consequence of the runway profile is only a possibility of long flare. In this case an increase of the automatic
R landing distance of 300 m is sufficient to address the runway specificity.